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Perceived racial discrimination and risk of insomnia among middle-aged and elderly Black women

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Abstract

Study Objective: To assess whether perceived racial discrimination is associated with insomnia among Black women.

Methods: Data on everyday and lifetime racism and insomnia symptoms were collected from questionnaires administered in the Black Women's Health Study, an ongoing prospective cohort of Black women recruited in 1995 from across the United States. In 2009, participants completed five questions on the frequency of discriminatory practices in daily life (everyday racism) and six questions on ever experiencing unfair treatment in key institutional contexts (lifetime racism). In 2015, the Insomnia Severity Index was used to assess insomnia symptoms. We estimated odds ratios and 95% confidence intervals for associations of racism with insomnia, using multivariable logistic regression models adjusted for potential confounders.

Results: The 26 139 participants in the analytic sample were 40–90 years old (median = 57 years, *SD* = 9.6 years). Higher levels of everyday racism and lifetime racism were positively associated with subthreshold (p_{trend} < .01) and clinical insomnia (p_{trend} < .01). Results remained unchanged after further adjustment for sleep duration and shift work.

Conclusions: Higher levels of perceived racism were associated with increased odds of insomnia among middle-aged and elderly Black women. Thus, perceived racism may contribute to multiple racial health disparities resulting from insomnia. Helping minority populations cope with their experiences of discrimination may decrease the significant public health impact of sleep disruption and subsequent diagnoses.

Statement of Significance

Public and social media have fostered greater awareness of racially motivated events and recognition that exposure to racial discrimination may be prevalent in the United States. It is imperative to examine potential effects of discrimination on population health. In a large cohort of Black women, greater exposure to everyday and lifetime racism was associated with increased odds of subthreshold and clinical insomnia. Although systematic reviews have examined psychosocial factors as contributors to sleep health, few studies have investigated racial discrimination. These findings provide support for the idea that efforts to address racism or ameliorate its effects could improve sleep among Black women. Thus, helping minority populations cope with discriminatory experiences may decrease the public health impact of sleep disruption and subsequent diagnoses.

Key words: African Americans; racism; women's health; sleep initiation and maintenance disorders; prospective studies; public health; United States

Introduction

Insomnia disorder is defined as chronic difficulties with falling or staying asleep, resulting in daytime sequelae [1]. The Centers for Disease Control and Prevention has called insomnia disorder a "public health epidemic" [2] due to its detrimental impact on individuals and society in general. Across the lifespan, insomnia is associated with a wide range of psychological disorders [3], including depression [4–7], anxiety [4, 5, 7, 8], and substance use disorder [4, 8], and physical health outcomes, including obesity [8–10], diabetes [10–12], and cardiovascular disease [5, 7, 10, 13, 14]. On a broader scope, the total health care costs of treating insomnia in the United States are estimated to exceed $13 billion per year [15–17], with significant additional societal costs associated with increased work absenteeism, reduced productivity, and both motor vehicle and nonmotor vehicle accidents [18–21].

Many [22–35], though not all [5, 34, 36–40], studies have found that Black Americans are at higher risk than other racial groups of experiencing sleep problems, such as more fragmented sleep, shorter sleep duration, and poorer sleep quality [22, 24, 26–32]. Black women are particularly affected and experience significantly poorer sleep quality than White women based on self-reported and objective measures [23–25, 33]. Consequently, the sequelae of disturbed sleep may disproportionately affect Black women, who have been shown to be more susceptible to the physical health consequences of poor sleep [41–43]. However, few existing epidemiological research on sleep disturbances among Black women have explicitly evaluated insomnia symptoms, which is an important independent predictor of health consequences. Instead, most prior research has assessed sleep duration and/or overall sleep quality, which can be impacted by other commons sleep disorders among Black Americans, such as sleep-disordered breathing [14, 23, 36].

There is a multitude of genetic, physical, and psychosocial factors that may result in the development of insomnia [44]. A potentially important factor that has received limited attention is exposure to racial discrimination, which Black Americans frequently experience [45–48]. Chronic stress due to perceived discrimination is associated with shorter sleep duration, greater difficulty in falling and staying asleep, disrupted sleep architecture, and poorer overall sleep quality [49–60]. The largest study of discrimination and sleep to date included 3106 Black women [50], but other studies have been small. Importantly, existing studies have not addressed insomnia specifically. To overcome these limitations, we assessed racial discrimination in relation to insomnia symptoms in the Black Women's Health Study, a large prospective cohort study.

Methods

Study population

Black women aged 21–69 years who subscribed to a popular magazine targeted to Black women and were residents of any of 17 states across the United States, including California, New York, Georgia, and Illinois, were enrolled in the Black Women's Health Study (BWHS) in 1995 by completing a mailed health questionnaire [61, 62]. Biennial follow-up is conducted through mailed and web questionnaires and has been successful for 85% of potential person-years after 10 completed follow-up cycles. The Boston University Medical Campus and Boston

Medical Center Institutional Review Board approved the BWHS human participants protocol, including informed consent for all participants.

Outcome data

The Insomnia Severity Index (ISI), a validated measure to assess clinically significant insomnia symptoms [63, 64], was administered as part of the 2015 BWHS questionnaire. The ISI is a 7-item questionnaire that has been well validated as an outcome measure in insomnia research [64]. Total scores on the ISI range from 0 to 28, with the following interpretations recommended: 0–7 = no clinically significant insomnia; 8–14 = subthreshold insomnia; 15–28 = clinically significant insomnia (clinical insomnia). The ISI has been found to have acceptable internal consistency [64], to be a reliable and valid instrument to detect cases of insomnia in the general population, and to be sensitive to treatment response in clinical patients [63]. We assessed the reproducibility of the ISI in the BWHS by comparing responses of 1244 women who completed duplicate 2015 questionnaires. The correlation coefficient for the ISI score was .83 ($p < .01$), indicating excellent agreement; for the four categories of ISI score, the weighted kappa was .65 (95% confidence interval [CI] = 0.62 to 0.69), indicating substantial agreement [65].

Exposure data

In the 2009 questionnaire, BWHS participants reported on (1) perceived "everyday" racism, which refers to discriminatory practices that occur in the daily life of racial minorities, and (2) perceived lifetime racism, which refers to unfair treatment in key institutional contexts. Specifically, the questionnaire asked five questions about the frequency of everyday racism (e.g., receiving poorer service in restaurants or stores than other people) and six questions about lifetime racism (experiences of unfair treatment on the job, in housing, by police, in the courts, at school, and getting medical care), adapted from questions developed by Williams et al. [47, 66]. The five possible responses to the everyday racism questions ranged from never (score of 1) to almost every day (score of 5). We calculated the overall everyday racism score by averaging the scores of the 5 questions [66] and then created quartiles for analysis. For the lifetime racism questions, the responses were scored 0 (no) and 1 (yes) and summed such that a woman who reported racism in all six areas received an overall lifetime racism score of 6. We categorized lifetime racism as no to all (a score of 0), yes to 1, yes to 2, yes to 3, and yes to ≥4 (scores of 4–6). We also created a combined racism score in order to approximate cumulative exposure to racial discrimination for a secondary analysis. For the combined racism score, we dichotomized each everyday racism question (never/a few times per year [0] vs. once a month/once a week/almost every day [1]), adding these values to the lifetime racism questions (no [0] vs. yes [1]). We then categorized the combined racism score into quintiles.

Covariate data

The 2015 BWHS questionnaire asked when the participant usually fell asleep and when she awoke over the past 2 years, from which sleep duration was calculated. The total hours of sleep

duration were categorized as <7, 7–8, and ≥9 h. Participants reported shift work on the 2005 and 2015 questionnaires. Data on additional variables included in the analyses were categorized as follows: marital status (married/living as married, divorced/widowed/separated, and single); education (≤12, 13–15, and ≥16 years); household income (≤$25 000, $25 001–$50 000, $50 001–$100 000, and >$100 000); vigorous physical activity (none, <5 h/week, and ≥5 h/week); body mass index (BMI), calculated using the participant's adult height in meters and weight in kilograms (<18.5, 18.5–24.99, 25.0–29.99, and ≥30.0 kg/m^2); and smoking (never, past, and current). Additional covariates assessed included ever diagnosed with diabetes, ever diagnosed with hypertension, menopausal status, born outside of the United States, self-rated health, and depressive symptoms. However, these factors did not influence the associations and were not included in final analytical models.

Statistical analysis

Of the 37 099 participants who completed the 2015 questionnaire, those who did not complete all ISI items (n = 5593) or had missing values for one or more of the racism questions (n = 5367) were excluded, leaving 26 139 participants in the analytic sample (Supplementary Table S1). Multinomial logistic regression models were used to estimate odds ratios (ORs) and 95% CIs for associations of racism variables with subthreshold and clinical insomnia. The reference category for everyday racism was quartile 1 of the everyday racism score; the reference category for lifetime racism was no to all contexts. To test for linear trends in the ORs, a categorical term was included in the logistic regression model and assessed as a continuous variable. In secondary analyses, stratified models were used to assess potential interaction by age (<50, 50–59, and ≥60 years), shift work (never, ever), duration of sleep (<7, 7–8, and ≥8 h), education (≤12, 13–15, and ≥16 years), and BMI (18.5–24.9, 25.0–29.9, ≥30.0 kg/m^2). To test for multiplicative interaction, regression models with and without interaction terms were compared using the likelihood ratio test. For the secondary analysis using the combined racism score, the reference category was quintile 1. A significance level of .05 was selected a priori. SAS 9.3 (SAS Institute Inc., Cary, NC) was used for all analyses.

Results

Among the analytic sample of 26 139 Black Women's Health Study participants, 15.4% had an ISI score of ≥15 (clinical insomnia) and 29.7% had an ISI score of 8–14 (subthreshold insomnia). The median age was 57 years (range: 40–90 years). As shown in Table 1, participants in quartile 4 of the everyday racism score, relative to those in quartile 1, reported more unfair treatment in institutional contexts (lifetime racism), were less likely to be married or living as married, and were more likely to have smoked, to have a BMI ≥30.0 kg/m^2, to sleep <7 hours, or to have ever engaged in shift work. For lifetime racism, participants who experienced unfair treatment in ≥4 institutional contexts, relative to those who reported no experiences of unfair treatment in institutional contexts, had higher everyday racism scores, were more highly educated, and were more likely to have smoked, to have a BMI ≥30.0 kg/m^2, to sleep <7 h, and to have ever engaged in shift work (Table 1). The median

duration of sleep was 7.5 h for participants with an ISI score <7, 7.0 h for participants with an ISI score of 8–14 (subthreshold insomnia), and 6.5 h for participants with an ISI score ≥15 (clinical insomnia).

Each of the five components of the everyday racism scale was associated with significantly greater odds of subthreshold insomnia (p_{trend} < .01) and clinical insomnia (p_{trend} < .01; Table 2). For subthreshold insomnia, the ORs ranged from 1.30 (95% CI = 1.14 to 1.47) for "people act as if they think you are dishonest" once a month or more often as compared to never to 1.62 (95% CI = 1.40 to 1.88) for "received poorer service than other people at restaurants or stores" once a month or more often as compared to never. For clinical insomnia, the ORs ranged from 1.45 (95% CI = 1.28 to 1.65) for "people act as if they are afraid of you" once a month or more often as compared to never to 2.04 (95% CI = 1.72 to 2.41) for "received poorer service than other people at restaurants or stores" once a month or more often as compared to never. The overall everyday racism score was positively associated with both subthreshold and clinical insomnia (p_{trend} < .01). Compared to quartile 1 of the everyday racism score, quartile 4 was associated with 54% (95% CI = 1.42 to 1.68) increased odds of subthreshold insomnia and 84% (95% CI = 1.64 to 2.04) increased odds of clinical insomnia. The multivariable ORs were similar when further adjusted for duration of sleep and shift work. For example, comparing quartile 4 of the everyday racism score with quartile 1, the ORs were 1.53 (95% CI = 1.40 to 1.67) for subthreshold insomnia and 1.80 (95% CI = 1.61 to 2.01) for clinical insomnia).

Five of the institutional contexts were associated with greater odds of subthreshold insomnia, whereas all of the six institutional contexts were significantly associated with greater odds of clinical insomnia (Table 3). For subthreshold insomnia, the multivariable ORs ranged from 1.06 (95% CI = 0.96 to 1.17) for unfair treatment in the courts versus no unfair treatment to 1.27 (95% CI = 1.18 to 1.37) for unfair treatment getting medical care versus no unfair treatment. For clinical insomnia, the multivariable ORs ranged from 1.38 (1.28–1.49) for unfair treatment at school versus no unfair treatment to 1.84 (1.69–2.01) for unfair treatment getting medical care versus no unfair treatment. The ORs for lifetime racism in ≥4 contexts as compared to no contexts were 1.43 (95% CI = 1.31 to 1.57) for subthreshold insomnia and 2.40 (95% CI = 2.13 to 2.69) for clinical insomnia. The ORs were similar to further control for duration of sleep and shift work. For example, the ORs for lifetime racism in ≥4 contexts as compared to no lifetime racism were 1.40 (95% CI = 1.28 to 1.54) for subthreshold insomnia and 2.31 (95% CI = 2.05 to 2.60) for clinical insomnia.

The associations of racism with clinical insomnia did not differ across strata of age ($p_{interaction}$ = .62 for everyday racism; $p_{interaction}$ = .31 for lifetime racism), shift work ($p_{interaction}$ = .71 for everyday racism; $p_{interaction}$ = .77 for lifetime racism), or education ($p_{interaction}$ = .18 for everyday racism; $p_{interaction}$ = .83 for lifetime racism; data not shown). There was also no evidence of interaction by duration of sleep, for which a similar magnitude of association was observed across all strata (Table 4).

For BMI, there was no evidence of interaction with everyday racism (Table 5). However, with lifetime racism, the association for clinical insomnia was strongest among participants with BMI ≥ 30.0 kg/m^2 ($p_{interaction}$ < .01) with an OR of 2.88 (2.45–3.39) for lifetime racism in four or more contexts as compared to no lifetime racism. The odds of clinical insomnia were also

Table 1. Distribution* of characteristics in BWHS participants by everyday racism and lifetime racism

	Everyday racism				Lifetime racism			
	Quartile 1		Quartile 4		No to all		Yes to ≥4	
	(n = 8009)		(n = 5718)		(n = 7779)		(n = 4548)	
Characteristic	n	%	n	%	n	%	n	%
Age (mean ± SD)	59.3 ± 10.3		55.5 ± 8.5		57.2 ± 10.0		58.3 ± 9.0	
Everyday racism								
Quartile 1					3961	51.1	368	8.1
Quartile 2					1442	18.5	497	10.8
Quartile 3					1657	21.3	1648	35.9
Quartile 4					719	9.2	2035	45.2
Lifetime racism								
No to all	3961	49.9	719	12.1				
Yes to 1	1960	24.4	821	14.0				
Yes to 2	1118	13.8	1081	18.4				
Yes to 3	602	7.4	1062	18.6				
Yes to ≥4	368	4.5	2035	36.9				
Education								
≤12 years	1061	12.5	590	10.7	1337	17.5	287	6.2
13–15 years	2191	27.2	1560	27.0	2200	28.4	1112	24.2
≥16 years	4753	60.3	3567	62.3	4237	54.0	3147	69.5
Marital status								
Married/living as married	3814	47.7	2328	40.4	3576	46.2	1929	42.3
Divorced/widowed/separated	2346	27.3	1613	30.9	2159	28.3	1523	32.3
Single	1816	24.6	1766	28.2	2017	25.2	1075	25.0
Income								
≤$25 000	714	8.5	632	11.2	776	9.8	440	9.8
$25 001–$50 000	2194	27.1	1595	27.9	2341	30.1	1134	25.4
$50 001–$100 000	2922	36.8	2058	36.3	2727	35.1	1709	37.1
>$100 000	1379	17.6	863	15.1	1111	14.4	836	18.1
BMI, kg/m^2								
<18.5	38	0.4	32	0.6	38	0.5	15	0.3
18.5–24.99	1724	21.2	873	16.0	1519	19.4	777	17.3
25.0–29.99	2630	32.4	1553	27.8	2536	32.7	1348	29.5
≥30.0	3459	44.0	3148	53.5	3540	45.6	2324	51.0
Vigorous activity								
None	3616	44.2	2510	44.9	3565	46.1	1914	41.7
<5 h/week	3202	41.2	2422	40.8	3096	39.5	1975	43.8
≥5 h/week	612	7.9	460	8.0	560	7.1	392	8.6
Smoking status								
Never	5365	68.6	3694	62.3	5342	67.9	2765	61.8
Past	2135	24.9	1504	28.9	1880	24.7	1438	30.6
Current	509	6.5	520	8.8	557	7.3	345	7.6
Duration of sleep								
<7 h	2499	31.5	2182	37.7	2434	31.3	1732	38.0
7–8 h	3940	49.6	2532	44.2	3823	49.1	2029	44.7
≥9 h	1497	18.1	974	17.5	1437	18.5	751	16.6
Shift work								
Never	5652	70.7	3507	61.2	5430	69.7	2761	61.0
Ever	1897	23.8	1951	34.0	1897	24.4	1595	34.8

*Except for age, frequencies are age adjusted and percentages may not add up to 100 due to rounding.

elevated for participants with BMI 25.0–29.9 who reported experiencing lifetime racism in three contexts (OR = 2.26, 95% CI = 1.84 to 2.82).

In a secondary analysis, a combined racism score based on both the everyday and lifetime racism variables was associated with subthreshold and clinical insomnia in all models (p_{trend} < .01) (Supplementary Table S2). The age-adjusted OR for quintile 5 compared to quintile 1 was 1.95 (1.78–2.13) for subthreshold insomnia and 3.38 (3.02–3.78) for clinical insomnia and the multivariable OR was 1.97 (1.80–2.16) for subthreshold insomnia and 3.53 (3.15–3.96) for clinical insomnia. With further adjustment for duration of sleep and shift work, the associations were attenuated but remained statistically significant.

Discussion

In the BWHS, 15% of respondents to the ISI questions reported experiencing clinically significant insomnia symptoms.

Table 2. Everyday racism in relation to subthreshold and clinical insomnia

Racism variables	Subthreshold insomnia				Clinical insomnia			
	Age-adjusted model		Multivariable* model		Age-adjusted model		Multivariable* model	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Received poorer service than other people at restaurants or stores								
Never	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
A few times a year	1.41	(1.32, 1.51)	1.29	(1.20, 1.38)	1.46	(1.34, 1.60)	1.24	(1.13, 1.36)
Once a month or more	1.95	(1.70, 2.24)	1.62	(1.40, 1.88)	3.01	(2.57, 3.52)	2.04	(1.72, 2.41)
p-trend	<.01		<.01		<.01		<.01	
People act as if they think you are not intelligent								
Never	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
A few times a year	1.27	(1.19, 1.35)	1.16	(1.09, 1.24)	1.43	(1.32, 1.55)	1.22	(1.12, 1.33)
Once a month or more	1.78	(1.62, 1.94)	1.49	(1.36, 1.64)	2.42	(2.17, 2.70)	1.66	(1.48, 1.87)
p-trend	<.01		<.01		<.01		<.01	
People act as if they are afraid of you								
Never	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
A few times a year	1.30	(1.22, 1.38)	1.19	(1.12, 1.26)	1.42	(1.32, 1.53)	1.20	(1.11, 1.30)
Once a month or more	1.59	(1.43, 1.76)	1.35	(1.21, 1.50)	2.08	(1.84, 2.34)	1.45	(1.28, 1.65)
p-trend	<.01		<.01		<.01		<.01	
People act as if they think you are dishonest								
Never	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
A few times a year	1.32	(1.24, 1.40)	1.20	(1.13, 1.28)	1.46	(1.36, 1.57)	1.23	(1.14, 1.33)
Once a month or more	1.59	(1.40, 1.79)	1.30	(1.14, 1.47)	2.34	(2.04, 2.68)	1.51	(1.30, 1.75)
p-trend	<.01		<.01		<.01		<.01	
People act as if they are better than you								
Never	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
A few times a year	1.34	(1.24, 1.44)	1.23	(1.14, 1.33)	1.43	(1.29, 1.58)	1.21	(1.09, 1.34)
Once a month or more	1.84	(1.68, 2.01)	1.53	(1.39, 1.68)	2.56	(2.28, 2.87)	1.73	(1.53, 1.96)
p-trend	<.01		<.01		<.01		<.01	
Everyday racism score								
Quartile 1	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
Quartile 2	1.18	(1.08, 1.28)	1.12	(1.02, 1.22)	1.21	(1.08, 1.36)	1.10	(0.98, 1.24)
Quartile 3	1.44	(1.34, 1.54)	1.31	(1.21, 1.41)	1.55	(1.41, 1.71)	1.29	(1.17, 1.43)
Quartile 4	1.82	(1.68, 1.97)	1.54	(1.42, 1.68)	2.65	(2.41, 2.93)	1.84	(1.64, 2.04)
p-trend	<.01		<.01		<.01		<.01	

*Multivariable model adjusts for age, marital status, education, income, BMI, vigorous physical activity, smoking status, and lifetime racism.

BWHS participants with clinical insomnia slept an hour less per night than participants without clinical insomnia and less than the minimum of 7 h recommended for adults by the American Academy of Sleep Medicine [67]. Both everyday and lifetime racism were strongly positively associated with clinical insomnia, with a doubling or more in odds after control for covariates. The association with lifetime racism appeared stronger among participants with BMI ≥ 30.0 kg/m². Everyday and lifetime racism were also positively associated with subthreshold insomnia with weaker associations than observed for clinical insomnia.

There is a paucity of data on the prevalence of insomnia among Black women and the use of different metrics to assess insomnia in studies prevents consensus on the scope of the problem for this population [5, 34, 68]. Although few studies of insomnia have been conducted on nationally representative samples of participants, estimates of the prevalence of insomnia among Black adults range from 3% to 46% [38, 69]. In 2012 data from the National Health Interview Survey, the prevalence of insomnia, which was measured using the question "During the past 12 months, have you regularly had insomnia or trouble sleeping?," was 21.8% among women and 16.5% among African American participants [70]. In the Multi-Ethnic Study

of Atherosclerosis (MESA), which used the Women's Health Initiative Insomnia Rating Scale [71], the prevalence of insomnia was 25% among Black participants [36].

Some studies on insomnia symptoms in diverse populations have concluded that Black adults have a similar or lower prevalence of insomnia and report fewer insomnia symptoms than White adults [34, 36–40, 69, 72, 73]. For example, in MESA, the prevalence of insomnia was higher among Black participants than among White participants, but Black participants were not at significantly increased odds of insomnia [36]. In the Health and Retirement Study, there was no Black/White difference in insomnia trajectory (assessed using the frequency of insomnia symptoms), but Black participants reported lower insomnia scores than White participants [39]. Racial minorities participating in the National Health and Nutrition Examination Survey 2007–2008 [40] and in a study of health maintenance organization members in California [72] reported fewer insomnia symptoms than White participants. Importantly, few studies of insomnia in Black populations used a nationally representative study population and utilized a validated measure of insomnia, which may partially account for inconsistent findings regarding a racial disparity in some data. The use of questions that have not been validated in diverse populations could also lead to

Table 3. Lifetime racism in relation to subthreshold and clinical insomnia

Racism variables	Subthreshold insomnia				Clinical insomnia			
	Age-adjusted model		Multivariable* model		Age-adjusted model		Multivariable* model	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
On the job								
No	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
Yes	1.34	(1.27, 1.42)	1.20	(1.14, 1.28)	1.62	(1.50, 1.74)	1.41	(1.30, 1.52)
In housing								
No	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
Yes	1.28	(1.20, 1.36)	1.16	(1.09, 1.24)	1.59	(1.47, 1.71)	1.42	(1.31, 1.53)
By police								
No	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
Yes	1.26	(1.18, 1.34)	1.14	(1.06, 1.21)	1.60	(1.48, 1.72)	1.39	(1.28, 1.51)
In the courts								
No	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
Yes	1.24	(1.12, 1.36)	1.06	(0.96, 1.17)	2.04	(1.84, 2.26)	1.59	(1.43, 1.77)
At school								
No	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
Yes	1.29	(1.22, 1.36)	1.19	(1.12, 1.26)	1.48	(1.38, 1.59)	1.38	(1.28, 1.49)
Getting medical care								
No	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
Yes	1.47	(1.37, 1.57)	1.27	(1.18, 1.37)	2.26	(2.08, 2.45)	1.84	(1.69, 2.01)
Lifetime racism								
No to all	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
Yes to 1	1.22	(1.12, 1.32)	1.19	(1.10, 1.29)	1.39	(1.25, 1.55)	1.42	(1.27, 1.58)
Yes to 2	1.35	(1.25, 1.47)	1.26	(1.16, 1.38)	1.57	(1.41, 1.76)	1.52	(1.36, 1.71)
Yes to 3	1.54	(1.40, 1.68)	1.39	(1.26, 1.53)	1.88	(1.68, 2.12)	1.78	(1.57, 2.01)
Yes to ≥4	1.68	(1.54, 1.83)	1.43	(1.31, 1.57)	2.81	(2.53, 3.11)	2.40	(2.13, 2.69)
p-trend	<.01		<.01		<.01		<.01	

*Multivariable model adjusts for age, marital status, education, income, BMI, vigorous physical activity, smoking status, and everyday racism.

measurement error and bias due to potential underreporting of insomnia symptoms.

Information from previous studies on racism and sleep disturbances is sparse and there is no information specifically on racism and insomnia. In the Jackson Heart Study (JHS), among 1757 Black men and 3106 Black women, participants with higher scores on the Global Perceived Stress Scale [74], which included a domain on racism and discrimination, or the Weekly Stress Inventory [75] were at higher risk of short sleep duration [50]. The scale used for everyday discrimination included the everyday discrimination questions used in the BWHS [76, 77]. JHS participants who reported greater everyday discrimination had shorter sleep duration and poorer sleep quality [51, 77]. In another study, in which one-third of the 441 participants were non-White, higher discrimination scores were associated with poorer sleep efficiency and poorer sleep quality [54].

Our finding of a stronger association for lifetime racial discrimination and clinical insomnia among obese participants could be due to the co-occurrence of both racial and weight discrimination. In the National Survey of Midlife Development in the United States, 23.9% of Black women reported weight/height discrimination compared to 12.7% of Black men, 9.0% of White women, and 4.4% of White men [78]. The prevalence of weight discrimination was lower among Black women than White women in the Coronary Artery Risk Development in Young Adults Study, but the prevalence increased across categories of BMI in all strata of race and sex [79]. In addition, perceived racial discrimination increased the odds of weight

discrimination in all race-sex groups. Black women have the highest prevalence of obesity (56.9%) in the United States [80], which could provide greater opportunities for Black women to be exposed to weight discrimination. Additionally, we [81] and others [82] have found that perceived racism was associated with increased risk of obesity. Based on the collected data in the present study, it was not possible to completely disentangle discrimination due to weight and due to race. However, whether or not there was an interaction of everyday racism with BMI, an association of racism with increased insomnia was apparent in every category of BMI.

The current findings are supported by a large body of research suggesting that stressors, such as racial discrimination, play a key role in the pathophysiology of sleep disorders. Various parts of the brain and brain functions are involved in insomnia but mechanisms are not established [83]. Hyperarousal and stress reactivity are overarching factors [84, 85], whereby stressors or other precipitating events can lead to abnormalities in neurobiological processes, such as circadian dysregulation [86, 87]. While exposure to stress or trauma has been associated with both higher and lower levels of cortisol reactivity [87, 88], hypothalamic-pituitary-adrenal axis hyperactivity can result in elevated corticotropin-releasing hormone and cortisol levels [89], which are associated with shorter sleep duration [90]. Another possible mechanism linking stress with sleep disorders involves neuron activity in the brain: patients with insomnia have increased β-electroencephalography activity [91, 92], which has been associated with stress and trauma [91, 93]. Psychological mechanisms, such as rumination

Table 4. Everyday and lifetime racism in relation to subthreshold and clinical insomnia,* stratified by duration of sleep

| Racism variables | Subthreshold insomnia | | | | | | Clinical insomnia | | | | | | $p_{interaction}$ |
| | <7 h (n = 3031) | | 7–8 h (n = 3446) | | ≥9 h (n = 1238) | | <7 h (n = 2074) | | 7–8 h (n = 1266) | | ≥9 h (n = 631) | | |
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	
Everyday racism													.44
Quartile 1	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	
Quartile 2	0.96	(0.82, 1.11)	1.25	(1.10, 1.41)	1.02	(0.82, 1.27)	0.91	(0.76, 1.08)	1.32	(1.08, 1.61)	0.97	(0.72, 1.30)	
Quartile 3	1.21	(1.06, 1.38)	1.39	(1.25, 1.55)	1.27	(1.06, 1.53)	1.20	(1.03, 1.40)	1.40	(1.18, 1.67)	1.27	(0.99, 1.63)	
Quartile 4	1.47	(1.27, 1.71)	1.58	(1.39, 1.79)	1.51	(1.22, 1.86)	1.70	(1.44, 2.01)	2.01	(1.67, 2.41)	1.72	(1.32, 2.25)	
Lifetime racism													.70
No to all	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	
Yes to 1	1.32	(1.15, 1.52)	1.12	(0.99, 1.25)	1.16	(0.95, 1.42)	1.46	(1.24,1.73)	1.36	(1.14, 1.64)	1.53	(1.17, 2.00)	
Yes to 2	1.36	(1.17, 1.58)	1.14	(1.00, 1.29)	1.42	(1.15, 1.75)	1.61	(1.35, 1.92)	1.46	(1.21, 1.77)	1.39	(1.04, 1.87)	
Yes to 3	1.38	(1.17, 1.62)	1.33	(1.16, 1.53)	1.53	(1.21, 1.93)	1.82	(1.50, 2.19)	1.50	(1.21, 1.87)	1.81	(1.33, 2.46)	
Yes to ≥4	1.52	(1.29, 1.78)	1.33	(1.16, 1.53)	1.49	(1.18, 1.88)	2.54	(2.12, 3.03)	2.14	(1.76, 2.60)	2.27	(1.70, 3.03)	

*Multivariable models adjust for age, marital status, education, income, BMI, vigorous physical activity, and smoking status and mutually adjust for racism variables.

Table 5. Everyday and lifetime racism in relation to subthreshold and clinical insomnia,*,† stratified by BMI

| Racism variables | Subthreshold insomnia | | | | | | Clinical insomnia | | | | | | $p_{interaction}$ |
| | BMI 18.5–24.9 kg/m^2 (n = 1325) | | BMI 25.0–29.9 kg/m^2 (n = 2380) | | BMI ≥ 30.0 kg/m^2 (n = 3902) | | BMI 18.5–24.9 kg/m^2 (n = 589) | | BMI 25.0–29.9 kg/m^2 (n = 1121) | | BMI ≥ 30.0 kg/m^2 (n = 2225) | | |
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	
Everyday racism													.97
Quartile 1	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	
Quartile 2	1.14	(0.94, 1.38)	1.12	(0.96, 1.31)	1.08	(0.95, 1.23)	1.08	(0.82, 1.44)	1.09	(0.88, 1.34)	1.12	(0.95, 1.32)	
Quartile 3	1.21	(1.01, 1.44)	1.30	(1.14, 1.49)	1.34	(1.20, 1.50)	1.39	(1.08, 1.78)	1.24	(1.03, 1.49)	1.28	(1.11, 1.48)	
Quartile 4	1.58	(1.29, 1.95)	1.56	(1.33, 1.83)	1.52	(1.34, 1.71)	2.14	(1.63, 2.82)	1.78	(1.46, 2.19)	1.73	(1.49, 2.01)	
Lifetime racism													<.01
No to all	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	
Yes to 1	1.22	(1.02, 1.48)	1.14	(0.99, 1.32)	1.20	(1.06, 1.34)	1.40	(1.08, 1.82)	1.42	(1.16, 1.73)	1.44	(1.24, 1.68)	
Yes to 2	1.38	(1.13, 1.68)	1.24	(1.06, 1.44)	1.23	(1.09, 1.40)	1.18	(0.88, 1.58)	1.46	(1.18, 1.81)	1.66	(1.41, 1.94)	
Yes to 3	1.35	(1.08, 1.69)	1.49	(1.26, 1.77)	1.37	(1.19, 1.57)	1.24	(0.90, 1.71)	2.26	(1.81, 2.82)	1.73	(1.45, 2.06)	
Yes to ≥4	1.32	(1.06, 1.66)	1.46	(1.24, 1.72)	1.46	(1.28, 1.68)	1.85	(1.38, 2.47)	1.92	(1.54, 2.39)	2.88	(2.45, 3.39)	

*Multivariable models adjust for age, BMI (continuous), marital status, education, income, vigorous physical activity, and smoking status and mutually adjust for racism variables.
†Participants with BMI <18.5 kg/m^2 were excluded.

and race-related vigilance [55, 94, 95], are also potential pathways by which racial discrimination could influence insomnia. However, it is not clear that these psychological mechanisms would operate independently from or via alternative biologic pathways.

The reliance on self-reported symptoms of insomnia is a potential limitation of this study. However, there is no objective test for insomnia and the ISI is both sensitive and specific in detecting clinical levels of insomnia [63]. It is a validated measure that, because of its brevity and ability to provide meaningful insomnia information as well as related impaired daily functioning and psychological distress, it is one of the most commonly used measures of insomnia [96] and has been demonstrated to be an appropriate self-report measure for use in population-based studies. The use of the ISI in a nationally represented sample is a particular strength of the present analysis. In addition, the ISI demonstrated reproducibility in the BWHS and it also provided important data about subthreshold insomnia, which is often overlooked in epidemiologic research.

The data on experiences of racism, of necessity, relied on self-report. We have reported previously that reproducibility of this variable has been satisfactory [66]. In addition, these variables have been associated with weight gain [97], obesity [81], diabetes [98], adult-onset asthma [99], and preterm birth [100] in the BWHS, as expected, lending credence to the validity of reports of racial discrimination. Another limitation is that we did not specifically assess for sleep apnea, which is often comorbid with insomnia [101, 102]. However, BMI is strongly associated with sleep apnea [103, 104] and we investigated BMI as a covariate and an effect modifier and controlled for continuous BMI within the ≥30 kg/m^2 stratum. Thus, we have crude adjustment for the possibility of sleep apnea, but future studies should evaluate for sleep apnea.

The present analysis is cross sectional in nature, which prevents conclusions about the temporality of the association. However, the analysis used data from a prospective cohort study and the exposure data on racism were collected years before data were collected on insomnia symptoms, attenuating

the likelihood of recall bias. This study benefited from a large sample size, which enabled stratification by important factors that could influence the relationship between racial discrimination and insomnia. The ability to stratify by duration of sleep is a particular strength of these analyses. In addition, the consistency of positive associations across the individual components of the everyday and lifetime racism measures suggests that the findings are not spurious. The BWHS includes only Black women, so the results may not be generalizable to Black men or other underrepresented groups. Future studies should investigate the relation among Black men and other populations that are exposed to discrimination. Importantly, there is a pressing need for data within strata of race/ethnicity and gender to better describe the relation of discrimination to insomnia in diverse populations and to compare associations across groups.

In summary, our results demonstrate that perceived experiences of racism in everyday life and in institutional contexts are associated with a substantially increased risk of insomnia symptoms in a large cohort of middle-aged and elderly Black women. Racism, thus, may be an important contributor to numerous health disparities resulting from sequelae to symptoms of insomnia.

Supplementary Material

Supplementary material is available at *SLEEP* online.
Supplemental Table S1. Distribution of characteristics among 37,099 BWHS participants by inclusion in the present analysis.
Supplemental Table S2. Combined racism score in relation to subthreshold and clinical insomnia.

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