



# Adherence to Positive Airway Pressure Therapy in a Cohort of Colombian Patients with Obstructive Sleep Apnea Syndrome

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## Abstract

### Keywords

- ▶ Sleep Apnea
- ▶ Obstructive
- ▶ Treatment Adherence and Compliance
- ▶ Continuous Positive Airway Pressure
- ▶ Cardiovascular diseases

**Objective** To describe the adherence to the use of positive air pressure (PAP) devices in a cohort of patients with sleep apnea syndrome in Colombia.

**Material and Methods** Descriptive cross-sectional study of adult patients treated between January 2018 and December 2019 in the sleep clinic of a private insurer in Colombia.

**Results** The analysis included 12,538 patients (51.3% women) with a mean age of 61.3 years; 10,220 patients (81.5%) use CPAP and 1,550 (12.4%) BIPAP. Only 37% are adherent (> 70% of use for 4 hours or more), adherence rates were highest in the >65 years age groups. 2,305 patients (18.5%) were hospitalized, on average 3.2 times; 515 of these (21.3%) had one or more cardiovascular comorbidities.

**Conclusion** Adherence rates in this sample are lower than those reported elsewhere. They are similar in males and females and tend to improve with age.

## Introduction

Obstructive sleep apnea syndrome (OSAS) has been recognized as a serious public health issue for several reasons, which include drowsiness that can lead to traffic accidents, work disability due to decreased productivity<sup>1</sup> and increased risk of cardiovascular disease. About 80% of OSAS patients complain of excessive daytime sleepiness and cognitive impairment, 50% report personality changes, and 1 in 4 newly diagnosed patients has neuropsychological impairment.<sup>2</sup> A cohort of patients from a cardiovascular health program screened for OSAS showed that risk of developing cardiovascular events more than doubles when compared with patients without OSAS ( $p < 0.001$ ).<sup>3</sup> Adherence to positive airway pressure (PAP) therapy is associated with im-

provement both of daytime sleepiness<sup>4</sup> and of cardiovascular risk. Meta-analyses of randomized clinical trials have shown that patients who use the device for 4 or more hours per night have a cardiovascular benefit, especially in relation to stroke.<sup>5</sup> In a retrospective observational study that included more than 3 million treated and untreated OSAS patients, a 3.5 times higher incidence of heart disease (95% CI: 3.40–3.69) was found in untreated patients, together with an increased risk of mortality (HR 1.86; 95% CI: 1.81–1.91)<sup>6</sup>.

The American Sleep Association has defined objective adherence to treatment as use greater than 4 hours per night on 70% of the nights during a consecutive period of 30 days.<sup>7</sup> Since adherence has been shown to decrease the risk of cardiovascular events, different strategies have been

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explored to improve compliance. Some studies suggest that the rate of adherence to the use of PAP therapy can increase up to 10% with remote monitoring systems,<sup>8</sup> as well as with the use of other strategies such as text messages, use of applications that provide feedback on the use of PAP, educational strategies, improvement of eating habits and physical activity, among others.<sup>4</sup>

A study with 244 patients found that, after adjusting for comorbidities and for compliance with treatment, the use of PAP in patients with cardiovascular disease and OSAS showed a significant reduction in the occurrence of myocardial infarction or stroke (HR 0.29  $p=0.026$ ).<sup>9</sup> Additionally, PAP therapy reduces daytime sleepiness, improves quality of life, and lowers blood pressure, all of which contribute independently to the prevention of cardiovascular diseases.<sup>10,11</sup>

Perhaps the greatest limitation of PAP continues to be suboptimal adherence to therapy. Different studies show great variation in adherence figures, ranging from 39% to 83%.<sup>12</sup> The objective of this study was to look at a large sample of Colombian patients to determine their compliance, and its association with age and gender.

## Material and Methods

This is a descriptive cross-sectional study based on electronic clinical records of all patients attending a specialized sleep clinic in Bogota, from January 2018 to December 2019, who were diagnosed with OSAS and were assigned PAP as part of their therapy, following American Academy of Sleep guidelines.<sup>4,7</sup> A descriptive statistical analysis was performed, including demographic variables (age and gender), adherence to treatment expressed as percentage of days with at least 4 hours of PAP therapy use during the previous 30-day period, as well as hospitalizations during the study period. If a patient had more than one control during the two-year period, the last adherence figure was considered. Hospitalizations were classified into cardiovascular or other, according to the ICD-10 classification (Chapter IX: diseases of the circulatory system).

All information was anonymized and treated according to Colombian data use regulations. The study was approved by the Institutional Review Board.

## Results

A total of 12,538 patients were included in the sample (See ►Table 1). Of the 11,270 that had this information, 10,220 (86.8%) were prescribed CPAP device, while 1,550 (13.2%) were on BPAP. Overall, there were more women than men, particularly in the older age groups. In the younger age groups (see ►Figure 1) there was a male predominance. 85% of the patients lived in Bogota (which is 2,600 meters above sea level), the rest came from neighboring areas in the departments of Cundinamarca, Boyacá, and Meta.

In more than a third of patients the adherence was 0%, which means they did not make use of the device during the previous month. Adherence was above the 70% threshold in

**Table 1** Characteristics and adherence rates of the patients included in the sample.

Variables	n = 12,538
Age in years, mean (standard deviation)	61.3 (12.5)
Range	18 - 99
Median	62
Females (%)	6,426 (51.3%)
<b>Adherence rate n = 12,310 **</b>	
No use of the device (0%)	4,660 (37.8%)
From 1 to 70%	3,048 (24.8%)
From 70 to 90%	2,447 (19.9%)
From 90% to 100%	2,155 (17.5%)

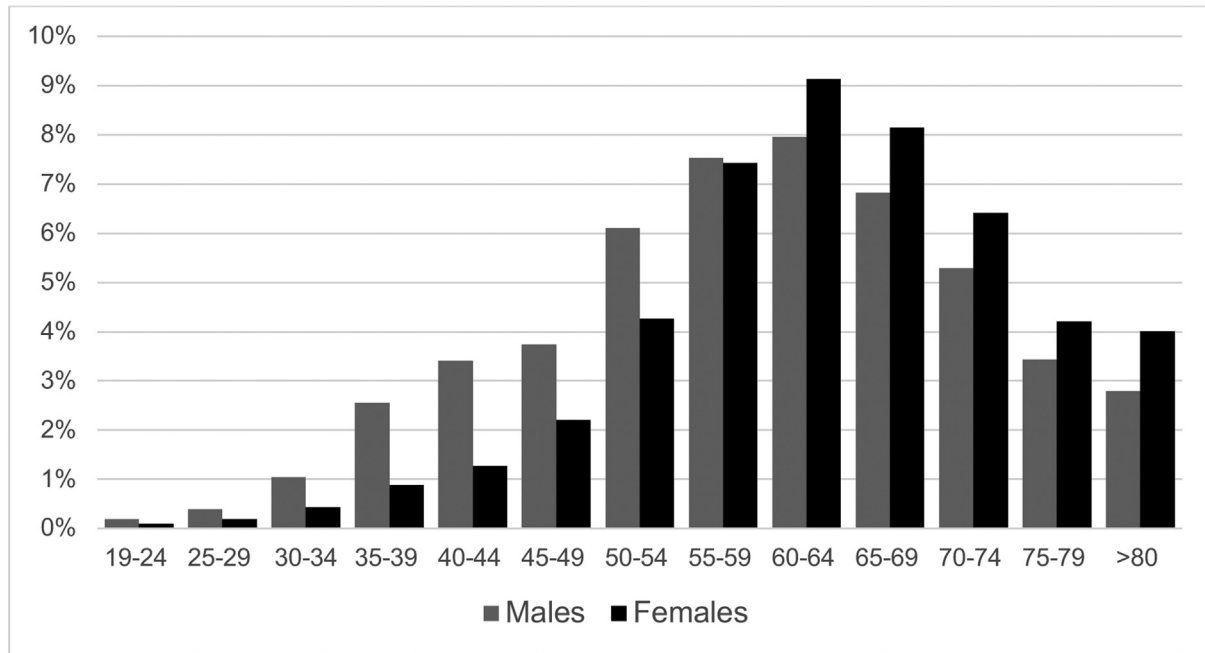
Adherence rate was defined as percentage of at least 4-hours use during the previous 30 days. Data were missing for 228 patients.

**Table 2** Proportion of adherent patients (PAP used for more than 4 hours during 70% or more of the previous 30 days) by age and gender.

Age (years)	Females (%)		Males (%)	
	n	(%)	n	(%)
18-24	5/28	(17.9%)	2/17	(11.8%)
25-29	5/49	(10.2%)	1/23	(4.3%)
30-34	28/130	(21.5%)	7/54	(13.0%)
35-39	74/320	(23.1%)	16/111	(14.4%)
40-44	115/426	(27.0%)	36/159	(22.6%)
45-49	145/468	(31.0%)	60/275	(21.8%)
50-54	264/764	(34.6%)	143/533	(26.8%)
55-59	359/942	(38.1%)	284/928	(30.6%)
60-64	384/995	(38.6%)	442/1142	(38.7%)
65-69	390/853	(45.7%)	432/1019	(42.4%)
70-74	297/662	(44.9%)	328/802	(40.9%)
75-79	180/430	(41.9%)	236/527	(44.8%)
>80	141/349	(40.4%)	213/502	(42.4%)
<b>Overall</b>	<b>2387/6414</b>	<b>(37.2%)</b>	<b>2200/6092</b>	<b>(36.1%)</b>

37.4% of patients, while just one out of each six patients (17.5%) used their PAP device for more than 4 hours per day in 90% or more of the previous nights. Our database did not include information on body mass index (BMI), on symptoms as expressed by the Epworth scale, on oxygen saturation figures, or on the individual patient's apnea-hypopnea index (AHI), to establish possible correlations with age, gender, or adherence rates.

With regards to hospitalizations, 2,305 (18.0%) patients were hospitalized during the two-year period, in 7,306 occasions, for an average of 3.2 hospitalizations per patient. Of these, 1,581 hospitalizations (22.0%) were due to circulatory system diseases (see ►Table 3). The four most frequent



**Fig. 1** Age distribution of the 12,538 patients.

**Table 3** Main cardiovascular causes for hospitalization.

Main diagnosis	Patients	Proportion
Ischaemic heart diseases	543	34.3%
Arrhythmia	351	22.2%
Heart failure	213	13.5%
Cerebrovascular disease	121	7.7%
Arterial embolism and thrombosis	74	4.7%
Hypertensive diseases	67	4.2%
Aneurism	43	2.7%
Peripheral vascular disease	38	2.4%
Cardiac valve disorders	33	2.1%
Myocarditis	8	0.5%
Other vascular diseases	90	5.7%
<b>Total</b>	<b>1,581</b>	<b>100%</b>

causes (which account for 78% of cardiovascular hospitalizations) were coronary disease, arrhythmias, heart failure, and cerebrovascular disease.

## Discussion

OSAS is a serious chronic disease with important consequences on health outcomes and quality of life. The first great unanswered question is the real magnitude of the problem. Figures of the prevalence of this disease show great variation, depending on the definition used for its diagnosis, as well as by conditions related to geographic location, age of the population, and prevalence of overweight and obesity, among other reasons<sup>13</sup>. According to Benjafield et al., world-

wide there could be close to a billion affected adults,<sup>14</sup> and some 80% of patients, at least in the United States, would be yet undiagnosed.<sup>2</sup>

Both an ageing population and the growing prevalence of overweight and obesity will no doubt increase the burden of this disease in the coming decades.<sup>13,14</sup> A limitation of this study is the lack of information with regards to BMI; the age profile of our sample, however, does suggest a growing incidence, with the highest age group being those 60 to 69 years of age (32% of the sample, see ►Table 2).

As with many other chronic conditions, adherence to therapy is essential to improve both quality of life or hypertension in the short term, as well as to reduce the incidence of serious long-term outcomes like stroke or myocardial infarction.<sup>7,9,10,12</sup> Perhaps the dichotomous definition of adherence implemented by the American Sleep Association is not ideal but, however, has several advantages. One of them is its objectivity, since it is the device itself, and not the patient, the one who provides the information on daily use; another advantage is its application in research, as adherence rate allows comparisons between different populations, and facilitates its use in risk factor analyses.

Ercelik et al. in Turkey found a 67% adherence rate in their sample of 98 patients with OSAS.<sup>15</sup> Genzor et al., in the Czech Republic, followed for ten years a cohort of 107 patients and found adherence figures ranging from 57.0% to 58.6%.<sup>16</sup> Adherence was correlated with somnolence assessed through the Epworth scale, with a high AHI, and with lower oxygen saturation figures, all of which are variables that are lacking in our patient database. Yang et al., in Taiwan, found lower adherence (31.5%) in their elderly sample (111 patients age 65 or more) as compared with 204 younger patients, who showed a 60.0% adherence rate.<sup>17</sup> This contrasts with the figures from our ►Table 2, which suggests increasing adherence with age.

► **Table 3** shows a relatively high number of cardiovascular conditions associated with OSAS in the patients in our sample. Our descriptive study does not allow us to do any causal inference, a common limitation when using administrative database.<sup>18</sup> It does suggest, however, that the low adherence figures in the patients of our sleep clinic might be related with these outcomes. Strategies to improve our patient compliance should be the next step in our research. In conclusion, adherence rates in this sample are lower than those reported elsewhere. They are similar in males and females and tend to improve with age.

#### Conflict of Interest

None declared.

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