

Association between Chronotypes and Comorbidities in Obstructive Sleep Apnea: Age effect

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Introduction

Obstructive sleep apnea (OSA) has been associated with an increased burden of cardiometabolic comorbidities. While OSA may influence chronotype, the impact of age on this relationship is unclear. To our knowledge, no study has systematically examined the association between OSA, chronotypes, and comorbidities, particularly in the context of the changes that occur over time, with a focus on comparing younger and middle-aged individuals to older adults.

Chronotype reflects the phenotypic expression of the circadian rhythm, representing individual differences in the alignment of internal biological clocks with preferred timing of daily activities, either earlier or later in the day. Chronotype varies across individuals, ranging from pronounced morning or evening preferences to an intermediate type, which is most common. In clinical settings, it is commonly assessed using the validated Morningness–Eveningness Questionnaire (MEQ).

Aim

This cross-sectional study aims to investigate whether the association between comorbidities in individuals with OSA and chronotypes is modulated by age within a large sample of OSA patients.

Methods

Data were collected across three sleep clinics affiliated with tertiary university hospitals in Greece (671 participants, 60,2% men, aged 56, IQR: 47- 65). Comorbidities were determined based on the patient's medical history and pharmacological treatment.

Sleep history was obtained, and the Morningness–Eveningness Questionnaire (MEQ) was completed. The MEQ consists of 19 items, with total scores ranging from 16 to 86. Based on their scores, participants were categorized as evening type (16–41), intermediate type (42–58), or morning type (59–86).

Table 1. Baseline demographic, clinical, and sleep characteristics of participants with comorbidities and comparisons across age and chronotype subgroups

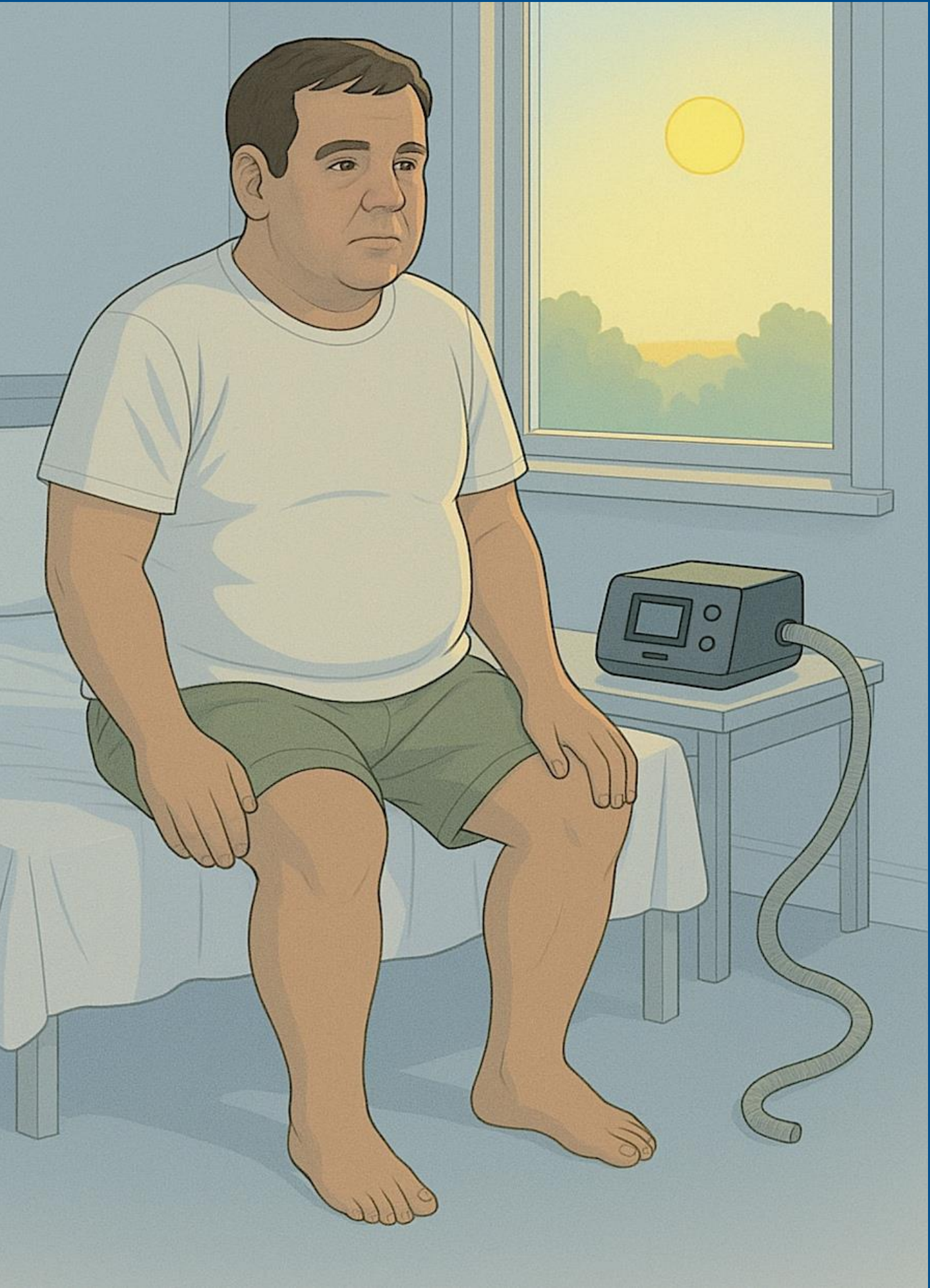
	Entire population	Adults < 60yrs	Adults ≥ 60yrs	p-value	Morning Type	Intermediate Type	Evening Type	p-value
	N=504	N=263	N=241		N=107	N=328	N=69	
Age	57.46 (49-67)	49 (42-55)	67 (64-72)	<0.001*	65 (59-71.5)	57 (48-66)	47 (36.7-58.2)	<0.001*
Sex (Male, %)	58.7%	62 %	55.2 %	0.122	57 %	60.1%	55.1%	0.68
BMI, kg/m²	31.5 (27.5-36.3)	32.4 (27.7-38.1)	30.85 (26.95-34.95)	0.005*	31 (26.6-34.6)	31.8 (27.8-36.2)	32.9 (27.5-40.8)	0.025*
Neck Circumference	40 (37-43)	41 (38-43)	39 (36-43)	0.012*	39 (36-43)	40 (37.3-43)	40.75 (38-44.3)	0.43
Waist/Hip Circumference	1 (0.94-1.06)	0.98 (0.92-1.06)	1.01 (0.95-1.07)	0.004*	1.01 (0.95-1.06)	0.99 (0.93-1.06)	1 (0.93-1.08)	0.27
Obesity (BMI ≥30 kg/m2) (%)	61.7 %	64.4 %	58.6 %	0.18	59.8%	62%	63.1%	0.89
Current Smokers (%)	16.7 %	15.6 %	17.8 %	0.49	13.1%	18.6%	13%	0.28
Thyroid Dysfunction	17.9 %	17.9 %	17.8 %	0.99	16.8%	19.5%	11.6%	0.28
Depression	10.7 %	9.9 %	11.6 %	0.53	4.7%	10.1%	23.2%	<0.001*
GERD	7.7 %	8 %	7.5 %	0.82	7.5%	7.9%	7.2%	0.97
Hypertension (%)	57.9 %	49.6 %	66.8 %	<0.001*	66.7%	57.2%	47%	0.037*
Diabetes (%)	19.8 %	19.1 %	25.7 %	0.06	30.1%	21.2%	15.2%	0.039*
Dyslipidemia (%)	32.7 %	25.5 %	40.7 %	<0.001*	41.1%	32.6%	20.3%	0.016*
CBVD	24 %	14.4 %	34.4 %	<0.001*	32.7 %	23.2%	14.5%	0.018*
Chronotypes (%)				<0.001*				
86-59: Morning Type	21.2 %	11 %	32.4 %		-	-	-	
58-42: Intermediate Type	65.1 %	69.2 %	60.6 %		-	-	-	
16-41: Evening Type	13.7 %	19.8 %	7.1 %		-	-	-	
Sleep Parameters								
≥15, events/hour	81.9 %	80.5 %	83.8 %	0.33	84%	82.3%	78.3%	0.62
AHI (events/hour)	30.85 (18.02-52.95)	30.4 (17.1-53.2)	34 (20.35-54.10)	0.187	34.5 (19.8-54.4)	31.5 (18.1-53.2)	30.10 (15.8-55.8)	0.85
SpO2<90% (%)	6.3 (1-22.04)	4 (0.4-15.5)	9.1 (2.4-27.8)	<0.001*	8.6 (2.17-20.75)	5.7 (0.9-22.2)	5 (0.4-25.9)	0.53
Minimum SpO2 (%)	82 (77-86)	82 (76-86.75)	82 (78-86)	0.716	83 (78-86)	82 (77-86)	83 (76.7-87)	0.58

Data are presented as median (IQR) for continuous variables and as percentages for categorical variables. P values refer to comparisons between age groups (<60 vs ≥60 years) and across the three chronotype subgroups. AHI: Apnea-Hypopnea Index; CBVD: History of cardiovascular disease (heart failure, cardiomyopathy, atrial fibrillation, coronary artery disease, and valvular heart disease) or stroke; Dyslipidaemia: Treatment for Hypercholesterolemia or/and Hypertriglyceridemia; GERD: Gastroesophageal Reflux Disease; Hypertension: Blood pressure ≥ 140/90 mm Hg and/or antihypertensive treatment; SpO2: Peripheral oxygen saturation.



Morning Chronotype

In OSA patients with comorbidities, a morning chronotype was associated with a **higher prevalence of hypertension, dyslipidemia, diabetes, and cardiovascular conditions** compared to the evening chronotype (all p-values <0.05).



Evening Chronotype

Depression was the only comorbidity more frequently observed in those with an evening chronotype.

All participants underwent in-lab or home-based polysomnography. Since there was a significant age effect, statistical analysis was conducted (SPSS) to examine the association between chronotype and the risk of cardiometabolic comorbidities, while adjusting for confounders.

Results

In OSA patients with comorbidities, a morning chronotype was associated with a higher prevalence of hypertension, dyslipidemia, diabetes, and cardiovascular conditions compared to the evening chronotype (all p-values <0.05). In the BLR, a shift toward a morning chronotype was significantly associated with increased comorbidity prevalence, particularly in individuals younger than 60 years.

Table 2. Associations between chronotype (MEQ score) and comorbidities: Binary logistic regression analyses in participants with comorbidities (All participants with comorbidities)

	Age <60			Age ≥60		
	OR	95% CI	P-value	OR	95% CI	P-value
Diabetes	1.041	1.001-1.083	0.043*	1.012	0.973-1.053	0.552
Hypertension	1.039	1.006-1.072	0.019*	1.011	0.975-1.047	0.566
Hyperlipidemia	1.054	1.015-1.093	0.006*	1.011	0.977-1.046	0.547
CBVD	1.035	0.992-1.079	0.112	1.003	0.969-1.038	0.858
Thyroid	1.029	0.987-1.073	0.181	1.001	0.957-1.047	0.962
GERD	0.98	0.929-1.043	0.587	1.027	0.962-1.096	0.423
Depression	0.945	0.897-0.995	0.030*	0.935	0.888-0.985	0.012*

Depression was the only comorbidity more frequently observed in those with an evening chronotype. No significant age effect was observed for depression.

Conclusion

In conclusion, our study demonstrates that the association between chronotype and cardiometabolic comorbidities in patients with OSA is more pronounced among individuals with a morning chronotype particularly younger than 60 years old.

Conflicts of interest

The authors declare that they have no conflict of interest. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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