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Original Research Article

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Determinants and rate of long-term adherence to continuous positive airway pressure in obstructive sleep apnea: a multicenter retrospective study

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ABSTRACT

Background: OSA is a chronic disorder associated with significant health and social risks. CPAP therapy is the gold standard treatment, but adherence remains a major challenge. Telemonitoring offers a potential tool to improve adherence and optimize long-term management.

This multicenter observational retrospective study evaluates long-term CPAP adherence in OSA patients telemonitored in the province of Treviso, Italy. The primary objective is to evaluate adherence rates over a six-year period in comparison to existing data with conventional follow-up strategies. Secondary objectives include subgroup analyses based on age, sex, mask type, and the presence of comorbid respiratory conditions beyond OSA, such as OSA-obesity hypoventilation syndrome and complex sleep-related breathing disorders.

Methods: Data from 579 OSA patients who initiated CPAP therapy from July 2018 onwards were analyzed. Patients underwent routine telemonitoring follow-up every 3 months, during which CPAP adherence, residual apnea-hypopnea index, and air leakage were recorded. Statistical analyses included Welch's t-test, Mann-Whitney test, chi-square test, and Fisher's exact test, with significance set at $p \leq 0.05$.

Results: The overall CPAP adherence rate was 80.66% over the 6-year follow-up period. Mean nightly usage was 6.6 hours, with a usage rate of 89.9% of nights. Elderly patients (>65 years) had higher rAHI (4.4 vs. 3) and air leakage (45.7% vs. 24.9%) compared to younger individuals but exhibited comparable adherence. Nasal masks were associated with superior adherence (6.8 vs. 6.4 hours per night) and lower rAHI (3.3 vs. 4.4) compared to oronasal masks. OSA patients with obesity-hypoventilation syndrome and complex sleep-related breathing disorders demonstrated similar adherence rates to general OSA patients, despite distinct characteristics.

Conclusions: In this first real-life study with a large sample size conducted in Italy so far, CPAP adherence in telemonitored patients was significantly higher compared to previous studies without telemonitoring. These findings suggest that telemonitoring enhances long-term adherence by facilitating early detection and management of nonadherence. The study highlights the advantages of nasal masks and emphasizes the greater challenges associated with managing elderly patients and those with comorbid conditions. Telemedicine appears to be a promising approach for optimizing OSA management.

Key words: Obstructive Sleep Apnea, CPAP, Telemonitoring, Adherence, Long-term follow-up.

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Introduction

Obstructive Sleep Apnea (OSA) is a chronic disorder characterized by recurrent partial or complete obstruction of the upper airway during sleep, resulting in intermittent hypoxia and sleep fragmentation. It is associated with increased risks of cardiovascular and metabolic diseases, neurocognitive impairment, and diminished quality of life, as well as a higher incidence of road and occupational accidents [1].

Continuous Positive Airway Pressure (CPAP) therapy is considered the gold standard for treating OSA. It effectively reduces the frequency of respiratory events during sleep, improves daytime sleepiness, lowers the risk of road accidents, and improves both blood pressure and overall quality of life compared to no treatment [2]. Several randomized clinical trials (RCTs) have investigated the impact of CPAP on preventing cardiovascular events in OSA patients. For instance, three RCTs, focused on non-sleepy OSA patients, found that CPAP did not prevent new cardiovascular events in those with an established cardiovascular disease, compared to untreated OSA patients [3-5]. However, recent data derived from metanalysis have shown that only those patients with consistent adherence to CPAP therapy demonstrated a reduced risk of cardiovascular events' recurrence and lower HbA1c levels [6,7]. These findings highlight the potential benefits of a correct use of CPAP in secondary cardiovascular prevention and long-term glycemic control, with evidence suggesting that using CPAP for an average of at least 4 hours per day could help to lower the risk of cardiovascular issues and complications associated with diabetes. However, CPAP adherence remains suboptimal in clinical practice. Recent studies have revealed varying patterns of CPAP use across different countries, with reported adherence rates of 69% in the United States and 88% in Belgium, over a period of three months [8,9]. In terms of long-term adherence, CPAP dropout rates of 27% and 48% have been observed in Belgium and France after 3 years, respectively [10]. These variations highlight the impact of different follow-up strategies, patient education, and healthcare support systems on CPAP compliance.

Some factors contributing to nonadherence include discomforts encountered during the first night of use, higher residual Apnea Hypopnea Index (rAHI) in the initial period of treatment, younger age, and lack of perceived benefit [11-14]. Despite CPAP's well-documented benefits, adherence remains challenging due to device-related issues, lifestyle factors, and patient education gaps. Interventions such as cognitive-behavioral therapy, personalized patient education, and frequent follow-up consultations can enhance adherence rates [15,16]. Telemedicine, particularly telemonitoring, has emerged as a promising approach to address CPAP adherence barriers. By enabling remote monitoring of CPAP usage, air leaks, and rAHI, telemedicine facilitates early interventions for nonadherent patients. While some studies have demonstrated improved short-term adherence with telemonitoring in the literature, there is limited and conflicting data regarding the effectiveness of telemonitoring in promoting long-term adherence [17,18].

In a previous study conducted by our group [19], a smaller cohort of patients undergoing CPAP telemonitoring was analyzed over a five-year follow-up period, with encouraging findings in terms of treatment adherence. In the present investigation, both the sample size and the follow-up duration were extended to allow for a more in-depth evaluation of adherence. Moreover, comparative analyses were performed across specific subgroups, with particular attention to differences based on age, gender, and type of mask used. Additional analyses were also conducted in selected populations presenting with different respiratory disorders. Finally, we evaluated whether there were factors that could be predictive of adherence to treatment.

Methods

Study design and population

This was a multicenter observational retrospective study conducted across four Pulmonology Units in Treviso, Italy. The research focused on adult patients (≥18 years old) diagnosed with Obstructive Sleep Apnea (OSA) who started Continuous Positive Airway Pressure (CPAP) therapy and were enrolled in a telemonitoring program from July 2018 onwards. To be included, patients needed a minimum follow-up of one year. Excluded from the study were patients with neuromuscular disorders, those who discontinued CPAP for justified reasons like recovery or death, and individuals managed with ventilation modes other than CPAP.

The study received approval from the Institutional Review Board and was performed in line with the Declaration of Helsinki. All participating patients provided informed consent.

Data collection and outcomes

Data was gathered by reviewing medical records and provider databases extracted from a cloud platform. The collected information included:

- Demographic data
- CPAP adherence metrics (hours of use per night and percentage of nights used)
- Residual Apnea-Hypopnea Index (rAHI)
- Air leakage
- Type of sleep disorder, CPAP device, and mask
- Treatment start and end dates

The primary outcome was the long-term adherence to CPAP therapy. Adherence was defined according to the Centers for Medicare & Medicaid Services criteria as using the device for at least 4 hours per night on 70% or more of nights.

Secondary outcomes involved comparative analyses of adherence and other metrics based on age, gender, mask type, and the presence of other respiratory disorders like OSA with obesity hypoventilation syndrome (OSA-OHS) and complex sleep-related breathing disorders (CSBD).

Comparison with existing literature

To benchmark the findings, a comparison was made against previously published studies that reported adherence data (including raw). This study did not have a concurrent control group; instead, the comparison was made against historical data from studies using conventional follow-up methods without telemonitoring. The criteria for selecting these comparative studies were:

- Conducted in a real-life (non-interventional) setting
- Retrospective design
- Sample size of more than 100 patients
- Minimum CPAP treatment duration of one year

Telemonitoring protocol

Patients underwent a pulmonology consultation 3 months after CPAP initiation, followed by routine quarterly telemonitoring. CPAP data, including adherence, rAHI, and air leakage, were collected remotely every three months for 6 years starting in 2018. During the reviewing of data, patients were contacted by phone if specific conditions were identified during each 3-month follow-up: rAHI >10 events per hour of sleep, excessive air leakage, adherence <4 hours per night, or usage on less than 70% of days. In the case of CPAP discontinuation, patients were contacted immediately. If the provider was unable to resolve these issues, the physician or nurse from the designated Unit would intervene to improve adherence or treatment efficacy. When adherence could not be restored to acceptable levels, CPAP therapy was discontinued in accordance with the prescribing center. This protocol is illustrated in Figure 1.

This study was conducted in accordance with the Declaration of Helsinki and the protocol was reviewed and approved by the Institutional Review Board. All patients enrolled provided informed consent.

Statistical analysis

Continuous data were presented as mean and standard deviation (SD), while categorical data were shown as absolute numbers and percentages.

To compare different patient groups, the following tests were used:

- Student's t-test with Welch's correction or the Mann-Whitney test was applied for continuous variables.
- The chi-square test or Fisher's exact test was used for categorical variables.

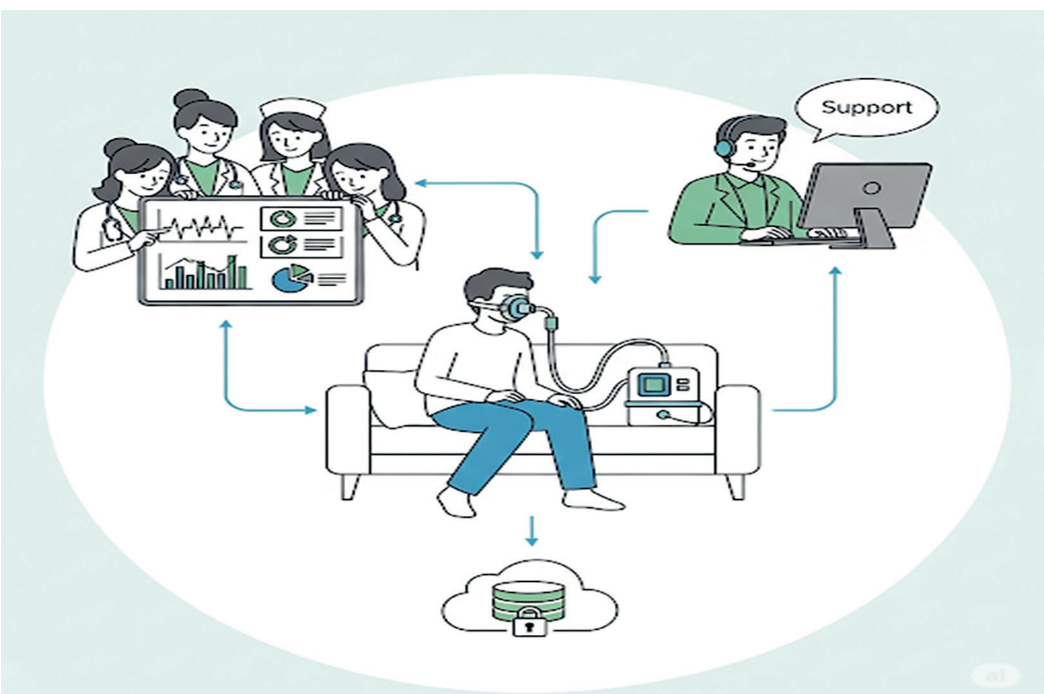

Figure 1. Description of the telemonitoring protocol. Data generated by the CPAP device are integrated and stored in a cloud-based platform, accessible to both the healthcare provider and the medical team. In the presence of low adherence, elevated rAHI, or significant air leaks, the provider initiates contact with the patient in an attempt to resolve technical issues. If these interventions are unsuccessful, the provider escalates the case to the pulmonology unit, which subsequently contacts the patient by telephone. Should the issue remain unresolved, the patient is scheduled for an in-person clinical evaluation.

A p-value of ≤ 0.05 was considered statistically significant for all tests. The Pearson's test was utilized to assess linear correlations, and a multiple linear regression model was developed to identify potential predictors of treatment adherence. All the statistical analyses have been performed using GraphPad Prism version 8.0.0 for Mac, GraphPad Software, San Diego, California USA, www.graphpad.com.

Results

Out of a population of 579 OSA patients, a total of 467 patients adhered to CPAP therapy, resulting in an adherence rate of 80.66%. Among non-adherent patients, CPAP was withdrawn from 23 individuals due to repeated lack of adherence, while follow-up was temporarily suspended for 47 patients because of poor adherence, pending medical reassessment. The remaining 42 patients had an average usage of less than 4 hours per night or a usage rate of less than 70% of the nights (Figure 2).

Among the 509 patients with available follow-up data, the mean age was 67.7 ± 12.4 years, with 359 males and 150 females. The mean rAHI was 3.8 ± 4.4 events per hour, the mean compliance was 6.6 ± 1.7 hours per night, and the mean usage rate was 89.9% ± 15.5% of nights. The mean follow-up duration was 40.1 ± 17.6 months. Additional information is summarized in Table 1.

Subgroup Analyses:

- Age: Elderly patients (>65 years) had higher rAHI (4.4 vs. 3, p = 0.0024) and higher air leakage (45.7% vs. 24.9%, p < 0.0001) but exhibited similar CPAP adherence compared to younger patients. These findings are summarized and represented in Table 2 and Figure 3.
- Gender: No statistically significant differences in adherence were observed between men and women.
- Mask Type: Nasal masks demonstrated superior adherence (6.8 vs. 6.4 hours per night, p = 0.0062) and lower rAHI (3.3 vs. 4.4, p < 0.0001) compared to oronasal masks. Additional results are summarized in Table 3 and Figure 4.
- OSA-OHS and CSBD: OSA-OHS patients were older at CPAP initiation (72.91 vs. 64.3 years, p = 0.0001) and more likely to use oronasal masks (98.2% vs. 46.8%, p = 0.007), but adherence remained similar compared to OSA patients. CSBD patients had significantly higher rAHI (13.9 vs. 3.8, p = 0.0043) and they were older at CPAP initiation (71.8 years vs. 64.3 years, p = 0.0001) compared to OSA patients. These findings are

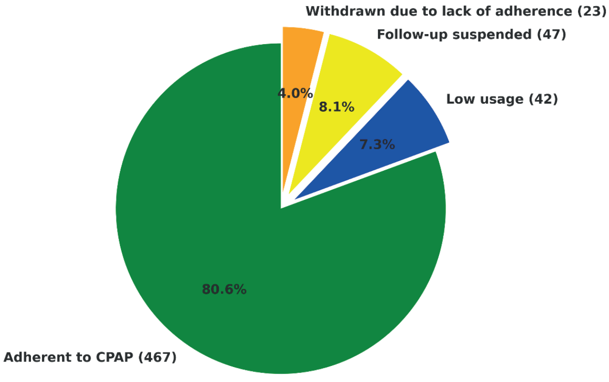

Figure 2. CPAP therapy adherence and nonadherence breakdown.

Table 1. Patients with OSA currently Under Follow-Up.

Total patients, n (%)	509 (100)
Age, mean (± SD)	67.7 (12.4)
Gender	
• Males, n (%)	359 (70.5)
• Females, n (%)	150 (29.5)
Age at CPAP initiation, mean (± SD)	64.3 (12.3)
Follow-up duration (months), mean (± SD)	40.1 (17.6)
CPAP Type	
• Philips, n (%)	253 (49.7)
• Resmed, n (%)	256 (50.3)
Mask Type	
• Nasal	271 (53.2)
• Oronasal	238 (46.8)
rAHI, mean (± SD)	3.8 (4.4)
Compliance	
• (hours), mean (± SD)	6.6 (1.7)
• (%), mean (± SD)	89.9 (15.5)
Leaks	
• Within normal range, n (%)	319 (62.7)
• High, n (%)	190 (37.3)

Table 2. OSA >65 years vs ≤65 years at follow-up.

	>65	≤65	p value
Total patients, n (%)	304 (59.7)	205 (40.3)	
Age, mean (± SD)	75.7 (6.1)	55.7 (9.4)	<0.0001
Gender			
• Males, n (%)	213 (70.1)	146 (71.2)	0.7
• Females, n (%)	91 (29.1)	59 (28.8)	
Age at CPAP initiation, mean (± SD)	72.2 (6.2)	52.5 (9.3)	<0.0001
Follow-up (months), mean (± SD)	41.5 (18.2)	38 (16.7)	0.02
CPAP Type			
• Philips, n (%)	161 (53)	92 (44.9)	0.86
• Resmed, n (%)	143 (47)	113 (55.1)	
Mask Type			
• Nasal	168 (55.3)	103 (50.2)	0.29
• Oronasal	136 (44.7)	102 (49.8)	
rAHI, mean (± SD)	4.4 (4.8)	3 (3.4)	0.0024
Compliance			
• (hours), mean (± SD)	6.7 (1.7)	6.5 (1.7)	0.33
• (%), mean (± SD)	90.2 (15.5)	89.6 (15.5)	0.69
Leaks			
• Within normal range, n (%)	165 (54.3)	154 (75.1)	<0.0001
• High, n (%)	139 (45.7)	51 (24.9)	

Table 3. Nasal mask Vs Oronasal mask.

	Nasal	Oronasal	p value
Total patients, n (%)	271 (53.2)	238 (46.8)	
Age at follow-up, mean (± SD)	67.9 (12.4)	67.4 (12.5)	0.6
Gender			
• Males, n (%)	198 (73.1)	161 (67.6)	0.2
• Females, n (%)	73 (26.9)	77 (32.4)	
Age at CPAP initiation, mean (± SD)	64.5 (12.3)	64 (12.3)	0.62
Follow-up (months), mean (± SD)	40 (18.2)	40.3 (17.1)	0.8
CPAP Type			
• Philips, n (%)	130 (48)	123 (51.7)	0.42
• Resmed, n (%)	141 (52)	115 (48.3)	
rAHI, mean (± SD)	3.3 (4.2)	4.4 (4.5)	<0.0001
Compliance			
• (hours), mean (± SD)	6.8 (1.7)	6.4 (1.7)	0.0062
• (%), mean (± SD)	91.5 (14.2)	88.1 (16.6)	0.014
Leaks			
• Within normal range, n (%)	172 (63.5)	147 (61.8)	0.72
• High, n (%)	99 (36.5)	91 (38.2)	

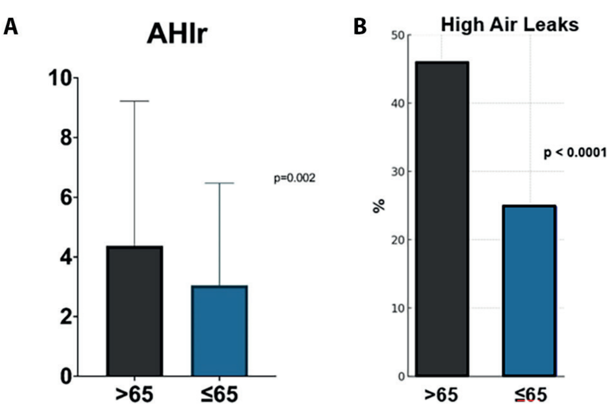

Figure 3. OSA >65 years vs ≤65 years: rAHI (A), High Air Leaks (B).

summarized and represented in Table 4 and 5, and in Figure 5 and 6.

- Finally, we managed to identify some potential predictive factor of good adherence. However, the multilinear regression analysis did not reveal any variables capable of significantly predicting higher adherence. Neither sex, age, air leakage, nor type of mask used emerged as significant predictors of greater compliance with CPAP therapy.

Comparison with adherence data from existing literature

The adherence rate in this study was compared with findings from previous retrospective studies that utilized standard follow-up strategies without telemonitoring. The current study demonstrated an adherence rate of 80.7% over a mean follow-up of 40 months. This rate is significantly higher than those reported in the comparative literature, highlighting how the telemonitoring strategy applied in our study proved to be associated with clinically and statistically significant improvements in long-term CPAP adherence compared to the standard follow-up methods documented in these previous real-world studies (for details see Table 6).

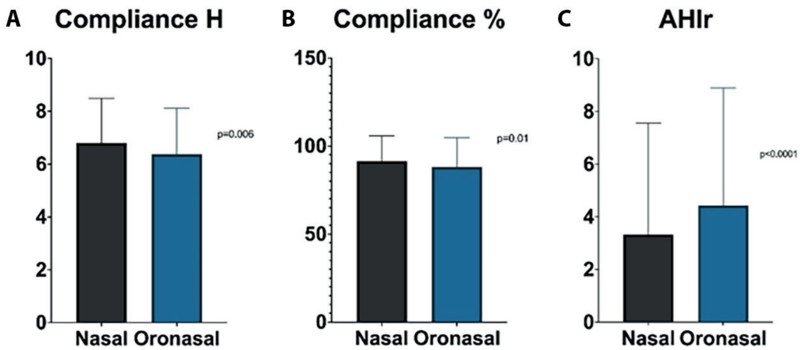

Figure 4. Nasal Mask Vs Oronasal Mask: Compliance H (A), Compliance % (B), rAHI (C).

Table 4. OSA Vs OSA-OHS.

	OSA	OSA+OHS	p value
Total patients, n (%)	509 (95.7)	23 (4.3)	
Age at follow-up, mean (± SD)	67.68 (12.4)	75.3 (8.9)	0.0005
Age at CPAP initiation, mean (± SD)	64.3 (12.3)	72.91 (8.7)	0.0001
Follow-up (months), mean (± SD)	40.12 (17.7)	29.43 (10)	0.005
Gender			
• Males, n (%)	359 (70.5)	10 (43.5)	0.001
• Females, n (%)	150 (29.5)	13 (56.5)	
CPAP Type			
• Philips, n (%)	253 (49.7)	3 (13)	0.0005
• Resmed, n (%)	256 (50.3)	20 (87)	
Mask Type			
• Nasal, n (%)	271 (53.2)	5 (1.8)	0.007
• Oronasal, n (%)	238 (46.8)	17 (98.2)	
rAHI, mean (± SD)	3.84 (4.4)	3.13 (3.6)	0.19
Compliance			
• (hours), mean (± SD)	6.6 (1.7)	7.7 (2.8)	0.09
• (%), mean (± SD)	89.9 (15.5)	89.2 (25.6)	0.9
Leaks			
• Within normal range, n (%)	319 (62.7)	17 (73.9)	0.4
• High, n (%)	190 (37.3)	6 (26.1)	

Table 5. OSA Vs CSBD.

	OSA	CSBD	p value
Total patients, n (%)	509 (96.6)	18 (3.4)	
Age at follow-up, mean (± SD)	67.7 (12.4)	74.8 (12.6)	0.029
Age at CPAP initiation, mean (± SD)	64.3 (12.3)	71.8 (12.5)	0.021
Follow-up (months), mean (± SD)	40.1 (17.7)	35.7 (15.7)	0.35
Gender			
• Males, n (%)	359 (70.5)	12 (66.7)	0.79
• Females, n (%)	150(29.5)	6 (33.3)	
CPAP Type			
• Philips, n (%)	253 (49.7)	8 (44.4)	0.81
• Resmed, n (%)	256 (50.3)	10 (55.6)	
Mask Type			
• Nasal, n (%)	271 (53.2)	6 (33.3)	0.22
• Oronasal, n (%)	238 (46.8)	11 (61.1)	
rAHI, mean (± SD)	3.8 (4.4)	13.9 (17.6)	0.0043
Compliance			
• (hours), mean (± SD)	6.6 (1.7)	6.4 (1.8)	0.57
• (%), mean (± SD)	89.9 (15.5)	83.4 (22)	0.37
Leaks			
• Within normal range, n (%)	319 (62.7)	12 (66.7)	0.81
• High, n (%)	190 (37.3)	6 (33.3)	

Discussion

This study demonstrated a high 6-year adherence rate to CPAP therapy, significantly exceeding rates observed in prior similar studies without telemonitoring. Indeed, we aimed to identify comparative studies that met our criteria: those conducted retrospectively in real-life settings, involving more than 100 patients, with CPAP treatment for at least one year, and including patients who accepted CPAP irrespective of OSA

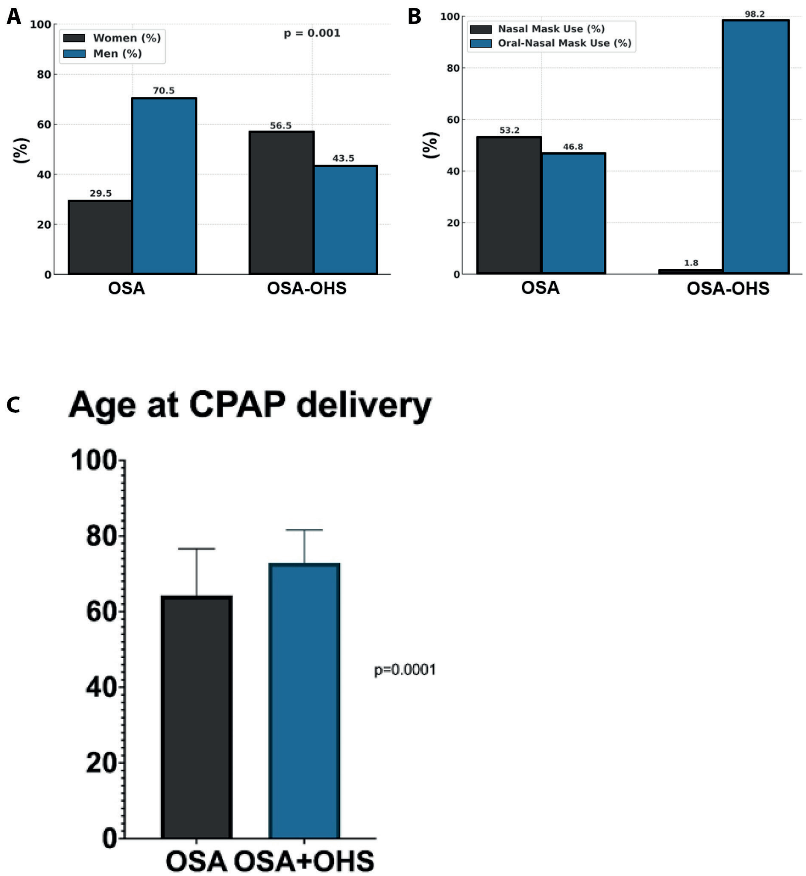

Figure 5. OSA vs OSA-OHS: Gender (A), Mask type (B), Age at CPAP delivery (C).

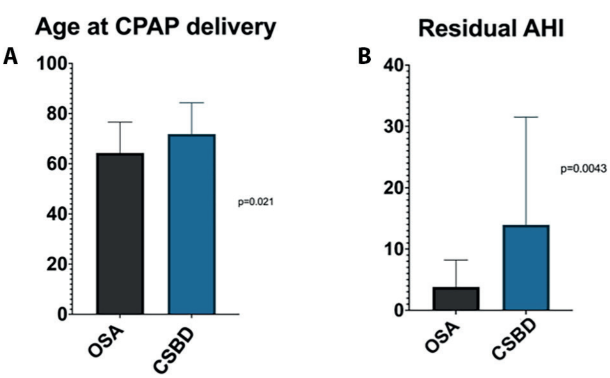

Figure 6. OSA Vs CSBD: Age at CPAP delivery (A), rAHI (B).

severity. A British study reported a 5-year follow-up showing that only 68% of patients continued CPAP therapy. Moreover, adherence was not defined in terms of hours of nightly use or the percentage of nights used [20]. As a result, the actual adherence rate could be even lower. An Italian retrospective single-center study reported a 37% adherence rate over a 10-year follow-up period, with only 51 out of 147 patients remaining adherent to CPAP therapy [21]. In a retrospective Swiss single-center study, adherence rates at 1, 5, and 10 years were 74%, 55%, and 51%, respectively [22]. A German study found that only 63% of patients remained adherent after a median follow-up of 13 months [23]. None of these studies included routine telemonitoring as a follow-up strategy. Importantly, among our adherent patients, 83% used CPAP for an average of at least 6 hours per night, which is critical, as evidence suggests that increased CPAP usage could reduce cardiometabolic risks associated with OSA [6,7].

In our study, among patients non-adherent to CPAP therapy, 47 had their follow-up temporarily suspended due to repeated non-compliance with

Table 6. At-a-glance comparison with existing literature.

Study	Country	Sample Size	Follow-up Duration	Adherence Definition	Adherence Rate	Follow-up Strategy	p-value vs Current Study
Current Study	Italy	579	Mean 40 months	≥4 h/night, ≥70% nights	80.7%	Telemonitoring	–
McArdle et al. (20)	UK	102	60 months	Not clearly defined	68%	Standard	0.0142
Zampogna et al. (21)	Italy	147	120 months	Not clearly defined	37%	Standard	<0.0001
Schoch et al. (22)	Switzerland	213	60 months	≥4 h/night	55%	Standard	<0.0001
Galetke et al. (23)	Germany	233	13 months (median)	≥4 h/night	63%	Standard	<0.0001

telemonitoring assessments. In some cases, despite suboptimal adherence, CPAP therapy was continued due to the presence of positive clinical effects (e.g., reduced daytime sleepiness). Others are currently awaiting re-evaluation during a follow-up pulmonology visit.

Regarding the type of mask, the nasal mask appears to be slightly superior to the oronasal mask in terms of adherence and effectiveness. This data aligns with existing literature, according to which oronasal masks often require higher CPAP levels and are associated with higher rAHI and lower adherence compared to nasal masks [24].

In our study population, there were no significant differences between genders in terms of rAHI and CPAP adherence. However, older patients exhibited a slightly higher frequency of rAHI during sleep, which was associated with a significant increase in unintentional air leakage. This does not appear to be related to the type of mask used, as the usage rate is similar between the two groups. Instead, it might be linked to the fact that younger patients are better able to manage the device or require lower CPAP pressures. This positive association between age and unintentional air leaks is also suggested in the existing literature and may be further explained by changes in facial morphology due to loss of teeth, changes in skin elasticity, or a decrease in subcutaneous fat [25]. The presence of unintentional leaks makes it more challenging for CPAP to effectively reduce AHI. Moreover, older adults, due to a higher burden of comorbidities, tend to present with a greater number of central apneas/hypopneas, which are not corrected by CPAP therapy [26]. These factors may contribute to the higher rAHI observed in this population. Nonetheless, these differences do not appear to affect CPAP adherence between the two groups.

The comparison between OSA and OSA-OHS patients shows that the latter group has a higher proportion of females, a higher average age at CPAP initiation, and a greater use of oronasal masks. Based on these differences, they appear to be two very distinct conditions. However, although these characteristics are acknowledged in the literature as factors impacting adherence [24,27], this was not confirmed in our study. In fact, no statistically significant differences in CPAP adherence or effectiveness were observed, likely due to the small sample size of the OSA-OHS group.

The comparison between the OSA population and the limited CSBD population shows that the latter are older and have poorer control of hypo-apneic events. Indeed, the increased comorbidities associated with age (especially cardiovascular and neurological conditions) are more strongly linked to the presence of central or mixed hypo-apneic events. These events result in a higher rAHI compared to the OSA population, as CPAP therapy is not adequately effective in their management [26].

The major limitation of our study is its retrospective design. It suffers from missing data, particularly the lack of additional clinical information that could better characterize the study population (such as severity of OSA, BMI, CPAP pressure used, comorbidities and data from the initial months of treatment). Moreover, the better CPAP adherence observed in this study could be associated not only with the use of telemedicine but also with multiple factors related to follow-up pathways and the organization of Pulmonology Units.

Study strengths: to our knowledge, this is the first multicenter study with a large sample size conducted in Italy, involving a homogeneous population of patients with OSA. It has clear adherence criteria, a high proportion of women (>25%) and elderly patients, it is consistent with real-life settings and excludes dropouts for justified reasons. Additionally, the study followed patients over a long-term period after appropriate CPAP titration. Comparison with existing literature also confirms that the telemonitoring strategy applied in our study proved to be clinically beneficial and statistically significant compared to what has been published to date and exists in the literature.

Future studies should investigate the cost-effectiveness of telemonitoring programs and their impact on long-term cardiovascular and metabolic outcomes in patients with OSA. In light of the increasing relevance of telemedicine and the substantial investments in digital health infrastructure, telemonitoring represents a promising strategy to optimize healthcare delivery. By potentially reducing patient mobility, limiting in-person visits to healthcare facilities, decreasing waiting times, and lowering overall healthcare expenditures, telemonitoring may contribute to a more sustainable and efficient healthcare system. In this context, Italy has incorporated telemedicine as a strategic priority within the restructuring of its National Recovery and Resilience Plan (PNRR). As part of this initiative, the Ministry of Health reallocated €750 million to reinforce interventions in home care and telemedicine, with the objective of delivering telemedicine services to 300,000 patients by the end of 2025 [28].

Conclusion

In this study, telemedicine, particularly CPAP telemonitoring, emerged as a promising strategy and now almost indispensable tool to achieve and sustain long-term adherence, while also enabling the early identification of patients at risk of poor compliance. The sub-analyses are consistent with findings reported in the literature, particularly highlighting the superior efficacy and tolerability of nasal masks, as well as the increased challenges associated with managing elderly patients and those with comorbidities. Finally, in our study telemonitoring proved to be superior to conventional strategies commonly used in clinical practice.

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