Racial Differences in Self-Reports of Sleep Duration in a Population-Based Study

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Study Objectives: Racial and ethnic differences in sleep duration are not well understood. Research shows that short (≤6 hours) and long (≥9 hours) sleepers have higher mortality risks than mid-range sleepers. We investigated whether sleep duration varies by racial and ethnic characteristics and if some of these associations may be explained by residential context.

Design: Cross-sectional National Health Interview Survey.

Setting: Non-institutionalized adults living in the United States in 1990.

Participants: 32,749 people aged 18 years or older.

Measurement and Results: We estimate a multinomial logistic regression that predicts short, mid-range, and long sleep duration; including covariates for race/ethnicity, among other demographic, health, and neighborhood characteristics. Black respondents had an increased risk of being short and long sleepers (OR=1.41, 95% CI=1.27-1.57 and OR=1.62, 95% CI=1.40-1.88, respectively) relative to white respondents. Hispanics (excluding Mexican Americans) and non-Hispanic "Others" were also associated with increased risk of short sleeping (OR=1.26, 95% CI= 1.07-1.49 and OR=1.35, 95% CI= 1.11-1.64, respectively). Living in an inner city was associated with increased risk of short sleeping and reduced risk of long sleeping, compared to non-urban areas. Some of the higher risk of short sleeping among blacks can be explained by higher prevalence of blacks living in the inner city.

Conclusions: Blacks and other racial minorities are more likely to have sleep durations that are associated with increased mortality. The results are consistent with the hypothesis that unhealthy sleep patterns among minorities may contribute to health differentials.

Keywords: Racial and ethnic disparities, health, neighborhood context, sleep duration

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INTRODUCTION

DISPARITIES BY RACE IN TERMS OF MORTALITY, HEART DISEASE, CANCER, DIABETES, AND A VARIETY OF OTHER MORBIDITIES ARE NOT FULLY UNDERSTOOD. Differential rates in health behaviors contribute to some extent, yet they have not been able to account for all of the disparities.[1-3] Socioeconomic factors,[4-6] racism,[7,8] discrimination,[9] segregation,[6,10] and variation in residential context[11] are other often explored sources of racial health disparities. However, sleep is not one of the health behaviors typically studied. In this paper, we investigate the roles of both race/ethnicity and urban environment on an understudied yet potentially very important health indicator, sleep duration.

While the physiological mechanisms are not understood, multiple studies have shown that both short and long sleep durations are associated with higher morbidity and mortality risks than mid-range sleep lengths.[12-18] However, because previous studies investigating racial differences in sleep have not examined both ends of the sleep duration distribution, they overlook the possibility that both short and long sleeping contribute to racial disparities in health.[19,20] This study examines the association between both individual socioeconomic characteristics and neighborhood context on racial differences in short and long sleep durations.

Race and Sleep Duration

Despite the breadth of literature on racial disparities in health, there are rather limited inquiries into the topic of how sleep varies by race.[21] While polysomnographic recordings show that blacks have only about half as much slow wave sleep as whites,[22] rarely are these data collected with the intention of analyzing them for racial differences; consequently, studies are not designed to consider this question. Epidemiological research on race and insomnia is limited, and the results are mixed. Bixler et al.[23] found that chronic insomnia is more common among nonwhite minorities, while Riedel et al.[24] found that the reverse is true. Ancoli-Israel et al.[25] found no significant differences between whites and nonwhites with regard to insomnia. However, using objective data on a group of 38- to 50-year-olds in the CARDIA study, Lauderdale et al.[19] found that blacks have lower mean sleep duration, lower sleep efficiency, and higher sleep latency than their white counterparts, even after controlling for various socioeconomic and demographic factors.

Neighborhood Effects

A growing body of literature has documented the association between disadvantaged residential environment and poor health outcomes.[26] The geographical divide between different groups of people, a partial consequence of racial and economic residential segregation, produces exposure to risk, hazard, and protection that are spatially distributed, with disadvantaged minorities disproportionately being exposed to detrimental physical and social environments.[27] Neighborhood context affects the health risks, beliefs, and behaviors of their residents. First, neighborhoods determine educational and employment opportunities. Through role models and friends in the neighborhood, individuals learn behaviors about how to live, work, and play that affect their health and life outcomes.

Disclosure Statement

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Residential segregation, by concentrating poverty, reinforces preexisting disadvantages ranging from diminished returns on real estate to reduced city services to social isolation.[10,28] For example, blacks are more likely to be exposed to chronic exposure to stressful neighborhood conditions, such as high crime rates, that can have a cumulative toll on health.[29] In addition, racial isolation may impose a psychological burden in the form of racial discrimination which has been hypothesized to have adverse effects on health outcomes for blacks.[6]

Given the notion that sleep is important for health and the growing evidence of the link between neighborhood context and health, we are interested in whether neighborhood characteristics may help explain racial/ethnic sleep disparities. To our knowledge, there is no background literature on this topic with regard to adults, although some work has found that neighborhood disadvantage is associated with increased risk of pediatric obstructive sleep apnea.[30]

METHODS

Subjects

Since 1957, the National Health Interview Survey (NHIS) has conducted nationwide household interviews to collect information concerning the health of the U.S. civilian non-institutionalized population. The survey collects information on race/ethnicity, socioeconomic characteristics, and health status. Each year contains varying supplemental information including health behaviors for a subsample of the respondents. In 1990, the NHIS included a health promotion supplement that asked respondents about their sleep patterns. Our sample consists of the 1990 NHIS health promotion supplement subsample who were ≥18 years at the time of the interview.

Sleep Measures

In the 1990 health promotion supplement, subjects were asked to provide a number between 0 and 24 for the question, "total hours usually slept during a 24-hour day, including naps." The mean hours slept in one day was 7.28, with a median of 7 and a mode of 8. Given the literature on short and long sleep, the variable was grouped into 3 categorical outcomes: ≤6, 7 or 8, and ≥9.

Other Measures

The NHIS survey also asked about various demographic factors: age, gender, race/ethnicity (grouped as non-Hispanic white, non-Hispanic black, non-Hispanic other, Mexican American, and Hispanic other). The socioeconomic factors that we used were education (<12 years, 12 years, 13-15 years, 16 years, and ≥17 years), marital status (married, single, separated, divorced, and widowed), income (<10K, 10-15K, 15-20K, 20-25K, 25-35K, 35-50K, ≥50K), family size (1, 2, 3, 4, and ≥5), and employment (employed, unemployed, not in the labor force age <65, and not in the labor force age ≥65). We divided labor force nonparticipants into 2 categories according to whether the respondent is aged less than or over 65 years because the reasons for not being in the labor force are likely to differ by age. Respondents in the younger group are more likely to be discouraged workers, students, and homemakers, while those in the older group are more likely to be retired.

Health characteristics were captured through the following measures: alcohol consumption (abstainer, lifetime infrequent drinker, former drinker, current drinker and no drinks in the last 2 weeks, current drinker and <4 days of drinking in the last 2 weeks, current drinker and 4-12 days of drinking within the last 2 weeks, and current drinker and 13 or 14 days of drinking in the last 2 weeks), self-reported stress level (a lot, moderate, relatively little, almost none), smoking status (never smoked, former smoker, current smoker), general exercise participation, activity limitation (unable to perform major activities, limited in kind/amount of major activities, limited in other activities, not limited in activities), self-rated health (whether the respondent self-reported poor or fair health versus good, very good, or excellent health), body mass index (underweight [<18.5], normal [18.5-25], overweight [25-30], and obese [>30] as calculated by self-reported weight and height), number of bed days in the past 12 months (0, 1-7, 8-30, or 31 or more), and whether the respondent thought about seeking professional help for stress.

Physical and urban environment variables included 4 regions of the United States (Northeast, South, Midwest, and West), type of residence (single family, apartment, or trailer), and 8 categories of urban environment. The type of urban environment is categorized by the combination of type of Metropolitan Statistical Area (MSA) of residence (MSA-central city, MSA-non central city, non MSA) and MSA population size. The census bureau defines an MSA as a county or group of contiguous counties that contains at least one city with ≥50,000 people. The center city of an MSA refers to either the primary city in the MSA, or an additional city within the MSA that has a population of at least one-third or more of the largest city in the MSA, and at least 25,000 people. Population density was not directly part of the measure here, although it was likely to be correlated with these variables.

Statistical Analysis

We estimated a multinomial logistic regression that predicts short (≤6 hours) and long (≥9 hours) sleep behavior relative to the category of mid-range (7 or 8 hours per night) sleeping, using a strategy developed in a related paper.[31] Stata 9.0 (Stata Corp, College Station, TX) was used to estimate all models. We estimated a series of 4 models, all of which use sampling weights: Model 1 included only demographic characteristics. Model 2 added in controls for individual socioeconomic factors. Model 3 added in controls for health conditions and behaviors. Model 4 added in variables about the metropolitan characteristics of residence in addition to controls for region of the country and type of residence. Most of the variables were coded as dummy variables for whether the person fit into the category described above. The one exception to this was age, which was specified as a continuous variable. Because previous studies have shown that the relationship between age and sleep duration to be nonlinear, we also included a quadratic term for age.

RESULTS

Sample Characteristics

Table 1 provides weighted descriptive statistics of our sample as a whole and by racial and ethnic group. Race/ethnicity includes 5 categories: non-Hispanic white (79.0%), non-Hispanic black

(10.1%), Mexican-American (4.1%), other Hispanic (3.5%), and other non-Hispanic (3.3%).

As shown, of the total sample (n=32,749), approximately a quarter of the population sleeps ≤6 hours (short duration) and 10% sleep ≥9 hours (long duration). Without adjusting for any other characteristics, blacks had the highest rates of sleeping both the short duration (30.8%) and the long duration (14.1%), while whites had the lowest rates for these durations (23.5% and 8.9%, respectively).

Socioeconomic factors included were marital status, family income, education, labor force status, and family size. The first column reveals that approximately two-thirds of the population was married, 17.6% single, 2.1% separated, 7.5% divorced, and 6.4% widowed. As shown in the subsequent columns, whites were more likely to be married than all other racial/ethnic groups. Whites and non-Hispanic others had more years of education than other racial categories. Around two-thirds of the sample was employed, with 3.1% unemployed, 16.6% aged <65 years and not in the labor force, and 12.8% aged ≥65 and not in the labor force.

With regard to health variables, approximately 10.5% of the population reported having fair or poor health, with blacks reporting the highest rates of fair or poor health. Although 29.2% reported experiencing a lot of stress, only 12.6% considered seeking professional help for the stress. By race, whites had the lowest rate or reporting having almost no stress. With regard to health behaviors, 42.0% of the population reported participating in general exercise, 25.8% are current smokers, and 13.5% were obese. More than 16% had some activity limitation, and 3.0% spent more than 30 days in bed within the last year.

Most of the respondents lived in single family units, but there were significant variations by race. There were also regional differences in the population by race.

There were 8 categories of residential environment: MSA, central city >1 million people (16.8%), MSA, non-central city >1 million people (26.5%), MSA, central city 250,000-1 million people (10.4%), MSA, non-central city 250,000-1 million people (17.6%), MSA, central city 100,000-250,000 people (2.5%), MSA, non-central city 100,000-250,000 people (3.6%), MSA<100,000 people (1.7%), and non-MSA (20.9%). There were large differences by race in where people reside. For example, while 36.6% of blacks lived in central city MSA areas of greater than 1 million people, only 11.8% of whites did. Mexican Americans (34.0%) and Other Hispanics (42.5%) also had higher prevalence of living in large urban areas than whites.

Table 2 shows the results of the multinomial logistic regression for the racial categories and the urban environment variables. The first model reveals that non-Hispanic black respondents had an increased risk of being short and long sleepers (OR=1.62, 95% CI=1.47-1.77 and OR=2.00, 95% CI=1.76-2.26, respectively, in Model 1) relative to white respondents. To some extent, the short and long sleeping associations for blacks were reduced by adjusting for SES, health, and urban living, as the odds ratios decreased from Model 1 to 4. The full model (Model 4) shows a reduction in the black/white sleep disparity to OR=1.41, 95% CI=1.27-1.57 for short sleep and to OR=1.62, 95% CI=1.40-1.88 for long sleep. The largest change in OR fell between Models 1 and 2 with the simple addition of the socioeconomic status variables.

Though to a lesser extent than observed for non-Hispanic blacks, non-Hispanic "others" and non-Mexican Hispanics also had increased odds of being short sleepers than whites (OR=1.35, 95% CI=1.11-1.64 and OR=1.26, 95% CI=1.07-1.49, respectively) after adjustment for SES, health, and urban living. These populations did not, however, reveal an increased risk of long sleeping.

Mexican Americans had higher odds of long sleeping compared to whites in Model 1 (OR=1.45, 95% CI=1.15-1.83), but after adjusting for socioeconomic characteristics, the association reduced to a level that was not statistically significant (OR=1.10, 95% CI=0.87-1.40). The coefficient value was stable and remained insignificant for all subsequent models.

Model 4 in Table 2 shows the results of the full multinomial logistic regression (M4) for the urban size categories. The odds of short sleeping were highest for those who lived in central city environments with over 1 million people (OR=1.43, 95% CI=1.28-1.58), compared with residents of more rural, non-metropolitan environments (non-MSA areas) after adjusting for socioeconomic and health characteristics. The odds of short sleeping were also elevated for the non-central city >1 million category (OR=1.26, 95% CI=1.15-1.39), the central city 250,000-1 million people (OR=1.25, 95% CI=1.12-1.40), the non-central city 250,000-1 million people (OR=1.23, 95% CI=1.11-1.36), and the central city 100,000-250,000 people (OR=1.23, 95% CI=1.02-1.48) categories. Thus both living in a city and city size were associated with short sleeping; residing in urban and more populated areas increased the odds of short sleeping.

The odds of long sleep was decreased for individuals who lived in central-city or non-central city metropolitan areas with a population greater than 1 million (OR=0.84, 95% CI=0.72-0.98 and OR=0.82, 95% CI=0.72-0.95, respectively), compared with those living in non-metropolitan environments.

Additional factors significantly associated with short sleep duration in the final model (results not shown) included being male (compared to female), being divorced or widowed (compared to being single), and having low levels of education. Having a lot or moderate amounts of self-reported stress (compared to almost none) was associated with increased short sleeping and a decreased long sleeping. Similarly, being employed was associated with increased short sleeping and decreased long sleeping.

Having fair or poor self-rated health (compared to excellent, very good, or good health) was associated with increased likelihood of both short and long sleep duration. Current smokers and those with activity limitations were also more likely to be short sleepers and long sleepers. In addition, former drinkers were more likely than abstainers to be short sleepers; and those who have had >14 drinks in the last 2 weeks were more likely than abstainers to be long sleepers. In addition, overweight and obese individuals were also more likely to be short sleepers compared to normal weight respondents, but only the overweight (and not obese) were more likely to be long sleepers.

Additional models were estimated in which gender interacted with each covariate, allowing for differential effects by sex. Very few variables revealed a significant gender interaction with regard to sleep (results not shown).

DISCUSSION

Blacks and to some extent other racial minorities have higher odds than whites of having high-risk sleep durations. Residents of metropolitan and areas with large populations are also at higher risk of reporting short sleep durations.

Table 1—Descriptive Statistics

Characteristics	Total Sample	White	Black	Mexican American	Other Hispanic	Other Non-Hispanic
n=	32,749	25474	4147	1127	1082	919
	%	%	%	%	%	%
Race/Ethnicity						
White	79.0					
Black	10.1					
Mexican American	4.1					
Other Hispanic	3.5					
Other NonHispanic	3.3					
Sleep Duration						
≤6 hours	24.6	23.5	30.8	23.9	28.7	26.2
7 or 8 hours	65.9	67.6	55.1	64.2	62.6	65.7
≥9 hours	9.5	8.9	14.1	12.0	8.8	9.2
Mean Age	43.2	44.3	40.6	36. 3	39.5	39.0
Sex						
Female	52.1	51.7	56.2	52.3	57.2	55.5
Male	47.9	48.3	43.9	47.7	42.8	44.5
Marital Status						
Married	66.4	69.2	46.1	67. 3	62.3	66.2
Single	17.6	15.4	29.8	21.9	20.4	23.8
Separated	2.1	1.5	6.5	2.8	3.5	1.9
Divorced	7.5	7.3	10.1	4.7	9.1	5.2
Widowed	6.4	6.6	7.5	3.3	4.6	2.9
Education						
Less than 12 yrs edu	19.5	16.5	28.7	48.6	28.6	16.4
12 years edu	38.5	39.3	40.5	31.1	32.3	29.3
13to15 years edu	20.8	21.2	19.5	15.2	21.9	21.6
16 years edu	12.0	13.0	7.2	3.4	9.8	15.2
17+ years edu	9.2	10.0	4.1	1.8	7.4	17.6
Family Income						
Less than 10K	10.8	8.7	24.1	14.2	14.7	10.3
10 to 15K	9.2	8.3	13.0	15.2	11.9	9.3
15 to 20K	10.3	9.5	14.8	13.4	11.9	8.5
20 to 25 K	9.2	9.2	7.9	12.7	9.4	8.8
25 to 35K	17.2	17.5	15.4	15.5	16.8	18.2
35 to 50K	19.7	20.9	13.7	16.0	16.5	18.2
50K and above	23.7	26.0	11.2	12.9	18.9	26.7
Employment						
employed	67.6	67.9	64.5	68.7	66.4	69.1
Unemployed	3.1	2.7	6.0	4.3	3.5	2.5
Not in Labor Force <65	16.6	15.2	20.4	22.3	23.2	22.4
Not in Labor Force 65+	12.8	14.2	9.1	4.8	6.8	6.0
Family Size						
1.00	15.9	16.5	17.1	7.0	12.6	12.6
2.00	31.0	33.5	23.9	15.4	22.4	21.5
3.00	20.2	20.3	21.2	18.7	20.3	18.7
4.00	18.9	18.6	18.1	19.7	23.3	22.8
5 or more	14.0	11.2	19.8	39.3	21.4	24.3
Self-Rated Health						
Excellent, Very Good, Good Health	89.5	90.3	83.6	87.7	88.9	91.6
Fair or Poor Health	10.5	9.7	16.4	12.3	11.2	8.4
Stress Level						
A lot	29.2	30.4	26.4	22.2	24.3	22.3
Moderate	37.8	39.9	30.9	27.3	27.8	31.2
Relatively Little	20.7	19.6	25.2	24.5	25.1	25.4
Almost None	12.5	10.1	17.5	26.0	22.8	21.1
Thought about seeking professional help for stress	12.6	13.3	10.2	9.9	10.5	8.8
Smoking Status						
Never Smoked	49.2	46.8	56.3	58.6	58.0	62.5
Former Smoker	25.1	27.2	17.2	17.4	17.6	17.0
Current Smoker	25.8	26.1	26.5	23.9	24.4	20.50

(Table continued on next page.)

Table 1—Descriptive Statistics *(Continued from pg 1099)*

Characteristics	Total Sample	White	Black	Mexican American	Other Hispanic	Other Non-Hispanic
n=	32,749	25474	4147	1127	1082	919
	%	%	%	%	%	%
Exercise Participation						
No	58.0	56.7	64.4	62.7	65.0	56.8
Yes	42.0	43.3	35.6	37.3	35.0	43.2
Activity Limitation Status						
unable to perform major activities	4.5	4.3	6.8	3.7	4.3	3.8
limited in kind/amount of major activities	5.9	6.3	5.6	3.7	4.8	2.6
limited in other activities	5.7	6.2	4.7	2.8	3.8	3.0
not limited, incl unknowns	83.9	83.3	82.9	89.9	87.1	90.5
Bed Days in the Last Year						
0	55.3	54.0	59.1	6.2	58.2	61.5
1-7	33.9	35.2	28.3	28.3	29.6	31.9
8-30	7.8	7.9	8.7	7.3	7.7	4.6
31 or more	3.0	2.9	4.0	2.1	4.4	2.0
Drink Alcohol						
Abstainer	15.3	12.5	9.2	22.3	22.0	32.5
Lifetime Infrequent Drinker	12.5	11.5	17.2	13.8	16.6	15.5
Former Drinker	9.5	9.7	9.8	9.0	5.7	5.5
Current Drinker, no drinks in last 2 weeks	15.0	15.8	10.7	12.3	13.4	11.6
Current Drinker, <4 drinks in last 2 weeks	28.1	29.1	22.4	27.8	28.0	22.8
Current Drinker 4-12 drinks in last 2 weeks	14.6	15.9	10.3	10.4	9.7	8.2
Current Drinker, 13-14 drinks in last 2 weeks	5.1	5.5	3.5	4.1	2.6	4.0
Weight						
Normal	50.8	52.1	40.3	44.0	51.6	61.2
Underweight	3.0	3.2	1.9	1.0	2.4	5.3
Overweight	32.7	32.2	36.2	37.5	32.5	28.1
Obese	13.5	12.6	21.6	17.5	13.5	5.5
Residence Type						
Single	75.1	77.9	65.5	71.2	53.1	65.1
Apartment	19.0	15.6	30.9	25.4	44.3	30.6
Trailer	5.9	6.5	9.4	3.5	2.6	4.3
Region						
Northeast	20.4	21.5	15.3	1.9	34.1	16.6
Midwest	25.3	28.1	21.5	9.0	6.3	10.4
South	32.9	30.9	55.0	31.6	31.6	18.2
West	21.4	19.5	8.2	57.5	28.0	5.5
MSA/Size						
MSA, central-city > 1 million	16.8	11.8	36.6	34.0	42.5	26.4
MSA, non central-city > 1 million	26.5	27.4	17.6	27.2	28.7	30.3
MSA, central-city 250,000 to 1 million	10.4	9.1	17.8	15.3	9.9	13.7
MSA, non central-city 250,000 to 1 million	17.6	19.9	7.7	12.2	8.5	10.6
MSA, central-city 100,000 to 250,000	2.5	2.6	3.2	1.1	1.2	1.2
MSA, non central-city 100,000 to 50,000	3.6	4.1	2.6	1.8	1.5	0.9
MSA < 100,000	1.7	1.9	0.6	0.2	0.5	0.1
Non MSA	20.9	23.3	14.0	8.1	7.3	15.7

Table 2—Selected Multinomial Odds Ratios [95% confidence interval] of Short (≤6 hours) and Long Sleeping (≥9 hours) Relative to Mid-Range Sleepers (7 or 8 hours), Race and Urban Environment Results

	Short Sleep Duration			
	M1	**M2**	**M3**	**M4**
Race/Ethnicity				
White	--	--	--	--
Black	1.62 [1.47-1.77]	1.47 [1.33-1.62]	1.45 [1.31-1.61]	1.41 [1.27-1.57]
Mexican American	1.09 [0.96-1.40]	0.98 [0.82-1.17]	1.00 [0.84-1.20]	1.04 [0.86-1.25]
Other Hispanic	1.33 [1.14-1.55]	1.26 [1.07-1.48]	1.30 [1.11-1.53]	1.26 [1.07-1.49]
Other Non-Hispanic	1.16 [0.96-1.40]	1.18 [0.97-1.42]	1.29 [1.06-1.56]	1.35 [1.11-1.64]
MSA/Size				
MSA, central-city> 1 million				1.43 [1.28-1.58]
MSA, non central-city > 1 million				1.26 [1.15-1.39]
MSA, Central-city 250,000 to 1 million				1.25[1.12-1.40]
MSA, non central-city 250,000 to 1 million				1.23 [1.11-1.36]
MSA, central-city 100,000 to 250,000				1.23 [1.02-1.48]
MSA, non central-city 100,000 to 50,000				1.01 [0.85-1.20]
MSA < 100,000				1.03 [0.81-1.32]
Non MSA				--
	Long Sleep Duration			
	M1	**M2**	**M3**	**M4**
Race/Ethnicity				
White	--	--	--	--
Black	2.00 [1.76-2.26]	1.53 [1.34-1.75]	1.55 [1.35-1.77]	1.62 [1.40-1.88]
Mexican American	1.45 [1.15-1.83]	1.10 [0.87-1.40]	1.15 [0.90-1.47]	1.07 [0.83-1.37]
Other Hispanic	1.12 [0.86-1.47]	0.94 [0.71-1.24]	0.97 [0.75-1.27]	1.00 [0.76-1.31]
Other nonHispanic	1.16 [0.83-1.62]	1.11 [0.79-1.56]	1.18 [0.84-1.55]	1.09 [0.78-1.53]
MSA/Size				
MSA, central-city> 1 million				0.84 [0.72-0.98]
MSA, non central-city > 1 million				0.82 [0.72-0.95]
MSA, central-city 250,000 to 1 million				0.90 [0.76-1.07]
MSA, non central-city 250,000 to 1 million				0.96 [0.82-1.12]
MSA, central-city 100,000 to 250,000				0.82 [0.59-1.15]
MSA, non central-city 100,000 to 50,000				0.95 [0.73-1.23]
MSA < 100,000				0.89 [0.64-1.23]
Non MSA				--

*** P <0.001 ** P<0.01 * P<0.05 + P<0.10

M1: Model 1 controls for age; age-squared; gender; and all racial categories.

M2: Model 2 is Model 1 + marital status (married, widowed, divorced, separated and single); education (<hs, high school, 2 years college, 4 years college, 5 years or more college); family income (<5 K, 5-7K,7-10K, 10-15K, 15-20K, 20-25K, 25-35K, 35-50 K, 50K+); family size (1, 2, 3, 4, 5 plus); employment status (unemployed, not in labor force <65, not in labor force 65+).

M3: Model 3 is Model 2 + stress level (a lot of stress, moderate stress, relatively little, almost none); smoking status (never, former, current); exercise participation (yes, no); Activity limitation status (unable to perform major activities, limited in kind/amount of major activities, limited in other activities, and not limited); alcohol consumption (abstainer, lifetime infrequent drinker, former drinker, current drinker with no drink-days within the last 2 weeks, current drinker < 4 drink-days within the last 2 weeks, Current drinker with 13-14 drink days within the last 2 weeks); weight (normal, underweight, overweight, obese); number of bed-days per year.

M4: Model 4 is Model 3 + Urban Environment variables (Urban > 1 million, Non-Urban > 1 million, Urban 250,000-1 million, Non-Urban 250,000-1 million, Urban 100,000-250,000, Non-Urban 100,000-250,000, Urban < 100,000 and Non-Urban < 100,000); residence type (single, apartment, trailer); and region (Northeast, Midwest, South, West).

Inadequate or prolonged sleep durations may be due to an abundance of life stressors among racial minorities and residents of urban environments. For example, people from disadvantaged communities may not have the luxury of sleeping through the night if they work night shifts or multiple jobs. Residents of poorer neighborhoods may also experience greater levels of psychosocial stress (such as uncertainty about the future) or depression that make it difficult to fall or stay asleep. Better measures and longitudinal data of mental and physical health may improve our understanding of this mechanism.

Social factors may also play a role in explaining these relationships. For example, late-night socializing may be more common in the large cities because of the proximity of friends, households, and increased opportunities for various social activities. Social and cultural practices that affect sleep patterns might also vary by racial category, and these practices may begin early in life.[30,32-34]

Structural conditions related to neighborhood and living environment may also contribute to the increased likelihood of high-risk sleep duration among racial minorities and city residents. For example, the crowded residences of the inner city may have thin walls, noisy neighbors, busy streets, and little room for a solid night's rest. Noise or light pollution may keep city residents awake later or wake them up earlier than those in less urban areas. These factors might lead to either shortening sleep or increasing frag-

mentation of sleep leading to prolonged reported sleep durations. However, when controlling for type of residence, people who live in apartments or trailers do not have significantly different sleep durations than those who live in single-family dwellings.

There may also be physiological differences in the demand for or the ability to sleep by racial category that are also associated with neighborhood characteristics. While it is generally agreed that sleep is a complex behavior determined by a multidimensional gene-environment interaction, much more needs to be understood about the relevance of these physiological pathways.[35] As with other health outcomes, such as non–insulin-dependent diabetes mellitus and essential hypertension, in which the frequency of occurrence differs between blacks and whites, the degree to which innate genetic differences between the 2 groups account for the gradient is profoundly unclear.[36] Moreover, since econometric models are susceptible to model misspecification, measurement error (e.g., poor, incomplete measures of SES), and the omission of probable social and environmental factors across a life-course, Frank[37] warns against erroneously interpreting, after adjustments for traditional confounders, the remaining racial differences in outcomes to racial genetic differences. Instead, she advocates the exploration of biological differences that are mutable to the complex influences of social and physical environments.

These cross-sectional relationships are not sufficient to identify a causal link between race and sleep duration, and should not be over-interpreted. Further, there may be concerns about the use of self-reported data. For example, people with sleep apnea may be reporting longer sleep times because they are in bed for longer, but they may not be sleeping more. That said, the results of this study are consistent with the hypothesis that unhealthy sleep patterns among blacks and city residents may contribute to health differentials. This information can assist public health and health care professionals in identifying segments of the population that are at higher risk for sleep or sleep-related disorders. An understanding of the correlations between race, neighborhood context, and sleep duration may also provide help in explaining outcomes where there are other racial disparities, such as test score gaps, educational attainment, employment, and crime. It may also lead to the incorporation of sleep and other biological variables in future public health, urban planning, and social science research.

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