SHORT COMMUNICATION

The STOP-BANG score and lung function in a general population

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Background: Obstructive sleep apnea (OSA) commonly coexists with lung disease. However, the association between OSA components and lung function remains unclear. This study estimated STOP-BANG scores according to lung function using nationwide Korean data. **Materials and Methods:** Three thousand and two hundred eighty adults with available STOP-BANG scores and spirometry data were analyzed. Multivariate regression models were applied to estimate STOP-BANG scores according to lung function. **Results:** Approximately 28% of participants had abnormal lung function, and the characteristics were diverse. The significant factors associated with abnormal lung function included the STOP-BANG score. In multivariate regression analyses, individuals with abnormal lung function had significantly higher STOP-BANG scores than those with normal lung function (odds ratio: 1.19; 95% confidence interval: 1.10–1.29; $P < 0.001$), and this difference was remarkable in men. **Conclusion:** Our results suggest that screening and management of OSA components are warranted to prevent impaired lung function.

Key words: Cross-sectional studies, obstructive sleep apnea, population surveillance, respiratory function tests

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INTRODUCTION

Chronic respiratory disease (CRD) remains a global health challenge, often entwined with sleep disorders, particularly obstructive sleep apnea (OSA).[1] This overlap is associated with worse outcomes when compared to the outcomes of OSA or CRD alone.[2,3] Continuous positive airway pressure – the core treatment of OSA – improves survival and decreases hospitalization of CRD patients.[4] Thus, early recognition and management of OSA may prevent lung function decline. Polysomnography, the standard method for diagnosing OSA, is not time-and cost-effective to perform routinely. STOP-BANG questionnaire is a simple screening tool with high sensitivity for detecting OSA.[5,6] We examined the association between the STOP-BANG score and lung function in a community-based setting.

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MATERIALS AND METHODS

This cross-sectional study analyzed 3280 individuals with STOP-BANG scores and spirometry results from the 2019 Korea National Health and Nutrition Examination Survey.[7] The protocol of this study was approved by the IRB of Gachon University Gil Medical Center (IRB No. GCIRB2023-100).

Prebronchodilator spirometry was performed with subjects aged ≥19, according to the American Thoracic Society/European Respiratory Society guidelines.[8] For each subject, predicted values (%) of forced expiratory volume in 1 s (FEV_1) and forced vital capacity (FVC) and FEV_1/FVC ratio were recorded. FEV_1/FVC ratio of >0.7 and %FVC of >80% were considered normal lung function groups.

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Individuals aged 40 years or older responded yes/no to OSA components of the modified Korean STOP-BANG questionnaire, which contains four questions and four objective scales: (1) Snoring; (2) tiredness; (3) observation of stop breathing; (4) pressure (= hypertension); (5) body mass index >30 kg/m^2; (6) aged >50 years; (7) neck circumference >36.3 cm; and (8) gender = Male.[9] The "yes" responses were summed.

Information on demographics (age, sex, and economic status), health-related behaviors (obesity, current smoking, monthly drinking, and aerobic exercise), and histories of physician-diagnosed diseases (hypertension and type 2 diabetes) was collected during interviews. Low economic status was defined as income less than the median household income, and unmarried status included those who were single or separated for any reason. Obesity was defined as a body mass index ≥25 kg/m^2.[10] Aerobic exercise was defined as ≥2.5 h/week of moderate-intensity activity, ≥1.25 h/week of high-intensity activity, or a combination of activities.

Descriptive statistics by lung function were calculated using *t*-test or Chi-squared test and presented as mean ± standard deviation (SD) or number (percentage). Stepwise multivariable logistic analysis was performed to identify factors associated with abnormal lung function. Considering covariates, we estimated STOP-BANG scores by lung function across sex. Analyses were performed using Stata/MP version 17.0 (StataCorp., College Station, TX, USA). All statistical tests were two-sided with a significance level of 0.05.

RESULTS

Table 1 presents the participant characteristics by lung function, and approximately 28% were in the abnormal lung function group. Significant differences were found in most variables, including the STOP-BANG score. A stepwise multivariable logistic regression model identified factors associated with abnormal lung function [Table 1]. STOP-BANG score was independently associated with abnormal lung function (odds ratio/1-point increase, 1.19; 95% confidence interval: 1.10–1.29; $P < 0.001$). In age-and sex-stratified analyses, the association between STOP-BANG score and abnormal lung function remained robust. Abnormal lung function group had significantly higher STOP-BANG scores (2.42 vs. 2.52; $P = 0.008$), and the association was more remarkable in men (3.52 vs. 3.69 in men, $P = 0.008$; 1.55 vs. 1.66 in women, $P = 0.043$).

DISCUSSION

Despite the existence of data supporting the overlap of CRD/OSA,[1] until now, no studies had assessed the association between STOP-BANG scores and lung function in a community-based setting. This nationally representative study indicates that OSA risk scores are significantly associated with abnormal lung function. This might be partially explained by sleep disturbance by OSA components, which can result in chronic respiratory dysfunction. Some physiological studies have documented that even in healthy subjects, sleep deprivation causes respiratory muscle fatigue.[11,12] In addition, our sex-specific finding can be simply explained by the low STOP-BANG scores in women (mean ± SD: 3.57 ± 1.24 in men vs. 1.70 ± 1.13 in women; the proportion of high risk for OSA [STOP-BANG score of 5–8]: 20.4% in men vs. 1.4% in women).

This preliminary study utilized cross-sectional data, which limits conclusions regarding the direction and causality of findings. Longitudinal studies and/or interventional studies

Table 1: Characteristics by lung function and factors associated with abnormal lung function

	Lung function			For abnormal lung function		
	Normal (*n*=2354), *n* (%)	Abnormal (*n*=926), *n* (%)	*P*	OR[c]	95% CI	*P*
Demographics						
Age (years)	56.0±10.7	64.2±10.5	<0.001	1.07 per 1-year increase	1.06–1.08	<0.001
Men	850 (36.1)	573 (61.9)	<0.001	2.13	1.69–2.70	<0.001
Low economic status (≤ quartiles 2)	994 (42.4)	506 (54.9)	<0.001			
Low education level (≤ middle school)	655 (28.6)	400 (45.5)	<0.001			
Unmarried	440 (18.7)	197 (21.3)	0.092			
Health-related habits						
Obesity[a]	759 (32.2)	390 (42.1)	<0.001	1.31	1.09–1.58	0.005
Current smoking	317 (13.5)	192 (20.9)	<0.001	1.52	1.20–1.93	<0.001
Drinking ≥1 drink/month	1182 (50.5)	489 (53.1)	0.173			
Aerobic exercise[b]	942 (41.1)	364 (41.4)	0.907			
Comorbidities						
Hypertension	595 (25.3)	424 (45.8)	<0.001			
Type 2 diabetes	224 (9.5)	162 (17.5)	<0.001			
STOP-BANG score	2.15±1.47	3.19±1.47	<0.001	1.19/1-point increase	1.10–1.29	<0.001

[a]BMI ≥25 kg/m^2 based on Asia-Pacific criteria; [b] ≥2.5 h/week moderate-intensity activity, ≥1.25 h/week high-intensity activity, or combination of both; [c]Stepwise multivariable logistic regression model. BMI=Body mass index; OR=Odds ratio; CI=Confidence interval

examining the effect of managing OSA components on lung function are needed to confirm our results. Timely screening and management of OSA are required to prevent the impairment of lung function.

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Conflicts of interest

There are no conflicts of interest.

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