

# SELF-REPORTED SLEEP IN OLDER AFRICAN AMERICANS AND WHITE AMERICANS

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**Objective:** Assess the relationship of self-reported sleep quality and possible sleep disorders with disability in a racially diverse sample of community-dwelling older adults.

**Methods:** Participants included 943 non-demented older African Americans (n=452) and Whites (n=491) from two cohort studies, the Minority Aging Research Study (MARS) and the Rush Memory and Aging Project (MAP). Participants completed a 32-item questionnaire assessing sleep quality and the possible presence of three sleep disorders (sleep apnea, restless leg syndrome [RLS] and REM behavior disorder [RBD]). Disability was assessed with scales that quantified the ability to perform instrumental activities of daily living (IADL), basic activities of daily living (ADL), and physical mobility activities.

**Results:** More than half of the participants reported impaired sleep quality (51%), or the possible presence of at least one sleep disorder (57%; sleep apnea 44%, RLS 25% and RBD 7%). Sleep quality was rated poorer in African Americans, those with advancing age and fewer years of education (all  $P < .05$ ). Only sleep apnea risk was associated with age ( $P < .02$ ). In logistic regression models adjusted for age, sex, years of education, and race, both sleep quality and disorders were associated with disability (sleep quality with mobility disability ( $P < .001$ ), sleep apnea risk with mobility disability and IADL disability (all  $P < .001$ ) and RLS symptoms with mobility disability ( $P < .01$ ).

**Conclusions:** Results indicate that self-assessed impaired sleep is common in old age and is associated with disability. *Ethn Dis.* 2016;26(4):521-528; doi:10.18865/ed.26.4.521

## INTRODUCTION

Sleep disturbances are common in older adults. Almost 40% suffer from a sleep disorder such as sleep apnea, and 32%-45% report difficulties falling or staying asleep.<sup>1,2,3</sup> The hallmark sleep complaint in old age is insomnia, with prevalence rates ranging from 15%-65%.<sup>4,5</sup> Empirical studies support that aging is associated with shorter sleep times, decreased time in deep sleep, increased arousals, and diminished sleep efficiency.<sup>6-8</sup> Characterizing sleep patterns in older adults is important because sleep is important for good health. Previous research indicates that poorer sleep quality and shorter sleep durations are associated with impairments in physical functioning,<sup>9,10</sup> and daytime consequences of insomnia include weakness and fatigue.<sup>10-12</sup> Unfortunately, most subjective sleep problems have been de-

termined from general health surveys or with limited sleep measures, and almost all studies have been done in the majority White population. In the relatively few studies that have been conducted in diverse studies, African Americans have been found to have a higher prevalence of sleep disturbances than Whites,<sup>13-15</sup> including being more susceptible to developing sleep disordered breathing.<sup>16,17</sup>

The purpose of our current study was to extend prior work with a more comprehensive self-assessment of sleep problems in a diverse sample of older adults. We assessed frequency of poor sleep quality and possible presence of three sleep disorders (sleep apnea, restless leg syndrome, REM behavior disorder) using validated instruments. We also examined whether these problems varied as a function of race, age, sex, and education. In a previous study we demonstrated that

**Keywords:** Sleep Quality; Sleep Apnea; Restless Leg Syndrome; REM Behavior Disorder; African Americans; Disability

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sleep complaints are related to an increased risk of incident disability, using a brief 5-item sleep questionnaire in a cohort of predominantly older Whites.<sup>18</sup> Thus, in the current study, we also examined racial differences in the association between sleep problems and disability.

## METHODS

### Participants

Participants were enrolled in one of two ongoing longitudinal epidemiological cohort studies of aging and cognition with similar recruitment techniques, and operational methods; both were approved by

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the Rush University Medical Center Institutional Review Board.

Participants in the Minority Aging Research Study (MARS) were older community-dwelling African Americans, without known dementia, recruited from churches, community-based organizations, senior-subsidized housing facilities in the greater Chicago area, and the Clinical

Core of the Rush Alzheimer's Disease Center. All participants signed an informed consent agreeing to annual clinical evaluations, as previously described.<sup>19</sup> Between the start of the study in 2004 and May 2014, more than 600 persons enrolled in MARS.

Participants in the Rush Memory and Aging Project (MAP; 88% White) were older community-dwelling adults recruited from Chicago area retirement and senior-subsidized housing facilities, without known dementia. These participants also signed an informed consent agreeing to annual clinical evaluations and organ donation, as previously described.<sup>20</sup> Between the start of the study in 1997 and May 2014, more than 1500 people enrolled in MAP.

The sleep measure was added to both studies in 2012. Only nondemented individuals who self-identified as African American or White were eligible for analyses. Of the 1563 alive and eligible MARS and MAP participants at the inception of the sleep questionnaire, 1020 had upcoming annual evaluations and received the sleep questionnaire (excluding 13 MAP participants who did not self-identify as African American or White). We received 1003 completed questionnaires (98% response rate; 1003/1020). Sixty participants who were found to have dementia at the clinical evaluation closest in time to the sleep questionnaire were excluded. Analyses are based on the remaining 943 people.

### Clinical Evaluation

Participants underwent annual uniform structured clinical evaluations including medical history,

neurological examination, and neuropsychological testing, as previously described.<sup>19,20</sup> An experienced clinician classified participants with respect to dementia according to criteria of the joint working group of the National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association.<sup>21</sup>

### Demographic Covariates

Age (in years) was computed from self-reported birth date and date of the sleep questionnaire in this analysis. Education was based on self-reported years of regular schooling. Race was based on self-report using the 1990 US Census categories.

### Assessment of Sleep

We constructed a 32-item questionnaire to assess sleep quality and determine the occurrence of 3 common sleep disorders (sleep apnea, restless leg syndrome, and REM behavior disorder) using selected questions from three validated measures of sleep quality and sleep disorders: the Pittsburgh Sleep Quality Index (PSQI),<sup>22</sup> the Berlin Questionnaire,<sup>23</sup> and the Mayo Sleep Questionnaire (MSQ).<sup>24</sup> Participants were given the sleep questionnaire and an addressed and stamped envelope at the end of their annual visit, and instructed to complete the questionnaire and return it via the stamped envelope.

To assess sleep quality, we used a modified version of the PSQI. Components 2-4 (sleep latency, sleep duration, and sleep efficiency) of the PSQI were assessed and scored as originally reported. To reduce participant burden, items 5d-j and 6 of the PSQI

were not assessed and so component 1 of the PSQI (overall sleep quality) was not scored, and component 5 (sleep disturbances) was based only on the mean of items 5b-c. To avoid duplication with existing medication assessment procedures, in lieu of item 7 of the PSQI, we obtained a detailed history of all medications consumed, examined medication bottles, and coded medication use using the MediSpan system. Participants were considered to be taking medications to help them sleep if they took any of the MediSpan coded insomnia medications in the preceding 2 weeks, and component 6 of the PSQI (use of sleeping medications) was scored as 0 (absent) or 1 (present). To reduce unnecessary duplication of questions regarding daytime sleepiness, we scored component 7 of the PSQI (daytime dysfunction) using items 6 and 9 from the Berlin questionnaire rather than items 8 and 9 from the PSQI, which were not assessed. A modified global PSQI score was then calculated as the sum of the above component scores.

To assess for sleep apnea, we administered the Berlin questionnaire,

and scored it as previously published and validated<sup>25</sup> indicating either a high or low risk for sleep apnea.

To screen for restless leg syndrome (RLS), we used items 2-3 of the MSQ. Participants were considered to screen positive for RLS if they answered yes to item 3 of the MSQ, consistent with other published work.<sup>26</sup> In addition, we determined the total number of RLS symptoms by taking the sum of items 2-3 of the MSQ (range 0-10).

To assess for REM sleep behavior disorder (RBD), we utilized items 1a-e of the MSQ, which was scored as previously published and validated.<sup>27</sup> In addition, a symptom count based on the answers to questions 1b-e ranged from 0-4.

**Assessment of Disability**

Disability was assessed using three modified self-report measures from the Established Populations for Epidemiologic Studies of the Elderly. We assessed the ability to perform instrumental activities of daily living (IADL; eg, self-care functions) using Lawton and Brody's 8-item scale of the same name.<sup>28</sup> Mobility disability was assessed

using the Rosow-Breslau scale (RosB),<sup>29</sup> a 3-item scale assessing the difficulty with which one can perform mobility tasks typically encountered by community-dwelling adults (eg, doing heavy housework). Basic activities of daily living (ADL) were assessed using the Katz Scale, a 6-item scale measuring the extent to which individuals need help with basic activities of daily living (e.g. bathing).<sup>30</sup> On all three scales, participants indicated whether they needed help in conducting the activities and were classified as being disabled if they reported either needing help or being unable to perform one or more of the tasks.

**Data Analysis**

The analytic process was completed in two phases. The first phase described the characteristics of sleep in older adults in our sample. We computed descriptive statistics of the sleep measures and obtained Spearman correlations across the sleep measures and between the sleep measures and demographic variables. We employed chi-square tests, t-tests and one-way ANOVAs to compare the mean sleep scores across different demographic

**Table 1. Participant characteristics for African Americans and Whites in MARS and MAP**

	Total sample (N=943)	African Americans (n=452)	Whites (n=491)
Age, years, mean (SD)	80 (7.8)	76.8 (6.4)	82.8 (7.8)
Women, %	76	77	75
Education, years, mean (SD)	15 (3.1)	14.8 (3.4)	15.4 (2.9)
Education categories, %			
≤12 years	27	30	24
13-15 years	26	32	21
≥16 years	47	38	55
n (%) with sleep problems			
Impaired sleep quality	482 (51)	244 (54)	238 (48)
Sleep apnea risk, high risk	421 (45)	199 (44)	223 (45)
Restless leg syndrome	246 (26)	117 (26)	129 (26)
REM behavior disorder	64 (7)	38 (8)	26 (5)

MARS, Minority Aging Research Study 2004-2014, Chicago; MAP, Memory and Aging Project 1997-2014, Chicago

**Table 2. Sleep scores in African Americans and Whites in MARS and MAP**

	Total Sample (N=943)	African Americans (n=452)	Whites (n=491)	P
Sleep quality total score	6.02 (2.79)	6.17 (2.99)	5.89 (2.59)	.002
Latency	1.12 (.95)	1.10 (.98)	1.14 (.93)	
Duration	.55 (.86)	.72 (.96)	.38 (.07)	
Efficiency	.86 (1.06)	1.08 (1.13)	.65 (.95)	
Disturbance	2.30 (.95)	2.13 (.99)	2.45 (.88)	
Sleepiness	1.16 (.60)	1.13 (.57)	1.20 (.62)	
Medication	.04 (.19)	.01 (.09)	.06 (.24)	
Sleep apnea risk score				NS
Snore category	.82 (.38)	.81 (.39)	.83 (.37)	
Fatigue category	.44 (.49)	.38 (.49)	.50 (.50)	
Physiological category	.78 (.041)	.88 (.33)	.69 (.46)	
Category sum	1.44 (.78)	1.49 (.74)	1.38 (.82)	
Restless leg syndrome (RLS)				
Possible RLS, n	246	117	129	
RLS symptom count	4.43 (1.90)	4.46 (1.97)	4.41 (1.85)	NS
REM sleep behavior disorder (RBD)				
Possible RBD, n	64	38	26	
RBD symptom count	1.06 (.92)	1.13 (1.01)	.96 (.77)	NS

Data are mean (SD) unless noted otherwise.

MARS, Minority Aging Research Study 2004-2014, Chicago; MAP, Memory and Aging Project 1997-2014, Chicago; NS, not significant at  $P < .05$ .

subgroups. Least square means were compared using Tukey-Kramer adjustment for multiple comparisons.

The second phase of the analysis tested the association between sleep measures and disability. Spearman correlations between sleep measures and disability summary scores were calculated and logistic regression models, adjusting for age, sex, years of education, and race, were used to determine the associations between the sleep measures and dichotomized disability scores.

Analyses were programmed using SAS/STAT® software version 9.3. Statistical significance was set at  $\alpha = .05$ .

## RESULTS

### Frequency of Sleep Problems

Sample characteristics of the 943 individuals in this study can

be found in Table 1. African Americans were younger ( $P < .001$ ), and had slightly less education ( $P < .01$ ).

Sleep quality scores ranged from 0-15 (mean=6.02, SD=2.79; Table 2) and 51.1% of the total sample, (53.9% of African Americans and 48.5% of Whites) had total sleep quality scores  $\geq 6$ , indicating a possible impairment in sleep. When examining the individual components of sleep quality, the total sample tended to have short sleep latencies (falling asleep 15-30 minutes after going to bed), and slept approximately 7 hours a night, with good efficiency. In addition, though participants suffered from daytime sleepiness and reported sleep disturbances, few employed sleep medications (Table 1).

Sleep apnea findings were categorized as either high or low risk for the disorder, 44.6% of the total sample (44% of African Ameri-

cans, 45.6% of Whites), were deemed at high risk for sleep apnea.

The possible presence of RLS was reported in 26.1% of the combined group, 25.9% of African Americans and 26.3% of Whites. Among those with possible RLS, symptom score ranged from 1-10 (mean=4.43, SD=1.90; Table 2).

The possible presence of RBD was rare in the cohort as it was reported in only 6.8% of participants in the combined group (8.4% African Americans and 5.3% Whites). Therefore this disorder was not included in further analyses.

All sleep measures derived from the questionnaire were intercorrelated. Unadjusted correlations revealed a modest association between sleep quality and both sleep disorders (sleep apnea category sum,  $r = .30$ ,  $P < .0001$ ; RLS symptoms  $r = .16$ ,  $P < .0001$ ). The sleep disorders were weakly cor-

**Table 3. Sleep scores by demographic subgroups**

	Age			P	Sex		P	Education			P
	65-75	76-85	≥86		Women	Men		≤12	13-15	≥16	
Sleep quality score	(n=310) 6.1 (2.83)	(n=402) 5.8 (2.81) <sup>a</sup>	(n=231) 6.3(2.69)	.031	(n=716) 6.1(2.82)	(n=227) 5.7(2.66)	.287	(n=255) 6.5(2.91)	(n=247) 6.2(2.82)	(n=441) 5.7(2.65) <sup>a</sup>	<.0001
Sleep apnea risk score	(n=309) .5 (.50) <sup>a</sup>	(n=396) .4 (.49)	(n=227) <sup>a</sup> 4(.50)	.015	(n=709) .5(.50)	(n=223) .5(.50)	.904	(n=255) .5(.5)	(n=245) .5(.5)	(n=432) .4(.049)	.169
RLS symptoms	(n=70) 4.6 (1.95)	(n=70) 4.2 (1.89)	(n=62) 4.7 (1.85)	.225	(n=200) 4.5(1.88)	(n=46) 4.1(2.01)	.229	(n=71) 4.5(1.83)	(n=70) 4.7(2.09)	(n=105) 4.2(1.81)	.144

Data are mean (SD) unless noted otherwise.

a. Indicates a mean statistically significantly different from other groups, which did not differ.

Mean differences for one-way ANOVAs are based on Tukey-Kramer post hoc analysis. Chi-square employed for Sleep apnea risk. RLS, restless leg syndrome.

related with one another ( $r=.013$ ,  $P=.04$ ). More than half of the participants reported at least one possible sleep disorder (536, 57%) with about one-fifth experiencing two or more possible sleep disorders (163, 17%), and more than a third having both impaired sleep quality and a possible sleep disorder (332, 35%).

**Sleep Problems and Demographics**

In a series of crude comparisons, we stratified the sample into three age and education categories based on the sample distribution (age: 65-75; 76-85; and 86+; education: ≤12 years; 13-15 years, and ≥16 years). Mean comparisons revealed that sleep quality differed by age group ( $F_{3939}=2.96$ ,  $P=.031$ ) education group ( $F_{2940}=8.62$ ,  $P<.001$ ) and

race ( $t_{451}=1.33$ ,  $P=.001$ ), but not by sex. Sleep quality was higher among those 76-85, those with 16+ years of education and among Whites than among the other groups (Tables 2, 3)

Sleep apnea risk differed by age group ( $X^2=8.41$ ,  $P=.015$ ; Table 3), individuals who were aged <75 years were at lower risk for sleep apnea. Sleep apnea risk did not differ based on sex, years of education, or race.

The possible presence of RLS did not differ by demographic subgroup. In addition, in the subsample of participants reporting possible RLS, symptom level did not differ by demographic subgroup (Table 3).

**Sleep Problems and Disability**

Sleep quality was correlated only with mobility disability ( $r=.11$ ,  $P<.001$ ). In logistic regression analy-

ses adjusting for age, sex, years of education, and race, poorer sleep quality was associated with mobility disability (OR 1.09, 95%CI 1.04-1.15; Table 4); individuals with poorer sleep quality were slightly more likely to have mobility disability than their counterparts with better sleep quality. When all sleep measures were entered into the same model, the association between mobility disability and sleep quality was no longer significant (data not shown), possibly due to the intercorrelated nature of the sleep measures.

In logistic regression analyses adjusted for demographics, being at higher risk for sleep apnea was associated with presence of IADL disability (OR 1.76, 95%CI 1.31-2.36). Being at higher risk for sleep apnea was also associated with presence of

**Table 4. Sleep problems and presence of disability in MARS and MAP participants (n=943)**

	Instrumental activities of daily living	Mobility disability	Basic activities of daily living
Sleep quality score	1.04 (.98-1.09)	1.09 (1.04-1.15) <sup>b</sup>	.98 (.91-1.06)
High sleep apnea risk	1.76 (1.31-2.36) <sup>b</sup>	1.97 (1.47-2.62) <sup>b</sup>	1.32 (.86-2.04)
RLS symptom level	1.12(.96-1.30)	1.22 (1.04-1.44) <sup>a</sup>	.89 (.70-1.12)

Nine logistic regression models; odds ratio (95%CI) adjusted for age, sex, race, and years of education.

MARS, Minority Aging Research Study 2004-2014, Chicago; MAP, Memory and Aging Project 1997-2014, Chicago; RLS, restless leg syndrome.

a.  $P<.01$ .

b.  $P<.001$ .

mobility disability (OR 1.97, 95%CI 1.47-2.63; Table 4). When all sleep measures were entered into the same model, the association between sleep apnea and mobility disability remained, but the association between IADL disability and sleep apnea was no longer significant (data not shown).

In the subsample with possible RLS, RLS symptoms were correlated with scores for both mobility disability ( $r=.17$ ,  $P=.009$ ) and IADL disability ( $r=.13$ ,  $P=.04$ ). However, in logistic regression analyses, adjusted for demographics, severity of RLS symptoms was associated only with mobility disability (OR 1.22, 95%CI 1.04-1.43; Table 4), as was the possible presence of RLS (data not shown). When all sleep measures were entered into the same model, results for RLS and disability remained the same.

Subsequent models tested for interactions between sleep problems and race on disability, but no interactions were significant (data not shown).

## DISCUSSION

In our present study, we used a comprehensive 32-item self-report sleep questionnaire to assess sleep problems in a diverse sample of older adults. Sleep problems were common affecting >50% of participants and sleep quality and frequency of sleep disorders was associated with age. Further, sleep complaints were more severe in African Americans than Whites but there were no racial differences in the frequency of sleep disorders. Finally, individuals who reported poor sleep or possible sleep disorders had an increased risk of being disabled.

The most common sleep complaint in older adults is insomnia.<sup>4,5</sup> Consistent with this, our overall sample reported poor sleep quality, which included two hallmarks of insomnia: difficulty initiating and/or maintaining sleep. In addition, African Americans had poorer sleep quality than Whites, as previously demonstrated.<sup>16</sup> Patel and colleagues' research suggests that the differences between African Americans and Whites in sleep quality may be attenuated by differences in health between the two groups. Future studies should

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examine the extent to which differences in sleep quality may be due to medical co-morbidities, such as heart disease or arthritis, or social/behavioral issues like increased stress levels, that have been shown to be related to sleep quality and may be more prevalent among African Americans.

It has been stated that, in older adult populations, sleep apnea and limb movement disorders are fairly common.<sup>1,31</sup> Consistent with this, about half of our sample were at high risk for sleep apnea. Restless leg syndrome was relatively uncommon in our sample, in contrast to other

studies,<sup>1</sup> and symptom severity was lower than commonly reported. In addition, there was no difference between African Americans and Whites on RLS measures, which agrees with some studies<sup>14,15,31,32</sup> but not all.<sup>11,33</sup>

Given that there is a link between sleep problems and health outcomes, we also explored the relationship of sleep with disability. Like sleep complaints, disability is common in older adults, with approximately 35%-50% of older adults having some difficulties with activities of daily living. Consistent with previous studies,<sup>34,35</sup> there was an increased burden of disability among African Americans. Further, sleep was a predictor of disability in our study. We found that poor sleep quality, high risk for sleep apnea, and increased symptoms of RLS were each associated with disability in our sample. This is consistent with previous studies that have shown that older individuals with sleep complaints are at higher risk for incident disability<sup>18</sup> and older adults with RLS symptoms are more likely to have functional disability.<sup>36</sup> Interestingly within our sample, sleep problems were most consistently related to mobility difficulties such as walking half a mile, suggesting that poor sleep may have a stronger influence on mobility difficulties than other activities of daily living, whether they are instrumental or basic. There are several possible paths for this relationship, for example mobility disability could contribute to sleep dysfunction via a lack of physical activity during the day translating to difficulties consolidating sleep at night. It is also possible that there is an underlying medical co-morbidity that affects

both mobility and sleep, such as excessive weight or cardiovascular disease. However, these cross-sectional analyses cannot determine the direction of the relationship between sleep problems and mobility disability. Future longitudinal studies are needed to further explore this relationship.

This study has several limitations. Although the comprehensive sleep measure was created from established, validated scales, the questions were self-report. Thus, recall bias and distortion may have influenced results. Though, we excluded persons with dementia, mild cognitive impairment may have influenced the reports for some people. Also, participants from the two cohorts were selected and may not represent the general population of older adults. For example, our results may be affected by the relatively high educational status of our sample, which might reflect a healthier population with less severe sleep problems and lower risks of disability. Finally, the cross-sectional nature of the study precludes us from identifying a causal link between sleep and disability. Longitudinal examinations of sleep disturbance with the measure used in this study are needed to replicate these findings.

This study also has several strengths. We used a comprehensive 32-item measure of self-reported sleep derived from three validated sleep measures to document a range of characteristics of sleep issues in older adults. Several established measures of disability were included as an external validation of the sleep measure. In addition, the study included a large proportion of African Americans, which greatly improves generalizability beyond Whites.

## CONCLUSION

There is increasing recognition of the importance of the relationship between sleep and health, and the potential for sleep as a modifiable risk factor. Sleep complaints and disorders are common, especially as we age; however, there is limited research that includes the very old as well as racially/ethnically diverse samples. Therefore, our current study extends prior studies in several important ways, by utilizing a comprehensive scale to capture both sleep quality and disorders, as well as examining the effects of age and the association with an adverse health outcome, all in a racially diverse sample.

### CONFLICT OF INTEREST

No conflicts of interest to report.

### AUTHOR CONTRIBUTIONS

Research concept and design: Buchman, Barnes; Acquisition of data: Bennett, Buchman, Barnes; Data analysis and interpretation: Turner, Lim, Leurgans, Bennett, Buchman, Barnes; Manuscript draft: Turner, Lim, Leurgans, Bennett, Buchman, Barnes; Statistical expertise: Leurgans, Buchman; Acquisition of funding: Bennett, Barnes; Supervision: Turner, Lim, Bennett, Buchman, Barnes; Administrative: Turner, Bennett, Buchman, Barnes

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