Original Article

Sleep-disordered breathing symptoms among African-Americans in the Jackson Heart Study

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ABSTRACT

Background: Sleep-disordered breathing (SDB) is an increasingly recognized risk factor for cardiovascular disease (CVD). Limited data are available from large African American cohorts.
Methods: We examined the prevalence, burden, and correlates of sleep symptoms suggestive of SDB and risk for obstructive sleep apnea (OSA) in the Jackson Heart Study (JHS), an all-African-American cohort of 5301 adults. Data on selected daytime and nighttime sleep symptoms were collected using a modified Berlin questionnaire during the baseline examination. Risk of OSA was calculated according to published prediction model. Age and multivariable-adjusted logistic regression models were used to examine the associations between potential risk factors and measures of sleep.
Results: Sleep symptoms, burden, and risk of OSA were high among men and women in the JHS and increased with age and obesity. Being married was positively associated with sleep symptoms among women. In men, poor to fair perceived health and increased levels of stress were associated with higher odds of sleep burden, whereas prevalent hypertension and CVD were associated with higher odds of OSA risk. Similar associations were observed among women with slight variations. Sleep duration <7 h was associated with increased odds of sleep symptoms among women and increased sleep burden among men. Moderate to severe restless sleep was consistently and positively associated with odds of adverse sleep symptoms, sleep burden, and high risk OSA.
Conclusions: Sleep symptoms in JHS had a strong positive association with features of visceral obesity, stress, and poor perceived health. With increasing obesity among younger African Americans, these findings are likely to have broad public health implications.

1. Introduction

Disrupted sleep is an increasingly recognized risk factor for hypertension and cardiovascular disease (CVD) [1], metabolic syndrome [2], stroke [3,4], and intracranial hypertension [5], arrhythmias [6], daytime sleepiness [7], and motor vehicle accidents [8,9]. Obstructive sleep apnea (OSA) or, more broadly, sleep-disordered breathing (SDB), is a common but underdiagnosed sleep disorder;

at least 26% of the adult United States population is at risk for this condition [10] – a substantial public health burden. While prevalence appears higher among males and those who are obese, older, and African American [11], existing research has focused on elderly African Americans [12–15] and few studies have examined the extent and burden of SDB among a well-characterized cohort of African American adults [12,16]. A better understanding of the prevalence and clinical correlates of SDB among this ethnic population is essential to stem the anticipated rising tide of OSA associated with increasing obesity among younger African Americans [17,18].

Risk factors for OSA include age, male sex, obesity, upper airway congestion, increased neck size, craniofacial abnormalities, and African-American race [11]. A recent meta-analysis of 10 published

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studies further reaffirmed the association of African-American race and both the prevalence and severity of SDB [19]. Several studies have also reported associations with socioeconomic status (SES), including annual household income, financial difficulties, and stress [16,20]; self-rated health [21]; and health-rated quality of life [13]. Epidemiologically, a diagnosis of likely OSA can be recovered from medical history utilizing the Berlin Sleep Questionnaire [22] and prediction algorithms for clinical use have been developed [23]. Successful treatment of OSA improves symptoms such as daytime sleepiness and increases quality of life [24].

We examined the prevalence and burden of symptoms suggestive of SDB in the Jackson Heart Study (JHS), a large, all-African-American cohort with wide age and body mass ranges and relatively large male proportion. We also examined the associations of sleep symptoms and risk of OSA with selected socio-demographic, anthropometric, health behaviors, and psychosocial factors, as well as chronic health conditions.

2. Methods

The JHS is a large, single-site, longitudinal cohort study designed to understand the etiology of CVD among African-Americans. The JHS cohort [25] includes a total of 5301 participants partly recruited from the Jackson site of the Atherosclerosis Risk in Communities (ARIC) study, with additional randomly selected and volunteer residents of a tri-county area contained within metropolitan Jackson, MS, as well as their family members. Procedures for recruitment [26], the family study [27], and the details of the testing, anthropometric measurements, classification of CVD, hypertension, and diabetes, as well as other aspects of the study, are described in detail elsewhere [28,29]. All current data were obtained during Exam 1 (2000–2004). Trained interviewers asked participants questions regarding their medical history, including symptoms of SDB, socio-demographic information, health behaviors, and self-reported health status and other psychosocial characteristics.

2.1. Sleep measures

Prevalent sleep symptoms were defined as a positive response ("Sometimes," "Often," or "Almost always") to a limited set of five questions adapted from the Berlin Sleep Questionnaire [22]: "You are told that you snore loudly and bother others"; "You are told that you stop breathing (hold your breath) in sleep"; "You fall asleep during the day, particularly when not busy"; "You are tired after sleeping"; and "You feel sleepy or fall asleep while driving." Responses of "Never"/"Seldom" to these questions were rated as a negative response for sleep symptoms. The Cronbach's alpha for internal consistency in this cohort was 0.53. Confirmatory factor analysis, a structural equation model used to validate the structure of the sleep questions, yielded factor loadings revealing two factors corresponding to OSA and insomnia (see Table 1). Although the internal consistency is relatively low, we were interested in classifying participants in regard to the number of self-reported symptoms and not determining OSA. The number of sleep symptoms was categorized as "None" (no symptoms), "Moderate" (1–2 symptoms), or "Severe" (⩾3 symptoms).

The burden of SDB (sleep burden) was quantified by first coding the responses to the sleep symptom questions ("Never," "Seldom," "Sometimes," "Often," or "Almost always") from 0 for "Never" to 4 for "Almost always" and then summing the individual scores, resulting in a sleep burden score that ranged from 0 to 20. Sleep burden was then classified as "None" (score: 0), "Mild" (score: 1–5), "Moderate" (score: 6–10), and "Severe" (score: ⩾11).

Table 1
Internal reliability and CFA.

Scale/individual questions	α Coefficient	Item total correlation	Factor loadings
Total sleep symptom questionnaire	0.53	0.24–0.34	
Risk of OSA			
Snore			0.80
Stop breathing			0.82
Insomnia			
Fall asleep			0.68
Tired			0.60
Feel sleepy while driving			0.74

Self-reported sleep duration, defined in hours, was ascertained from the following question: "During the past month, excluding naps, how many hours of actual sleep did you get at night – or during the day, if you work at night – on average?" Perceived quality of sleep ("During the past month, how would you rate your sleep quality overall?") was self-rated as either "Excellent," "Very Good," "Good," "Fair," or "Poor." Restless sleep within the week prior to Exam 1 was assessed using the following question from the Centers for Epidemiologic Studies Depression Scale [30]: "During the past week, my sleep was restless," and categorized as "None/Mild," "Moderate," or "Severe."

Risk of OSA was calculated according to a clinical decision rule developed by Rodsutti et al. using five significant predictors of OSA: male sex, sleep complaints, including snoring and stopping breathing during sleep, categories of body mass index (BMI) and age [23]. The risk of OSA was determined by assigning the corresponding numerical value in parentheses for male sex (1.1), prevalent sleep complaints (0.9 for snoring and 0.9 for stopping breathing during sleep), BMI category: normal weight (0.0), overweight (1.0), obese (1.4) and morbidly obese (2.2), and age category: less than 30 (0.0), 30–44 (1.0), 45–59 (1.5), and 60 years and above (2.2), and then summed. The total risk of OSA score ranged from 0 to 7.3 and was categorized as Low (score < 2.5), Moderate (score of 2.5 to <4.2), and high (score ⩾ 4.2) risk, in accord to the clinical decision rule [23].

2.2. Covariates

2.2.1. Socio-demographic factors and health behaviors

Select socio-demographic factors included age, sex, socioeconomic status (SES), as measured by the highest level of education achieved and annual household income, and marital status. Current smoking was defined by a positive response to current cigarette use and lifetime consumption of ⩾400 cigarettes. Former smoking was defined as a negative response to current cigarette use but a past consumption of ⩾400 cigarettes. A total physical activity (PA) score was calculated as the sum of four individual index scores for Active Living, Work, Sport, and Home and Family Life activity using a modified version of the Baecke PA questionnaire used in the ARIC study [31].

2.3. Anthropometrics

Height was measured without shoes and recorded to the nearest centimeter. Participants stood with their feet together and head held in the Frankfurt plane. Weight was measured and recorded to the nearest kilogram using a balance scale, with participants in light clothing and not wearing shoes or constricting garments. Normal weight was defined as a measured BMI of 25 kg/m² or less; overweight as BMI 25–29.99, and obesity as BMI of ⩾30 kg/m².