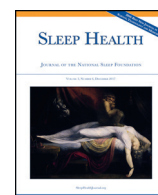




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## Sleep and cardiometabolic health by government-assisted rental housing status among Black and White men and women in the United States

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## ABSTRACT

**Objectives:** To investigate Black-White disparities in suboptimal sleep and cardiometabolic health by government-assisted rental housing status.

**Design:** National Health Interview Survey (NHIS) pooled cross-sectional data (2004–2016).

**Setting:** United States.

**Participants:** Black and White adult participants (n = 80,880).

**Measurements:** Poisson regression with robust variance was used to estimate prevalence ratios (PRs) and 95% confidence intervals for self-reported unrecommended (<6 hours), short (≤6–<7 hours), and long (>9 hours) sleep duration (each separately vs recommended (≤7–9 hours)) and sleep difficulties (eg, trouble falling/staying asleep ≥3 days/week) (yes vs no) among Blacks compared to Whites within rental housing categories (government-assisted vs unassisted), separately, for men and women. Within sex/housing categories, we applied the same approach to compare cardiometabolic health outcomes (ie, overweight/obesity, hypertension, diabetes, heart disease, stroke) between Blacks with worse sleep and Whites with recommended sleep. Models were adjusted for age and other potential confounders.

**Results:** Participants' mean age was 42 ± 18 years, 57% were female, and 30% Black. Blacks in unassisted housing had a higher prevalence of unrecommended and short sleep (PR = 1.22 [1.15–1.30] -men, PR = 1.14 [1.08–1.21] -women) compared to their White counterparts (p<sub>housing\*race</sub> = 0.001 -men, p<sub>housing\*race</sub> = 0.008 -women), but no Black-White differences (PR = 0.88 [0.73–1.07] -men, PR = 0.98 [0.89–1.09] -women) were observed among government-assisted renters. Generally, Blacks were less likely to report sleep difficulties than Whites. Cardiometabolic health disparities between Blacks with worse sleep and Whites with recommended sleep were generally smaller among government-assisted renters, but relationships varied by sex.

**Conclusions:** There were no racial disparities in short sleep duration, and cardiometabolic health disparities were generally attenuated when Blacks and Whites resided in government-assisted rental housing.

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## Introduction

Blacks in the United States are more likely than their White counterparts to have established cardiovascular disease (CVD) risk factors,<sup>1</sup> and are twice as likely to die from CVD.<sup>2</sup> Although poor sleep is a less well-established contributor to racial/ethnic disparities

in cardiovascular health,<sup>3</sup> it has been associated with an increased risk of obesity, hypertension, type 2 diabetes, coronary heart disease, stroke, and premature mortality.<sup>4–6</sup> While one-third of US adults report not getting the recommended amount of sleep suggested for optimal health,<sup>7,8</sup> Black/African-American adults (46%) are more likely to report not obtaining the recommended amount of sleep.<sup>7</sup> Given the apparent detrimental impact of poor sleep on cardiometabolic health and Black-White disparities in sleep health,<sup>7,9,10</sup> sleep may help explain recalcitrant, poorly understood disparities in cardiometabolic health by race/ethnicity.<sup>3</sup>

Housing tenure, the financial arrangement by which housing is occupied, may contribute to racial/ethnic disparities in sleep and

Abbreviations: PR, Prevalence ratio; BMI, Body mass index; CI, Confidence interval; NCHS, National Center for Health Statistics; NHIS, National Health Interview Survey.

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cardiometabolic health by determining where individuals live and their direct exposures, but there is limited research regarding these relationships in the epidemiologic literature. One prior study of British adults found that compared to homeowners and private renters, residents in public housing or government-assisted rentals – where they have lower rent because it is partially paid by the local, state, or federal government – had a higher prevalence of frequent sleep problems.<sup>11</sup> There are currently no comparable studies among US adults (to our knowledge), but data from the American Housing Survey (2011 and 2013) suggest that government-assisted renters may live in residences with more severe physical problems/breakdowns (e.g., plumbing and sewage disposal breakdowns, heating equipment breakdowns, and leaking water inside units) compared to unassisted renters.<sup>12,13</sup> Although differences were small, other issues more prevalent among government-assisted renters include inadequate heating and insulation, cold temperatures in the winter, peeling paint, and signs of rodents and cockroaches.<sup>13</sup> These suboptimal environmental features of housing could contribute to noise pollution due to poor insulation, suboptimal indoor temperatures, and poor indoor air quality, which are factors that can negatively affect one's ability to initiate and maintain healthy sleep.<sup>14</sup> Furthermore, social environments may be worse among public housing tenants who reported lower neighborhood ratings compared to unassisted renters.<sup>12</sup> Neighborhood factors (eg, noise, air pollution, high crime due to poverty) are also more common among low-income residences.<sup>15</sup> Such exposures are increasingly associated with worse sleep and cardiometabolic health outcomes (eg, obesity, cardiovascular disease).<sup>3,16</sup>

Black-White disparities in both sleep and cardiometabolic health have been observed in prior literature, and the historical legacy of racial residential segregation likely contributes to these disparities due to the potential for vastly different physical and social environmental exposures by race whereby Blacks generally experience more inopportune, health damaging exposures.<sup>15</sup> However, Blacks and Whites living in government-assisted housing are likely to live in more similar environments that impact sleep and cardiometabolic health. In fact, previous studies have demonstrated similar housing environments between Black and White residents of assisted housing<sup>17</sup> as well as reduced or non-existent racial disparities in sleep and cardiometabolic health outcomes when low-income Blacks and Whites live in similar or integrated environments.<sup>18,19</sup> However, these studies did not measure housing tenure as a possible modifier of racial disparities in poor sleep and cardiometabolic health. Given the potential environmental commonalities between Black and White residents of government-assisted rental housing, it is important to consider housing tenure in investigations of racial disparities in sleep and cardiometabolic health. Therefore, the objective of our study was to investigate housing tenure as a potential modifier of associations between race and (1) sleep duration/quality and (2) cardiometabolic health outcomes in a nationally-representative sample of US-born Black and White housing renters. We investigated men and women separately because sleep characteristics like insomnia symptoms, relationships between home socioeconomic environments and sleep, and racial disparities in cardiometabolic health outcomes like obesity vary by sex.<sup>20–22</sup> We hypothesized that smaller disparities in sleep and cardiometabolic health would be observed between Blacks and Whites living in government-assisted rental housing compared to Blacks and Whites living in unassisted rental housing.

## Participants & methods

### *The National Health Interview Survey (NHIS)*

We analyzed a series of cross-sectional data from the NHIS for the survey years 2004–2016. NHIS is an annual household interview survey that employs a multistage sampling design, which permits

representative sampling of the non-institutionalized US civilian population. A detailed description of the NHIS is published elsewhere.<sup>23</sup> Briefly, interviewers, trained by the US Census Bureau per National Center for Health Statistics (NCHS) procedures, obtained self-reported sociodemographic characteristics and health information through in-person interviews from a probability sample of households. A random adult and child (if present; not included in this analysis) provided additional health information. Data were collected with computer-assisted personal interviewing. The response rate for adults was 81% (range: 74.2% in 2008–83.8% in 2004). Participants provided written informed consent, and NHIS protocols were approved by the NCHS review board.

### *Study population*

We included participants who were at least 18 years of age, rented their homes, and self-identified their race/ethnicity as non-Hispanic White or non-Hispanic African-American/Black. Participants were excluded if they had missing data for housing tenure, cardiometabolic outcomes (including weight/height), sleep duration (<3%), or if they reported <3 or >22 hours of sleep duration. We also excluded participants born outside of the United States because evidence suggests sleep pattern differences exist between foreign-born and native US residents.<sup>24</sup> Our final analytic sample consisted of 80,880 adults.

### *Measures*

#### *Race/ethnicity*

Participants were asked what race or races they considered themselves to be and could select one or more of 12 categories. Participants were also asked to report Hispanic or Latino ethnicity. Our analysis was restricted to participants who self-identified as non-Hispanic/Latino and either White or Black/African-American (hereafter referred to as White or Black).

#### *Government-assisted rental housing status*

Only families who rent their houses or apartments were asked about government-assisted rental housing. Participants were classified as government-assisted renters if they provided an affirmative response (yes vs no) to the following question: “[Are you/Is anyone in your family] paying lower rent because the Federal, State, or local government is paying part of the cost?”

#### *Sleep duration and sleep difficulties*

NHIS interviewers were instructed to record the number of hours slept on average during a 24-hour period in whole numbers, rounding values 30 minutes or more up to the nearest hour and otherwise rounding down to the nearest hour.<sup>23</sup> Based on the National Sleep Foundation recommendations, we categorized sleep duration as unrecommended (<6 hours), short sleep ( $\leq 6$ –<7 hours), recommended sleep ( $\geq 7$ – $\leq 9$  hours), and long sleep ( $> 9$  hours).<sup>8,25</sup> We combined unrecommended and short sleep into a short sleep category (<7 hours) in analyses regarding cardiometabolic health. In addition to being recommended by the National Sleep Foundation, seven-to-nine hours of sleep was used as the reference category because it is associated with the lowest levels of morbidity and mortality.<sup>26,27</sup> Sleep difficulties in the past week included reports of trouble falling asleep and trouble staying asleep (both  $\geq 3$  days/week vs <3 days/week), days woke up feeling rested (‘most’ (4–7 days) vs ‘few/none’ (0–3 days)), and taking sleep medication  $\geq 3$  days/week (vs <3 days/week). While sleep duration data were available for all survey years (2004–2016), sleep difficulties data were available for the years 2013–2016.

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