



Original Contribution

Racism, Segregation, and Risk of Obesity in the Black Women's Health Study

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We assessed the relation of experiences of racism to the incidence of obesity and the modifying impact of residential racial segregation in the Black Women's Health Study, a follow-up study of US black women. Racism scores were created from 8 questions asked in 1997 and 2009 about the frequency of "everyday" racism (e.g., "people act as if you are dishonest") and of "lifetime" racism (e.g., unfair treatment on the job). Residential segregation was measured by linking participant addresses to 2000 and 2010 US Census block group data on the percent of black residents. We used Cox proportional hazard models to estimate incidence rate ratios and 95% confidence intervals. Based on 4,315 incident cases of obesity identified from 1997 through 2009, both everyday racism and lifetime racism were positively associated with increased incidence. The incidence rate ratios for women who were in the highest category of everyday racism or lifetime racism in both 1997 and 2009, relative to those in the lowest category, were 1.69 (95% confidence interval: 1.45, 1.96; $P_{\text{trend}} < 0.01$) and 1.38 (95% confidence interval: 1.15, 1.66; $P_{\text{trend}} < 0.01$), respectively. These associations were not modified by residential segregation. These results suggest that racism contributes to the higher incidence of obesity among African American women.

African Americans; obesity; prospective studies; racism; segregation; women; women's health

Abbreviations: BMI, body mass index; BWHS, Black Women's Health Study; CI, confidence interval; IRR, incidence rate ratio.

The prevalence of obesity in the United States has increased rapidly over the past few decades, with the greatest increases reported among black women (1). Approximately half of black women are classified as obese (defined as a body mass index (BMI) (weight (kg)/height (m)²) ≥ 30.0) compared with one-third of white women (2). By 2020, 70% of black women are projected to be obese (1). Obesity is a risk factor for numerous health conditions, including cardiovascular disease and type 2 diabetes, as well as for death (3–6).

Stress has been associated with weight gain and obesity in both animals and humans (7–14). Chronic exposure to stress can disrupt regulation of neuroendocrine-autonomic physiological pathways which, in turn, contributes to the accumulation of excess body fat (8, 15–18). Perceived racial discrimination, an important psychosocial stressor in the lives of black women (19, 20), has been associated with obesity in cross-sectional studies. Several such studies reported

associations between internalized racism and general (13) and abdominal obesity (9, 13, 21) in Caribbean populations. In the United States, perceived experiences of racial discrimination have been associated with higher rates of obesity in Asian Americans (22) and a lower waist-hip ratio in African American women (23). In a multiracial sample of adults from the Chicago, Illinois, area, perceived racial/ethnic discrimination was associated with overweight/obesity and larger waist circumference among non-Hispanic whites, but not among Hispanics and non-Hispanic blacks (24). In the prospective Black Women's Health Study (BWHS), experiences of racism were associated with higher mean 8-year weight gain and with a greater increase in waist circumference (25).

Racial residential segregation has also been associated with individual-level risk of weight gain and obesity (26–30). Studies using national (26, 29, 30) and state-level (27, 28) data have reported associations between neighborhood racial isolation and overweight/obesity in minority women

(26, 28–30). Neighborhood racial context may influence experiences of racism. In the BWHS, neighborhood segregation was inversely correlated with experiences of racism (31). In addition, neighborhood context or status may be related to levels of stress and, therefore, might modify an association of racism with obesity (32).

The BWHS previously assessed racism in relation to 8-year weight gain (25). The present study expands on this by assessing the relation of experiences of racism to the incidence of obesity, exploring the modifying role of residential racial segregation, and adding 6 years of follow-up. We have focused on the group at highest risk of weight gain, women under the age of 40 years (1, 33–35). Our hypothesis is that higher levels of experiences of racism will increase obesity risk.

METHODS

Establishment of the BWHS and follow-up

The human subjects protocol for this study was approved by the Boston University Medical Center's institutional review board. The BWHS is a follow-up study of US black women that began in 1995 when 59,000 women aged 21–69 years enrolled through mailed health questionnaires. Participants indicated their informed consent by completing the questionnaires. At baseline, subjects were 21–69 years of age (median, 38 years), 97% had completed high school, and 44% had completed college. Participants updated health information on biennial questionnaires. Follow-up of the original cohort is 80% through 7 completed questionnaire cycles.

On the 1995 baseline questionnaire, BWHS participants provided data on demographic characteristics, medical and reproductive history, smoking and alcohol use, physical activity, anthropometric measures (e.g., height, weight), use of selected medications such as oral contraceptives and female hormone supplements, diet, and use of medical care.

Incident obesity

Data on weight are updated every 2 years by follow-up questionnaire. In a validation study among 115 BWHS participants, the Spearman correlation coefficients were 0.97 for the correlation between self-reported and technician-measured weight and 0.93 for self-reported height with technician-measured height (36). The coefficients were 0.91 among women who were obese and 0.95 among women who were not. The corresponding coefficients were 0.92 and 0.95, respectively, within the lowest and highest quartiles of everyday racism and 0.97 and 0.93, respectively, for the lowest and highest categories of everyday racism.

BMI was calculated at each follow-up cycle. Participants were classified as incident cases of obesity if they attained a BMI of 30 or greater during follow-up.

Perceived racism

The 1997 follow-up questionnaire contained questions on perceptions and experiences of racism adapted from an instrument developed by Williams et al. (37). Five questions

asked about the frequency in daily life (everyday racism) of the following experiences: “you receive poorer service than other people in restaurants or stores,” “people act as if they think you are not intelligent,” “people act as if they are afraid of you,” “people act as if they think you are dishonest,” and “people act as if they are better than you.” Response options were “never,” “a few times a year,” “once a month,” “once a week,” and “almost every day,” scored as 1–5 with 1 indicating “never” and 5 indicating “almost every day.” Three questions asked about lifetime experience of being “treated unfairly due to your race” on the job, in housing, and by the police (lifetime racism), with responses of yes or no. Two summary racism variables were created. The everyday racism score averaged subjects' responses to the 5 questions about everyday racism and was divided into quartiles. The lifetime racism score summed the positive responses to the 3 questions about lifetime racism, with scores ranging from 0 (no to all) to 3 (yes to all). The questions were preceded by a question asking how often the participant thought about her race. Thus, the questions were designed to stimulate the respondent to think about racism rather than some other attribute. The same questions were included again on the 2009 questionnaire.

Neighborhood segregation

US Census Bureau data for census block groups, subdivisions of census tracts that include approximately 1,500 people (38), were used as proxies for participants' neighborhoods of residence (39–41) and were linked to participant addresses every 2 years. Year 2000 data were linked to addresses from 1995–2003, and year 2010 data were linked to addresses from 2005–2009. Neighborhood racial composition was measured by the census variable “percent of total block group population that is African American” (hereafter, “percent African American”).

Covariates

Data on smoking status, alcohol consumption, vigorous exercise, walking for exercise, parity, and geographical region of residence were updated on each follow-up questionnaire. Data on hours of television watching were collected on the 1995, 1997, 1999, and 2001 questionnaires; data on years of education were collected on the 1995 and 2003 questionnaires; and data on family income and household size were collected on the 2003 questionnaire. The short-form National Cancer Institute-Block food frequency questionnaire (42) was included in the 1995 and 2001 questionnaires. From these, we identified the following 2 dietary patterns: the “prudent” pattern (high in vegetables/fruit) and the “Western” pattern (high in a meat/fried foods) (33).

We created a neighborhood socioeconomic status score by conducting a factor analysis of 29 census block group variables measuring aspects of education, income, and wealth (43, 44). From the top-loading variables, we selected the following 6: median household income; median housing value; percentage of households receiving interest, dividend, or net rental income; percentage of adults aged 25 years or more who have completed college; percentage of employed persons

aged 16 years or more who are in occupations classified as managerial, executive, or professional specialty; and percentage of families with children that are not headed by a single woman. Factor analysis regression coefficients were used to weight the variables for a combined neighborhood score (44), which was divided into quintiles. We used the census block group variable “net housing density” as an indicator of urbanization (hereafter “neighborhood housing density”).

Data analysis

Follow-up for the current analysis began in 1997, when the racism questions were first asked. There were 18,393 women under age 40 years who were not obese at baseline in 1997. We excluded 1,279 women who were recently pregnant (within 1 year); 712 who were missing BMI data at baseline; 771 who were missing BMI data over the follow-up period; 464 who had a baseline BMI of less than 18.5; 221 who had

experienced gastric surgery, coronary bypass surgery, cancer, myocardial infarction, or stroke before baseline; 869 who had missing values for 1 or more of the 1997 racism questions; and 1,267 who had an address that could not be geocoded, leaving a total analytical sample of 12,810 women.

Incidence rate ratios (IRRs) and 95% confidence intervals were estimated for categories of the racism variables in relation to obesity incidence using Cox proportional hazard models, stratified by age in single years and 2-year questionnaire cycle. Person-years were calculated from baseline in 1997 to the occurrence of obesity, loss to follow-up, death, or end of follow-up, whichever occurred first. Models were adjusted for education (≤ 12 , 13–15, 16, or ≥ 17 years), household income ($\leq \$25,000$, $\$25,001$ – $\$50,000$, $\$50,001$ – $\$100,000$, or $> \$100,000$), cigarette smoking (never smoker, past smoker, current smoker of < 15 cigarettes/day, or current smoker of ≥ 15 cigarettes/day), alcohol consumption (never drinker; past drinker; or current drinker of 1–3, 4–6, 7–13,

Table 1. Age-Standardized^a Baseline Characteristics (in 1997) According to Summary Everyday and Lifetime Racism Scores, Black Women’s Health Study, 1997–2009

Individual-Level Factors	Total Sample, % (n = 12,810)	Summary Everyday Racism, %		Summary Lifetime Racism, %	
		Quartile 1 (n = 3,674)	Quartile 4 (n = 2,755)	No to All (n = 4,155)	Yes to All (n = 1,162)
Age, years	31.9 (4.6) ^b	32.5 (4.5) ^b	31.3 (4.7) ^b	31.5 (4.7) ^b	32.7 (4.5) ^b
Body mass index ^c	24.3 (2.9) ^b	24.1 (2.9) ^b	24.5 (2.9) ^b	24.3 (2.9) ^b	24.3 (2.9) ^b
Geographical region					
Northeast	28	30	26	27	28
South	33	33	32	35	27
Midwest	21	20	22	21	22
West	18	18	20	17	24
College graduate	51	50	49	49	51
Household income $> \$50,000$	50	49	47	50	49
Vigorous exercise ≥ 5 hours/week	14	14	15	13	18
Walking for exercise ≥ 5 hours/week	12	12	14	12	15
Television watching ≥ 5 hours/day	13	13	14	14	15
Current smoker	13	12	16	12	16
Current drinker	27	27	31	25	32
Prudent dietary pattern (quintile 5)	19	19	19	17	23
Western dietary pattern (quintile 5)	19	18	21	19	18
Parous	48	49	49	47	50
Neighborhood-level factors					
Neighborhood socioeconomic status (quintile 5)	20	19	21	19	23
Housing density (quintile 5)	20	22	20	20	20
% African American (quartile 4)	25	26	22	27	22

^a Values are standardized to the 1997 age distribution of the study population.

^b Value expressed as mean (standard deviation).

^c Weight (kg)/height (m)².

or ≥ 14 drinks/week), vigorous exercise (none, <5 , or ≥ 5 hours/week), walking for exercise (none, <5 , or ≥ 5 hours/week), hours of television viewing (<1 , 1–2, 3–4, or ≥ 5 hours/day), geographical region (Northeast, South, Midwest, or West), parity (nulliparous, 1, 2, 3, or ≥ 4 births), prudent dietary pattern (in quintiles), Western dietary pattern (in quintiles), neighborhood socioeconomic status score (in quintiles), and neighborhood housing density (in quintiles). All variables, with the exceptions of income and number in household supported by the income, were time varying and were updated with the use of the Anderson-Gill data structure (45). We performed tests for trend by including the summary racism variables in the model as ordinal variables. We used Wald tests for interaction, using cross-product terms between each covariate and each summary racism variable (coded in its ordinal form). *P* values are 2-sided. All analyses were performed using SAS, version 9.2, software (SAS Institute, Inc., Cary, North Carolina) (46).

The racism questions were asked in 1997 and again in 2009. Analyses were based on the 1997 data alone and on responses in both 1997 and 2009. The latter analyses were among women who answered both sets of questions and whose responses were in the same quartile of level of perceived racism at both time points (e.g., quartile 1 in 1997 and quartile

1 in 2009); the analytical samples were 3,908 for everyday racism and 4,409 for lifetime racism. We conducted a further analysis restricted to women who stayed in the same quartile or category of the racism scores in 1997 and 2009 and also lived in neighborhoods in the same quartile of percent African American for all years during follow-up; the analytical samples included 1,363 subjects for everyday racism and 1,536 subjects for lifetime racism.

RESULTS

In 1997, the mean age of the analytical cohort was 31.9 years, and the mean BMI was 24.3. Table 1 shows the distribution of individual- and neighborhood-level risk factors according to perceived racism. The highest quartile of everyday racism was positively associated with smoking, alcohol consumption, and high consumption of red meat/fried foods (Western dietary pattern); there were inverse associations with age, residing in the Northeast, and racial residential segregation. The highest category of lifetime racism was positively associated with age, residing in the West, vigorous physical activity, smoking, alcohol consumption, high consumption of fruits and vegetables (prudent dietary pattern), and residence in a neighborhood of high socioeconomic status. Living

Table 2. Summary Racism Scores and Neighborhood Percent African American in Relation to Risk of Obesity for 12,810 Subjects in the Black Women's Health Study, 1997–2009

Study Variable	No. of Cases	No. of Person-Years	Age-Adjusted ^a		Multivariable ^b	
			IRR	95% CI	IRR	95% CI
Summary everyday racism (in 1997)						
Quartile 1	1,105	33,235	1.00	Referent	1.00	Referent
Quartile 2	1,234	33,142	1.12	1.03, 1.21	1.12	1.03, 1.22
Quartile 3	933	23,077	1.22	1.12, 1.33	1.21	1.11, 1.32
Quartile 4	1,043	23,403	1.34	1.23, 1.46	1.31	1.20, 1.43
<i>P</i> _{trend}				<0.01		<0.01
Summary lifetime racism (in 1997)						
No to all	1,385	36,999	1.00	Referent	1.00	Referent
Yes to 1	1,511	40,497	1.00	0.93, 1.07	1.00	0.93, 1.08
Yes to 2	1,014	25,302	1.07	0.99, 1.16	1.09	1.01, 1.19
Yes to 3	405	10,059	1.07	0.96, 1.20	1.09	0.98, 1.22
<i>P</i> _{trend}				0.06		0.02
Neighborhood % African American (in 1997)						
Quartile 1	1,005	31,299	1.00	Referent	1.00	Referent
Quartile 2	1,182	29,562	1.24	1.14, 1.35	1.12	1.02, 1.22
Quartile 3	1,153	29,379	1.21	1.12, 1.32	1.04	0.94, 1.15
Quartile 4	975	22,617	1.35	1.24, 1.48	1.11	0.99, 1.23
<i>P</i> _{trend}				<0.01		0.25

Abbreviations: CI, confidence interval; IRR, incidence rate ratio.

^a Adjusted for age and questionnaire cycle.

^b Adjusted for age, questionnaire cycle, education, household income, number of people in the household, cigarette smoking, alcohol consumption, vigorous exercise, walking for exercise, hours of television viewing, geographical region, parity, prudent dietary pattern, Western dietary pattern, neighborhood socioeconomic status, and neighborhood housing density.

in the South and racial residential segregation were inversely associated with lifetime racism.

There were 4,315 incident cases of obesity identified from the beginning of follow-up through 2009. As shown in Table 2, obesity incidence increased with increasing quartile of everyday racism score. Compared with the lowest quartile, the multivariable IRR for quartile 4 was 1.31 (95% confidence interval (CI): 1.20, 1.43; $P_{\text{trend}} < 0.01$). Lifetime racism score was weakly associated with incidence of obesity. The IRR for the highest compared with the lowest level was 1.09 (95% CI: 0.98, 1.22; $P_{\text{trend}} = 0.02$). A positive association between percent African American residents and obesity incidence was attenuated after adjustment for covariates. The covariates that most affected the change in the IRRs were years of education, household income, vigorous exercise, walking, and sitting. The multivariable IRR for quartile 4 versus quartile 1 of neighborhood percent African American was 1.11 (95% CI: 0.99, 1.23; $P_{\text{trend}} = 0.25$).

Table 3 shows IRRs for women who remained in the same quartile of everyday racism score ($n = 3,908$) or had the same lifetime racism score ($n = 4,409$) in 1997 and 2009, or who

remained in the same quartile of neighborhood percent African American ($n = 3,550$) from 1997 through 2009. IRRs were increased for all exposures. The IRRs for the highest quartiles of everyday racism, lifetime racism, and neighborhood percent African American were 1.69 (95% CI: 1.45, 1.96; $P_{\text{trend}} < 0.01$), 1.38 (95% CI: 1.15, 1.66; $P_{\text{trend}} < 0.01$), and 1.38 (95% CI: 1.12, 1.70; $P_{\text{trend}} = 0.01$), respectively.

Table 4 shows IRRs for the racism scores by quartile of neighborhood percent African American in the subset of women who stayed in the same quartile or level of the respective scores in 1997 and 2009. Everyday racism was positively associated with incidence of obesity within all strata of neighborhood segregation. IRRs for the highest level of lifetime racism were greatest in the 2 lowest quartiles of neighborhood percent African American, but there was no evidence of interaction.

DISCUSSION

In these prospective analyses, we observed a positive association between perceived everyday racism and incidence of obesity, and the association was present at all levels of

Table 3. Summary Racism Scores and Neighborhood Percent African American in Relation to Risk of Obesity Among Women With Consistent Experiences of Racism and Neighborhood Segregation, Black Women's Health Study, 1997–2009

Study Variable	No. of Cases	No. of Person-Years	Age-Adjusted ^a		Multivariable ^b	
			IRR	95% CI	IRR	95% CI
Summary everyday racism score among 3,908 women with same quartile of score in 1997 and 2009						
Quartile 1	586	19,404	1.00	Referent	1.00	Referent
Quartile 2	366	9,658	1.25	1.09, 1.42	1.25	1.10, 1.43
Quartile 3	149	3,575	1.37	1.15, 1.64	1.33	1.11, 1.60
Quartile 4	253	4,699	1.77	1.52, 2.05	1.69	1.45, 1.96
P_{trend}				<0.01		<0.01
Summary lifetime racism score among 4,409 women with same score in 1997 and 2009						
No to all	651	19,525	1.00	Referent	1.00	Referent
Yes to 1	456	12,416	1.10	0.98, 1.24	1.12	0.99, 1.26
Yes to 2	275	6,751	1.21	1.05, 1.40	1.25	1.08, 1.44
Yes to all	147	3,257	1.33	1.11, 1.60	1.38	1.15, 1.66
P_{trend}				<0.01		<0.01
Neighborhood % African American among 3,550 women in same quartile over follow-up from 1997 to 2009						
Quartile 1	324	11,230	1.00	Referent	1.00	Referent
Quartile 2	344	8,060	1.46	1.25, 1.70	1.28	1.08, 1.52
Quartile 3	350	8,540	1.42	1.22, 1.65	1.20	1.00, 1.44
Quartile 4	264	5,394	1.68	1.42, 1.97	1.38	1.12, 1.70
P_{trend}				<0.01		0.01

Abbreviations: CI, confidence interval; IRR, incidence rate ratio.

^a Adjusted for age and questionnaire cycle.

^b Adjusted for age, questionnaire cycle, education, household income, number of people in the household, cigarette smoking, alcohol consumption, vigorous exercise, walking for exercise, hours of television viewing, geographical region, parity, prudent dietary pattern, Western dietary pattern, neighborhood socioeconomic status, and neighborhood housing density.

Table 4. Summary Racism Scores in Relation to Risk of Obesity Among Women With Consistent Experiences of Racism in 1997 and 2009 by Neighborhood Percent African American, Black Women's Health Study

Study Variable	Neighborhood % African American ^a								P for Interaction
	Quartile 1		Quartile 2		Quartile 3		Quartile 4		
	IRR	95% CI	IRR	95% CI	IRR	95% CI	IRR	95% CI	
Summary everyday racism score ^b									
Quartile 1	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent	
Quartile 2	1.60	1.21, 2.11	1.35	1.03, 1.76	1.20	0.93, 4.56	1.07	0.80, 1.43	
Quartile 3	1.64	1.12, 2.40	1.20	0.82, 1.76	1.28	0.89, 1.83	1.28	0.87, 1.89	0.57
Quartile 4	1.96	1.43, 2.68	1.60	1.19, 2.17	1.44	1.05, 1.97	2.22	1.56, 3.14	
P _{trend}	<0.01		<0.01		0.02		<0.01		
Summary lifetime racism score ^c									
No to all	1.00	Referent	1.00	Referent	1.00	Referent	1.00	Referent	
Yes to 1	1.05	0.80, 1.37	1.09	0.86, 1.38	1.17	0.92, 1.48	1.11	0.86, 1.44	
Yes to 2	1.24	0.91, 1.69	1.22	0.92, 1.61	1.29	0.97, 1.17	1.35	0.99, 1.85	0.99
Yes to all	1.44	1.01, 2.05	1.48	1.05, 2.07	1.19	0.80, 1.77	1.24	0.76, 2.01	
P _{trend}	0.03		0.02		0.09		0.08		

Abbreviations: CI, confidence interval; IRR, incidence rate ratio.

^a Adjusted for age, questionnaire cycle, education, household income, number of people in the household, cigarette smoking, alcohol consumption, vigorous exercise, walking for exercise, hours of television viewing, geographical region, parity, prudent dietary pattern, Western dietary pattern, neighborhood socioeconomic status, and neighborhood housing density.

^b Summary everyday racism score among 3,908 women in the same quartile in 1997 and 2009. There were 330, 353, 366, and 305 cases in neighborhood percent African American quartiles 1, 2, 3, and 4, respectively.

^c Summary lifetime racism score among 4,409 women in the same quartile in 1997 and 2009. There were 341, 423, 411, and 354 cases in neighborhood percent African American quartiles 1, 2, 3, and 4, respectively.

residential segregation. The association was stronger among women with consistent experiences of racism over time. The association between lifetime racism score in 1997 and incident obesity was weak, but became stronger among women with consistent experiences of racism. Neighborhood segregation was positively associated with incidence of obesity among women who had lived in neighborhoods with similar levels of the percent of African American residents over follow-up. However, the variable neighborhood percent African American did not appear to modify the association of experiences of racism with obesity.

Several cross-sectional studies have explored the relationship between exposures to racial discrimination and weight gain or obesity (9, 13, 21–25). One study, conducted in a national sample of nearly 2,000 Asian Americans, reported a positive association between reports of racial discrimination and obesity (22). Another study of 129 black women in Barbados found 2-fold higher odds of overweight among women reporting a high level of internalized racism (13). A study of 172 adolescents in Barbados similarly found a positive association between mean BMI and high levels of internalized racism in girls (9). Finally, a study of US black and white subjects in Chicago noted that whites of Irish, Jewish, Polish, and Italian ancestry who reported experiencing any racial or ethnic discrimination were more likely to be overweight or obese and to have higher abdominal obesity compared

with whites of the same ethnicity who did not experience discrimination (24).

Residential segregation, a “structural” form of racism (47), can affect individual health by creating pathogenic neighborhood environments (48). In the United States, segregation is still highest for African Americans compared with all other groups, despite decreasing trends in recent years (49). Higher education and income do not translate into the same level of financial and housing opportunity for blacks as for whites, with the result that middle-class blacks are more likely to live in poorer quality neighborhoods than are middle-class whites (47, 50–53). Compared with white neighborhoods of similar socioeconomic status, African American neighborhoods are less likely to contain supermarkets selling a variety of fresh produce (54), less likely to offer recreational resources (55, 56), and more likely to have fast food outlets (57). All of these factors may contribute to the risk of obesity. Furthermore, racially isolated neighborhoods are more likely to be disordered (27), resulting in chronic stress, an important biological mechanism linking neighborhood and BMI. Both animal and human data indicate that chronic exposure to stress can result in neuroendocrine-autonomic dysregulation, which in turn can influence the accumulation of excess body fat (7, 8, 16, 58, 59). Stress activates the central nervous system and hypothalamic-pituitary-adrenal axis, which, via corticotropin-releasing hormone, stimulates adrenocorticotropic

hormone production and, thus, cortisol secretion (60). Cortisol activates lipoprotein lipase, a regulator of lipid accumulation in adipocytes, increasing fat retention (8, 16). Aside from the nonavailability of material services and amenities and the persistence of psychosocial stressors, neighborhood context may influence social norms regarding body weight by shifting local weight ideals and lessening the broader stigma associated with being obese (26, 27, 61). Studies have shown that African Americans tend to be more tolerant than whites of heavier weight status (62–64). Indeed, in the present analysis we observed an increased risk of obesity within areas with the highest percent of African American residents, particularly among women who consistently lived in segregated neighborhoods.

A primary strength of the current study is its prospective design. Participants' perceptions of racism were reported prior to becoming obese, greatly reducing the possibility of recall bias and establishing the temporal sequence between exposure and outcome. The large sample size conferred high statistical power. We were able to control for potential confounding factors, including age, education, geographical region, household income, parity, smoking, alcohol consumption, physical activity, hours of television viewing, diet, and neighborhood characteristics. High follow-up of the cohort lessened the potential for bias from selective losses.

We relied on self-reported weight and height. Results from a validation study of BWHS participants showed strong correlations between self-reported and measured anthropometric variables (36). The correlations were high regardless of the participant's weight status or experiences of racism. However, underreporting of weight by heavier women would have diluted the observed associations with BMI and weight change. We excluded women with a baseline BMI of less than 18.5 to avoid distortion of results by a relatively small number of women with extreme values.

The measures of perceived racism used in the present study have been used previously in the BWHS (25, 31, 65–67) and have demonstrated high reproducibility both within our cohort (65) and elsewhere (22, 24, 37). The results of factor analysis imply that these questions adequately capture the underlying paradigms of everyday and lifetime experiences of racism (65). Because of the prospective collection of data, any errors in the reporting of racial discrimination are likely to be random, generally resulting in an underestimation of the association.

The BWHS cohort is not a random sample of US black women. Participants must be literate in order to complete mailed questionnaires, and BWHS participants underrepresent the approximately 15% of black women nationally of the same ages who did not graduate from high school (68). However, participants represent the 85% of US black women nationally who have completed 12 or more years of education. In addition, BWHS participants were not from any particular geographical region, but rather were drawn from many areas of the continental United States.

In summary, in the present study, greater experiences of racism were independently associated with higher incidence of obesity among African American women during the period in which the greatest weight gain occurs (1, 34)—young adulthood through middle age. Many important behavioral

factors that influence weight gain were controlled for in the analysis. Blacks experience racism to a greater extent than whites (69). Thus, these findings suggest that experiences of racism may explain, in part, why US black women have a disproportionately high prevalence of obesity.

Our findings add to growing evidence that experiences of racism adversely affect health. Workplace- and community-based programs to combat racism and interventions to reduce racism-related stress could be important components of strategies for prevention of obesity, especially in communities at high risk. Various stress reduction interventions that have been developed to address stress related to intimate partner violence (70) and military service (71) might be useful.

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