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scientific posters



CPAP termination and mortality in pulmonary fibrosis + OSA: a French nationwide database analysis

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INTRODUCTION

Obstructive sleep apnea is a common comorbidity in people with pulmonary fibrosis, but the impact of stopping continuous positive airway pressure (CPAP) treatment of obstructive sleep apnea on all-cause mortality in people with pulmonary fibrosis is unknown.

AIMS

To investigate the impact of CPAP therapy termination in the first year on all-cause mortality in people with pulmonary fibrosis and comorbid obstructive sleep apnea.

METHODS

French national health insurance reimbursement system data were analyzed for all CPAP-naïve adults who started CPAP from January 2015–December 2018 and had idiopathic pulmonary fibrosis (disease codes + expert algorithm) and obstructive sleep apnea (disease codes). CPAP termination was defined as the cessation of CPAP reimbursements triggered by the physician in charge of follow-up. All-cause mortality was compared between the CPAP termination and CPAP continuation groups.

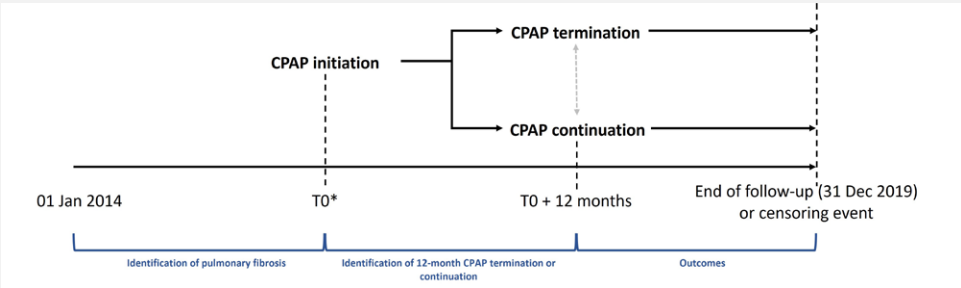


Figure 1. Study design. Index date was one year after CPAP initiation to identify those continuing or having stopped CPAP. PF was identified before the index date. *T0 was between 1 January 2015 and 31 December 2018.

CONCLUSION

Patients with pulmonary fibrosis should be systematically screened and appropriately treated for OSA. Maintaining CPAP therapy is a key therapeutic goal in this population, despite potential challenges to long-term adherence. Discontinuation of CPAP within the first year is associated with a substantially increased risk of mortality in patients with pulmonary fibrosis and OSA. Personalized strategies are needed to support CPAP adherence and improve clinical outcomes.

ACKNOWLEDGEMENTS

This study was funded by Resmed and 2 authors are employees of Resmed.

RESULTS

Of 756,326 individuals starting CPAP, 547 had pulmonary fibrosis and obstructive sleep apnea.

Compared with the group that continued using CPAP, individuals in the therapy termination group were significantly older, were significantly more likely to have diabetes mellitus, and significantly less likely to have state-funded health insurance (table 1)

At 1 year, 372/547 (68%) were still using CPAP and 175/547 (32%) had terminated CPAP.

Adjusted all-cause mortality rates were **significantly higher in the CPAP termination versus continuation group.**

The adjusted risk of death was **nearly four times higher in the CPAP termination versus continuation group** (hazard ratio 3.94, 95% confidence interval 1.80–8.61). (Figure 2)

Significant independent risk factors for all-cause death in this population with pulmonary fibrosis and comorbid OSA were **age, severe chronic respiratory failure, respiratory-related hospitalisation, and CPAP termination.**

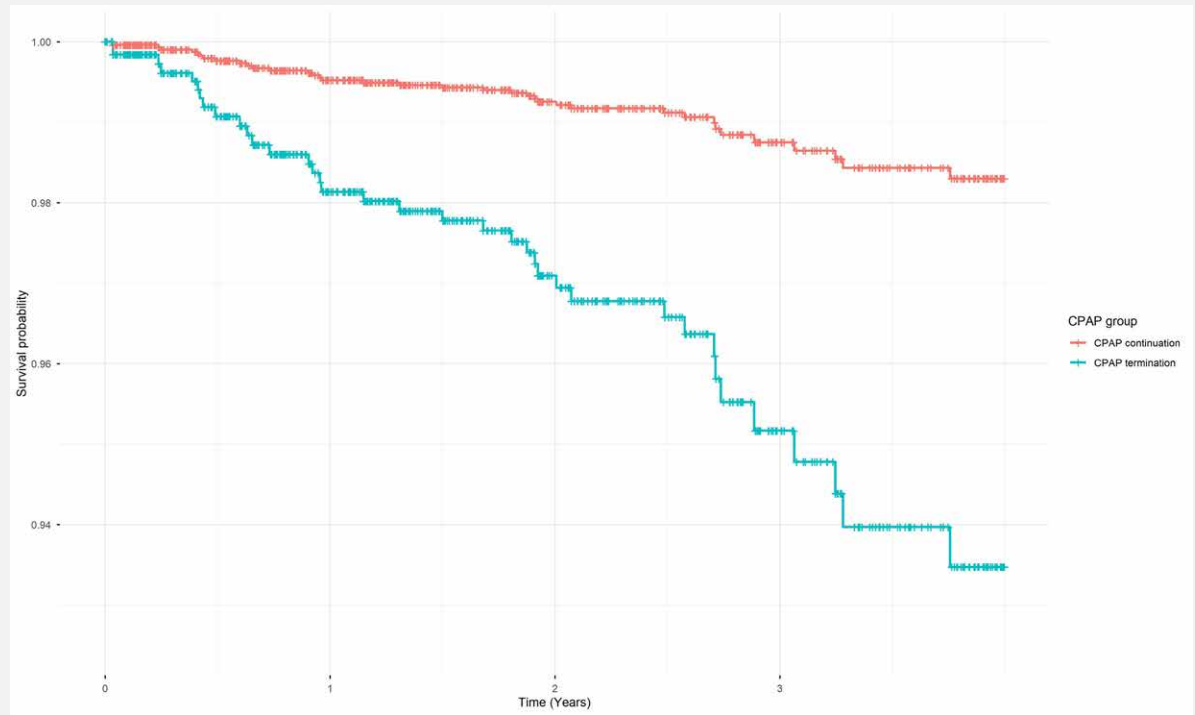


Figure 2. Adjusted all-cause mortality survival curves in the CPAP continuation and CPAP termination groups (Cox model, adjusted for age, sex, and the presence of arrhythmias, hypertension, cardiac failure, chronic obstructive pulmonary disease, stroke and diabetes).



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Switching from NIV to CPAP in OHS: impact on all-cause mortality and time to first hospitalization

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INTRODUCTION

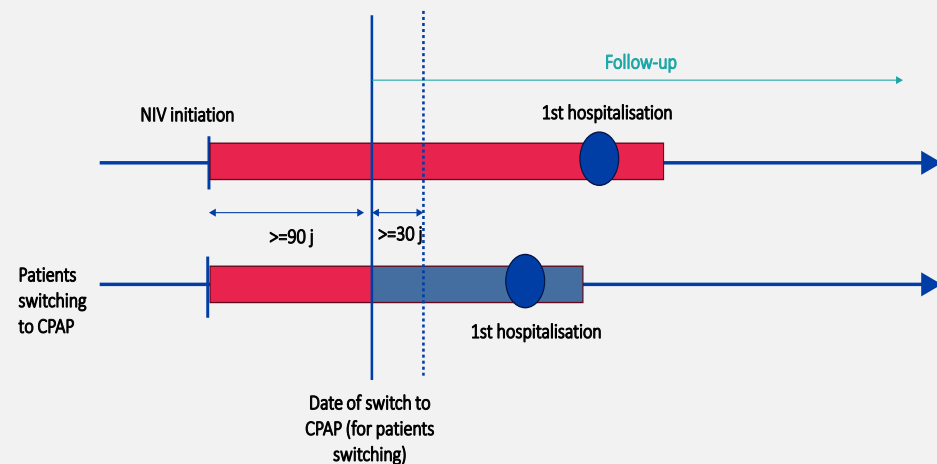
Transitions between positive airway pressure modalities in patients with obesity hypoventilation syndrome (OHS) are common in routine practice, but data on the impact of switching from non-invasive ventilation (NIV) to continuous positive airway pressure (CPAP) on objective clinical outcomes are lacking.

AIMS

This study evaluated the impact of switching from NIV to CPAP on all-cause mortality and time to first hospitalization in people with OHS.

METHODS

Data came from the French national health insurance reimbursement system database for individuals with OHS and a first NIV reimbursement in 2015–2019. A nested case-control design was used, matching individuals switching from NIV to CPAP (cases) with those who remained on NIV (controls).



CONCLUSION

In this nationwide real-world cohort, only a small proportion of patients with OHS initiated on NIV were switched to CPAP (9%).

Switching from NIV to CPAP was not associated with an increased risk of all-cause mortality or earlier hospitalization.

These findings support the safe transition from NIV to CPAP in selected patients with OHS, potentially reducing treatment complexity and healthcare costs without compromising outcomes.

RESULTS

791/8,842 people with OHS started on NIV switched to CPAP (switch rate 8.9%); of these, 633 had been on NIV for ≥ 3 months and 574 of these individuals (cases) were matched with 574 controls (table 1)

All-cause mortality was not significantly different in cases versus controls (hazard ratio [HR] 0.676, 95% confidence interval [CI] 0.443–1.032) (table 2, Figure 1).

Switching from NIV to CPAP also had **no significant effect on time to first hospitalisation** versus staying on NIV (HR 0.961, 95% CI 0.818–1.129) (Figure 2).

	Matched population		Cases not matched (n=59)
	Controls (n=574)	Cases (n=574)	
Age group, n (%)	62.0 (48.0; 72.0)	62.0 (52.0; 71.0)	62.0 (47.0; 72.0)
0–34 years	24 (4.12)	31 (5.40)	1 (1.69)
35–44 years	39 (6.77)	35 (6.10)	5 (8.47)
45–54 years	81 (14.02)	93 (16.20)	9 (15.25)
55–64 years	152 (26.45)	153 (26.66)	20 (33.90)
65–74 years	158 (27.44)	148 (25.78)	13 (22.03)
≥ 75 years	122 (21.20)	114 (19.86)	11 (18.64)
Male sex, n (%)	356 (62.08)	353 (61.50)	43 (72.88)
Comorbidities*, n (%)			
Hypertension, cardiovascular disease	391 (68.21)	378 (65.85)	42 (71.19)
Type 2 diabetes	210 (36.64)	214 (37.28)	19 (32.20)
Depression/anxiety psychiatric treatments	147 (25.58)	149 (25.96)	11 (18.64)
Long-term oxygen therapy, n (%)	109 (18.99)	116 (20.21)	9 (15.25)

Table 1. Baseline demographics and characteristics of matched cases and controls, and cases who were not matched.

	All-cause mortality risk for NIV to CPAP switch vs. staying on NIV	
	HR (95% CI)	p-value
All patients	0.676 (0.443–1.032)	0.0697

Table 2. Risk of all-cause death in patients switching from non-invasive ventilation (NIV) to continuous positive airway pressure versus staying on NIV.

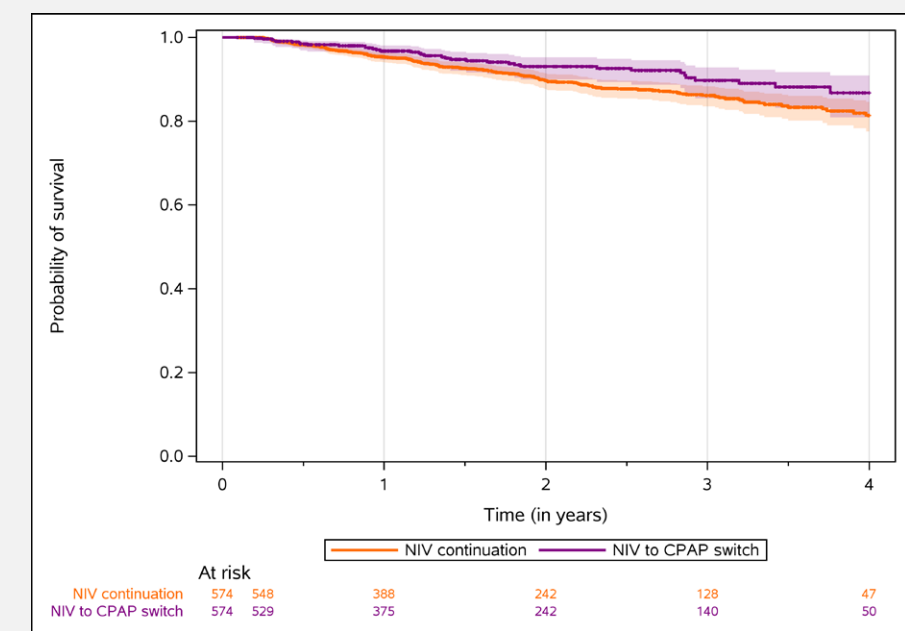


Figure 1. Kaplan-Meier curves for all-cause mortality in patients with OHS who did versus did not switch from NIV to CPAP.

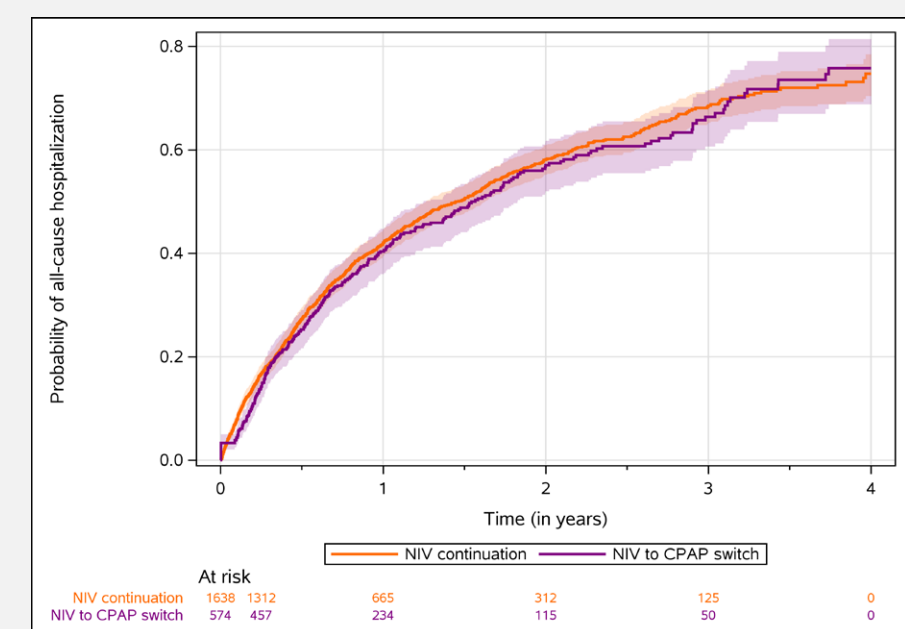


Figure 2. Time to first all-cause hospitalization in patients with OHS who did versus did not switch from NIV to CPAP.



ACKNOWLEDGEMENTS

This study was funded by Resmed and 2 authors are employees of Resmed.



INTRODUCTION

- Comorbid insomnia and obstructive sleep apnea (COMISA) is a common sleep disorder phenotype associated with adverse cardiometabolic outcomes
- Individuals with COMISA may experience a particularly high burden of cardiovascular disease (CVD)
- However, the future population burden of COMISA and associated CVD across Europe remains poorly characterized

AIMS

We aimed to project the future prevalence of COMISA and CVD among adults aged 20–79 years in France, Germany, and the United Kingdom through 2050.

METHODS

Using a previously published population simulation framework, we developed an open-cohort model to simulate adults aged 20–79 years from 2020 through 2050 in 5-year cycles The model incorporated population demographics, including age, sex, fertility, and migration. Baseline COMISA prevalence was informed by published European estimates and calibrated by country.

COMISA risk incorporated BMI, depression, anxiety, and CVD, while CVD risk incorporated COMISA, depression, and anxiety. Primary outcomes were COMISA prevalence, overall CVD prevalence, and CVD prevalence in individuals with COMISA

CONCLUSION

Our modeling study projects a substantial increase in COMISA prevalence through 2050 across Germany, France, and the UK. CVD prevalence was consistently higher among individuals with COMISA than in the overall population and increased substantially over the simulation period.

By 2050, more than 40% of adults with COMISA were projected to have CVD in all three countries. These findings highlight a growing population living with both sleep disorders and substantial cardiovascular comorbidity. COMISA may represent an increasingly important population for cardiovascular risk identification and management.

By 2050, >40% of adults with COMISA are projected to have cardiovascular disease across France, Germany, and the UK

RESULTS

- **COMISA prevalence was projected to increase in all three countries from 2020 to 2050:**
 - France, **11.5% to 17.3%**; Germany, **14.4% to 20.6%**; and the UK, **20.4% to 26.8%**.
- **CVD prevalence increased in the overall population and remained consistently higher among adults with COMISA.**
 - By 2050, CVD prevalence among adults with COMISA reached **43.2% in France, 48.2% in Germany, and 45.7% in the UK.**
- The absolute number of adults living with **both COMISA and CVD increased substantially:**
 - from **1.7 to 3.3 million in France, 2.0 to 4.0 million in Germany, and 1.9 to 5.7 million in the UK** between 2020 and 2050.
- Thus, by 2050, **>40% of adults with COMISA were projected to have CVD in all three countries:**
 - corresponding to approximately **13 million adults living with both conditions** across the three modeled populations.

Table. Prevalence and case counts of COMISA across Germany, France, and the UK

Outcome	Year	France	Germany	UK
COMISA	2020	11.5% (5.4M)	14.4% (7.2M)	20.4% (9.8M)
	2050	17.3% (7.6M)	20.6% (8.3M)	26.8% (12.5M)
Overall CVD	2020	18.8% (8.9M)	17.5% (8.7M)	11.8% (5.7M)
	2050	22.5% (10.0M)	25.6% (10.3M)	24.8% (11.6M)
CVD among COMISA	2020	31.3% (1.7M)	28.5% (2.0M)	19.9% (1.9M)
	2050	43.2% (3.3M)	48.2% (4.0M)	45.7% (5.7M)

Note. M = millions

Real-World Insights on Early PAP Challenges: Evaluating Digital Feedback from the Care Check-In (CCI) tool

Digital health

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DATA PRIVACY & ePOSTER

This analysis included myAir™ users who provided consent for the collection and use of their data through the myAir™ application.



Scan ePoster

BACKGROUND



Digital engagement tools offer opportunities to identify and characterise patient challenges during early PAP therapy. Integrated into the myAir™ app, the Care Check-In (CCI) feature captures structured, patient-reported feedback to support personalised care.



AIMS AND OBJECTIVES

To characterise the type, timing, and prevalence of early therapy issues reported by new AirSense™ 11 users via the CCI tool in the myAir™ app.

METHODS



This analysis included 43,018 European patients who engaged with CCI via myAir™ within the first 30 days of PAP therapy (from March 13, 2024, onward).



Patients who answered issue-related questions and follow-ups ("Did the content solve your issue?" on days 8, 15, 22, or 29) were included.



Issue categories and frequency were analysed descriptively.

RESULTS



43,018
patients included
(engaged with CCI within first 30 days)



70.1%
reported multiple issues
29.9% reported a single issue



69.5%
male
(among patients with available gender information)



30.5%
female



Most CCI responses occurred between **days 3–14**



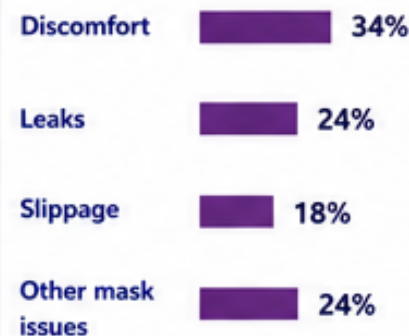
Mean age **53.5** years

REPORTED ISSUES BY CATEGORY

MASK-RELATED



48%
of patients



PRESSURE-RELATED



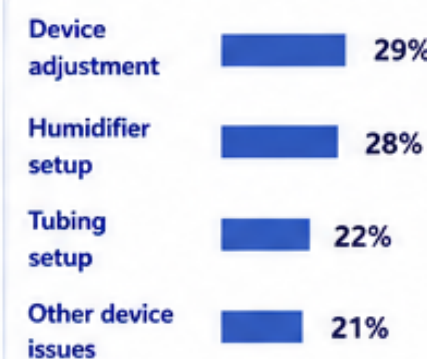
20%
of patients



DEVICE-RELATED



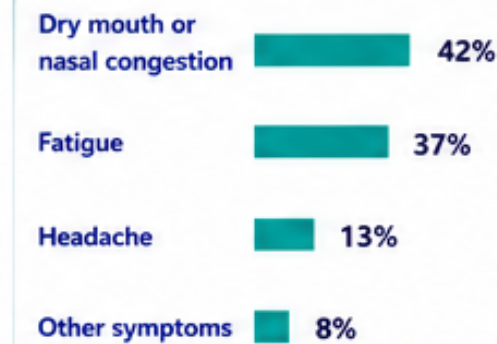
5%
of patients



SYMPTOM-RELATED



11%
of patients



CONCLUSION



Nearly three-quarters of new PAP users reported multiple early concerns via CCI in myAir™, with mask-related discomfort being most common. Digital self-reporting tools offer real-time insight into patient experience, supporting early, targeted interventions.



IMPLICATION

Integrating digital feedback early in therapy can enhance patient support and improve PAP adherence and outcomes.

KEY TAKEAWAYS



Nearly three-quarters of new PAP users reported multiple early concerns via CCI in myAir™.



Mask-related issues were the most commonly reported, driven by discomfort, leaks and slippage.



Most feedback was provided within the first two weeks of therapy.



Digital self-reporting tools deliver real-time insights to guide early, targeted interventions.

Early positive airway pressure use predicts therapy discontinuation, treatment effectiveness, and behavioural patterns in obstructive sleep apnoea

Telemedicine, Sleep, Patient/professional partnership

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BACKGROUND

Positive airway pressure (PAP) adherence in obstructive sleep apnoea (OSA) is poorly captured by binary usage thresholds stratified by nights of early PAP use and may be predictive of therapy discontinuation, treatment effectiveness, and behavioural patterns.



OBJECTIVE

To test whether early PAP use across pre-defined strata predicts risk of longer term therapy discontinuation, treatment effectiveness, and behavioural patterns in obstructive sleep apnoea (OSA).



METHODS

- Retrospective analysis of OSA patients using PAP therapy with a patient engagement tool (myAir™) and ≥365 days of follow-up.
- Patients were stratified by average PAP use over the first 90 days into six groups: <2 h, ≥2 to <4 h, ≥4 to <6 h, ≥6 to <7 h, ≥7 to <9 h, and ≥9 h.
- Outcomes included therapy discontinuation (≥90 consecutive days without use), residual apnoea-hypopnoea index, and behavioural patterns.

This analysis included myAir™ users who provided consent for the collection and use of their data through the myAir™ application.



BASELINE CHARACTERISTICS (Overall Cohort)

N = 298,089

Age at first use date

Mean ± SD: 52.73 ± 12.80 years

Median (Q1–Q3): 53 (44–62)

Gender, n (%)



Male

217,671 (73%)



Female

78,784 (26%)



Prefer not to say

1,634 (1%)

Mode of PAP therapy at first use, n (%)



AutoSet

229,747 (77%)

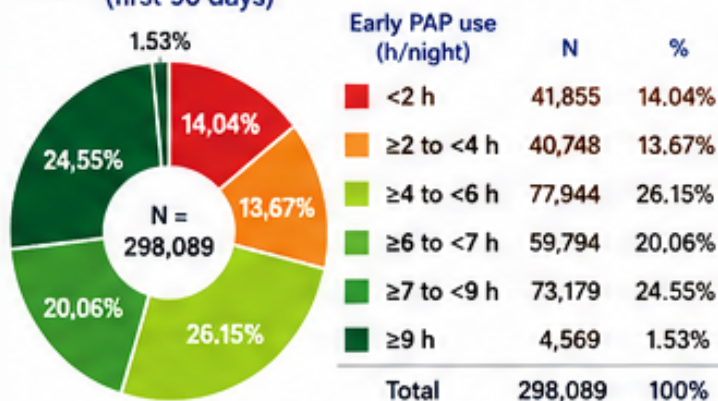


CPAP

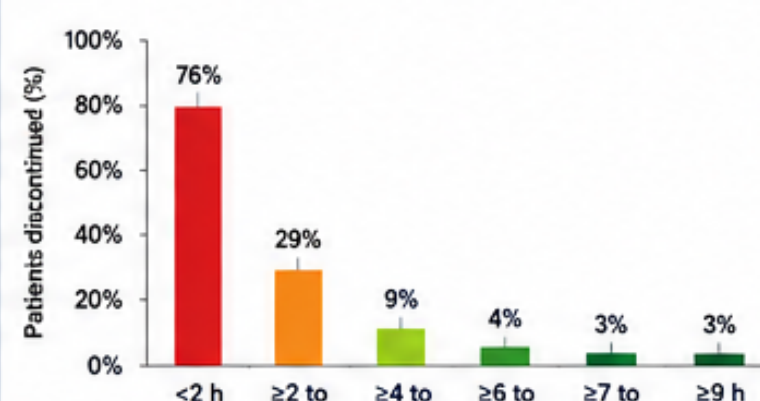
68,342 (23%)

RESULTS

1 Patient distribution by early PAP use (first 90 days)

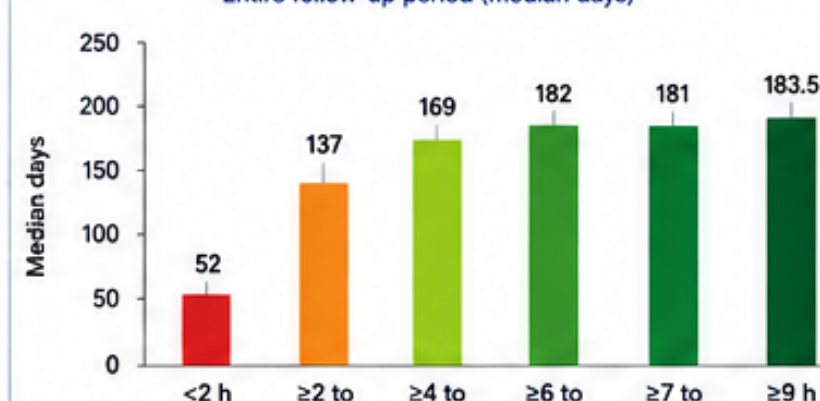


2 Therapy discontinuation (≥90 days)



Overall: 55,332 patients discontinued therapy (19%)

3 Days to therapy discontinuation (≥90 days) Entire follow-up period (median days)



Overall median time to discontinuation: 98 days

CONCLUSIONS



Lower early PAP use (<2 h) is strongly associated with higher therapy discontinuation.



Patients with higher early PAP use remain on therapy for significantly longer periods (median ~180 days vs 52 days in <2 h group).



Residual AHI improved from the first to the last 90 days across all early-use strata.



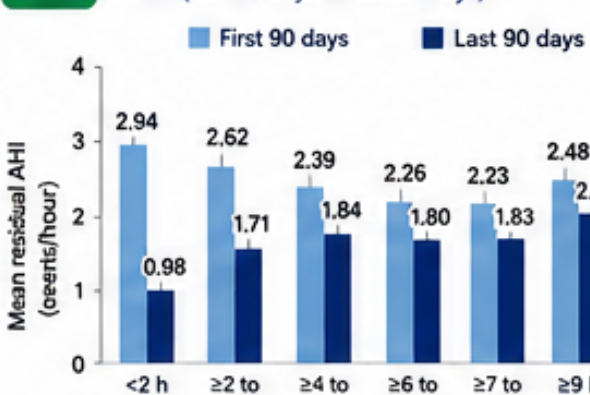
Early usage behaviour differs between low- and high-use groups: lower-use groups decrease use on weekends, while higher-use groups maintain or slightly increase use.



Interruption patterns differed across early-use strata.



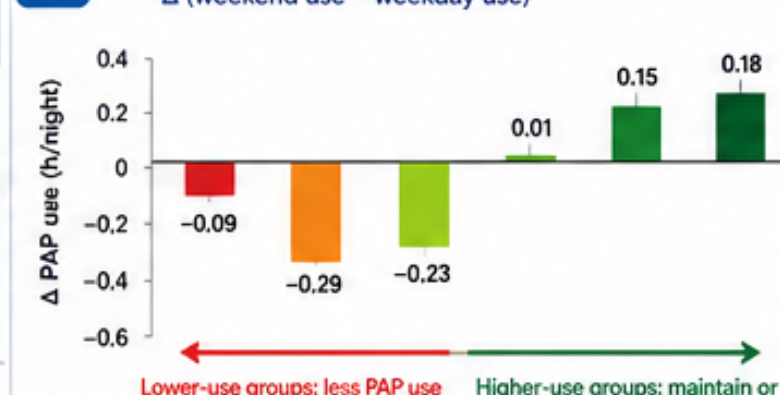
Residual AHI (events/hour) Mean (first 90 days vs last 90 days)



Improvement in residual AHI observed across all early-use strata.



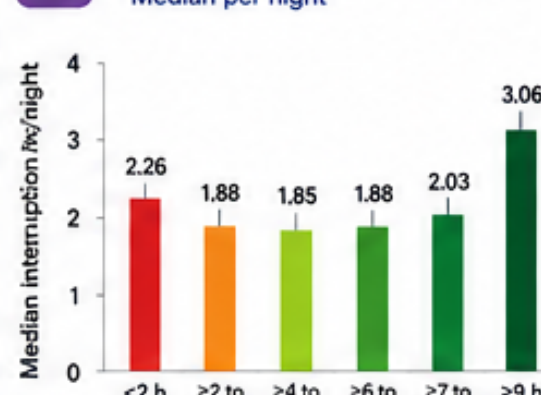
Weekend vs weekday PAP use Δ (weekend use – weekday use)



Lower-use groups: less PAP use on weekends
Higher-use groups: maintain or slightly increase weekend use



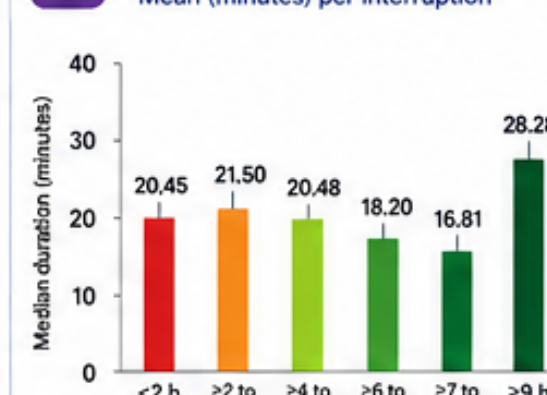
Therapy interruptions – Number Median per night



Higher early use (≥9 h) is associated with more interruptions per night.



Therapy interruptions – Duration Mean (minutes) per interruption



Lower-duration interruption in mid- and higher early-use groups; longest duration in ≥9 h group.

Couple-level Benefits of PAP Therapy for OSA: Contrasting Sexual and Relation Outcomes in U.S. vs. European Studies: A Narrative Review

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INTRODUCTION

- PAP therapy for obstructive sleep apnea (OSA) may affect not only patients, but also bed partners and couple functioning
- Sexual, relational, and partner outcomes have been studied in both the US and European populations, but regional differences have not been systematically compared

To compare sexual and relational outcomes associated with PAP therapy across U.S. and European studies

METHODS

- **Narrative review** of 30 studies comparing sexual and relational outcomes associated with PAP therapy for OSA in the **U.S. (n=16)** and **Europe (n=14)**.
- Included adults (≥ 18 years) with OSA treated with PAP and/or their partners.
- Studies included **qualitative (n=12)** and **quantitative (n=18)** designs.
- Follow-up was categorized as **short-term (≤ 3 months; n=11)** or **long-term (≥ 6 months; n=19)**.
- Outcomes included **sexual function and satisfaction, intimacy, relationship functioning, partner sleep and PAP acceptance, partner involvement, and PAP adherence**.
- Findings were synthesized by **region and follow-up duration**, with attention to partner involvement and couple-focused interventions.
- Differences in **outcome measures, adherence assessment, and follow-up periods** were considered when interpreting cross-regional findings.

ACKNOWLEDGEMENTS

This study was funded by Resmed and all authors are employees of Resmed

RESULTS

- **European studies: high partner acceptance and positive relational outcomes**
 - High partner acceptance of PAP
 - Improved partner sleep and relationship satisfaction
 - Generally low disruption to intimacy
 - Some studies reported improved sexual functioning with longer follow-up

European studies generally suggest PAP can support both partner well-being and couple functioning

- **U.S. studies: PAP adaption is a dyadic process**
 - Greater emphasis on partner involvement during PAP initiation and adaptation
 - Partner support was associated with better PAP adherence
 - Intimacy challenges were more commonly described during treatment initiation
 - Autonomy-supportive partner behaviors were associated with:
 - More sustained PAP adherence
 - Better relational outcomes



U.S. studies show how partners engage in PAP therapy may influence both adherence and relationship outcomes

- **Consistent findings across regions**
 - **Partner involvement** predicted better PAP adherence
 - PAP was associated with **improvements in partner and relational outcomes**
 - **Sexual benefits** were reported, particularly with longer-term PAP use.

Partner-inclusive PAP care may benefit both the patient and the dyadic relationship

- **Clinical implications**
 - **Incorporate partners** into PAP initiation and ongoing care
 - Encourage **autonomy-supportive partner behaviors**
 - Consider continued **couple-focused support** beyond initial PAP adaption
 - **Standardize** sexual, intimacy, and relational outcome measures across studies

CONCLUSION

Regional patterns suggest differences in how PAP-related sexual and relational outcomes are experienced and studied. European studies generally report higher partner acceptance, improved partner sleep and relation satisfaction, and limited intimacy disruption, where US studies more often emphasize PAP adaption as dyadic process and the role of partner support in adherence.

Partner involvement is a consistent facilitator of PAP adherence, but regional differences and heterogeneous outcome measures highlight the need for partner-inclusive care and standardized assessment of sexual and relational outcomes.

Sleep Efficiency as Marker of Health in Obstructive Sleep Apnea: Insights from Wearable Data

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INTRODUCTION

- Sleep efficiency, defined as the proportion (%) of time in bed spent asleep, reflects sleep quality and recovery
- In obstructive sleep apnea (OSA), sleep efficiency may capture broader behavioral and physiological health
- Data from consumer wearable devices enables large-scale evaluation of these associations in OSA patients on CPAP therapy

Goal: To evaluate whether sleep efficiency is associated with differences in physiological and

METHODS

- **Study design:**
 - A retrospective observational analysis of wearable-derived data
 - N = 40,248 adults with OSA on CPAP therapy
- **Cohort inclusion criteria:**
 - Within a 365-day window:
 - ≥30 valid sleep nights (3–12 h/night)
 - ≥45 valid activity days (≥100 steps/day)
- **Sleep efficiency definition:**
 - Calculated as total sleep time divided by time spent in bed (%)
 - Values of 100% excluded to ensure physiological validity
- **Sleep efficiency categories:**
 - Efficient: ≥85%
 - Moderately efficient: 80–<85%
 - Inefficient: <80%
 - Between-group comparisons using Kruskal-Wallis tests
- **Variables analyzed :**
 - Sleep: total sleep time (TST)
 - Activity: daily steps, exercise minutes
 - Physiology: body mass index (BMI), resting heart rate (HR), heart rate variability (HRV), blood oxygen saturation (SpO₂)

RESULTS

- **Sleep efficiency distribution:** **92%** were efficient sleepers (≥85%), **3.7%** were moderately efficient (80%–<85%), and **4.3%** were inefficient (<80%)
- **Sleep & activity:** Higher sleep efficiency was associated with a consistent pattern of improved behavioral outcomes, including longer sleep duration (**412** vs **382 min/day**), greater daily step counts (**6,489** vs **5,893/day**), and more exercise time (**47** vs **33 min/day**), suggesting more structured and restorative daily routines (**Figure**)
- **Cardiovascular physiology:** Efficient sleepers had a lower resting heart rate (**61.0** vs **64.2bpm**) . Mean HRV was similar between efficient and inefficient sleepers (**37.4** vs **37.5 ms**), although HRV differed across the three groups overall
- **Body composition & oxygenation:** BMI did not differ significantly across groups, while SpO₂ showed a small but statistically significant difference, with lower mean SpO₂ among efficient sleepers (**94.6%** vs **95.7%**)
- **All comparisons, except BMI,** were significant (p < 0.001), reflecting consistent patterns across a large real-world population **Figure.** Behavioral and physiologic profile by sleep efficiency category

	Inefficient (<80%) N = 1,734	Moderately Efficient (80–<85%) N = 1,506	Efficient (≥85%) N = 37,008	
Sleep efficiency (%)	71.1 (8.0)	82.8 (1.4)	97.4 (4.0)	
Total sleep time (min/day)	382.3 (74.7)	403.1 (59.7)	411.5 (72.2)	
Steps (count/day)	5,893 (2,695)	6,148 (2,711)	6,489 (2,937)	
Exercise (min/day)	32.9 (24.9)	36.0 (28.5)	47.0 (43.9)	
BMI (kg/m ²)	32.9 (24.9)	31.9 (5.8)	32.0 (6.0)	
Resting heart rate (bpm/day)	64.2 (8.5)	64.5 (8.8)	61.0 (8.2)	
Heart rate variability (ms/day)	37.5 (24.5)	35.8 (21.3)	37.4 (21.2)	
Oxygen saturation (SpO ₂ , %)	95.7 (1.4)	95.7 (1.2)	94.6 (2.6)	

Values are mean (standard deviation).
More favorable direction: higher = better for sleep efficiency, total sleep time, steps, exercise, HRV, and SpO₂; lower = better for resting heart rate and BMI.

More favorable →

Values are presented as means, min = minutes, kg = kilogram, bpm = beats per minute, ms = milliseconds , all values, except BMI, are p < 0.001

CONCLUSION

Sleep efficiency is a potential marker of behavioral and physiological health in OSA. Higher efficiency was associated with longer sleep duration, greater physical activity, and lower resting heart rate. These findings position sleep efficiency as a scalable, wearable-derived indicator with potential applications in digital health monitoring and targeted behavioral interventions.

Higher sleep efficiency is associated with longer total sleep time, greater physical activity, and lower resting heart rate in adults with OSA on CPAP therapy

INTRODUCTION

- Obstructive sleep apnea (OSA) is associated with cardiometabolic and neurocognitive morbidity
- Growth of connected consumer wearable devices enables large-scale real-world monitoring
- Global benchmarks for sleep, activity, and physiology in OSA remain limited

This study aimed to characterize real-world patterns of sleep, physical activity, and physiology in Western European adults with OSA using wearable device data

METHODS

- Study design**
 - A retrospective observational analysis of real-world wearable data from CPAP users
 - Descriptive, population-level benchmarking analysis
- N = 72,453 Western European adults with OSA using continuous positive airway pressure (CPAP) therapy
- Cohort inclusion criteria:**
 - Within a 365-day window:
 - ≥30 valid sleep nights (3–12 h/night)
 - ≥45 valid activity days (≥100 steps/day)

- Variables analyzed;**
- Sleep: duration, efficiency (total sleep time / by time in bed)
 - Activity: daily steps and exercise minutes
 - Physiology: body mass index (BMI), resting heart rate (HR), heart rate variability (HRV), and blood oxygen saturation (SpO₂)

RESULTS

Figure. Sleep and Activity outcomes among Western European CPAP users

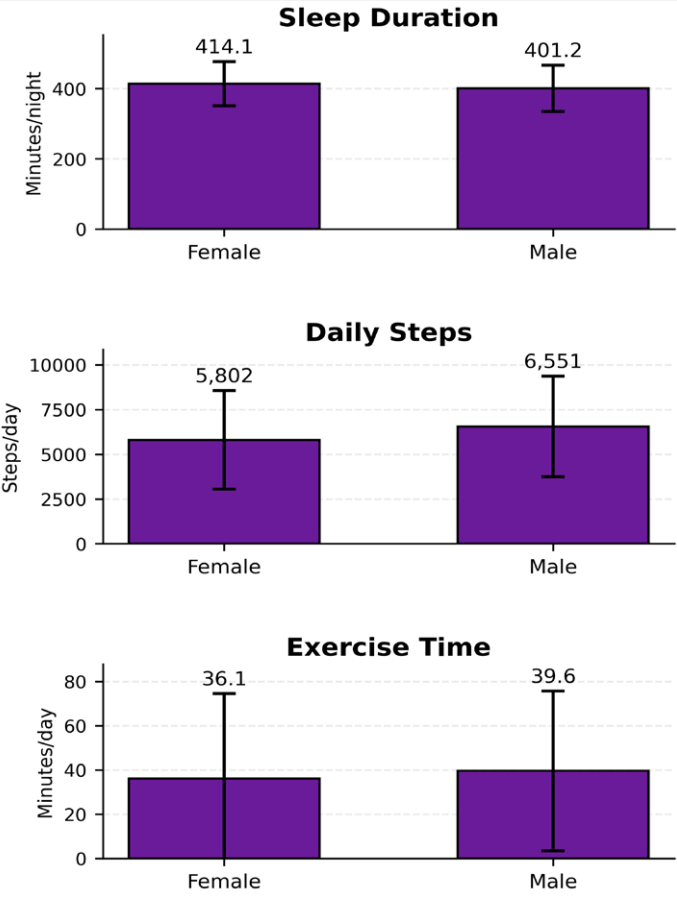


Table. Wearables characteristics among Western European CPAP users

Characteristic	Overall (N=72,453)	Female (N=15,069)	Male (N=56,818)
Age (years)	55.0 ± 11.8	56.1 ± 11.4	54.7 ± 11.9
Sleep duration (min/night)	403.9 ± 67.7	414.1 ± 63.0	401.2 ± 66.1
Sleep efficiency (%)	95.8 ± 7.2	96.1 ± 7.5	95.7 ± 7.2
Daily steps (steps/day)	6,392 ± 2,811	5,802 ± 2,752	6,551 ± 2,807
Exercise (min/day)	38.8 ± 36.5	36.1 ± 38.4	39.6 ± 36.1
BMI (kg/m²)	32.5 ± 6.2	34.2 ± 7.6	32.2 ± 5.9
Resting HR (bpm)	63.2 ± 8.4	64.5 ± 7.8	62.8 ± 8.5
HRV (ms)	38.0 ± 22.0	34.0 ± 16.9	39.0 ± 23.0
SpO₂ (%)	95.3 ± 2.0	95.0 ± 2.4	95.3 ± 1.9

Values are presented as mean ± standard deviation, min = minutes, kg = kilogram, bpm = beats per minute, ms = milliseconds, female-male comparisons were statistically significant (p < 0.05)

CONCLUSION

This analysis provides wearable-derived estimates of sleep, physical activity, and physiology in Western European adults with OSA. These findings highlight the opportunity to analyze wearable data alongside PAP therapy data, potentially enabling patient phenotyping and supporting individualized and adaptive OSA therapy.

Wearable data from more than 72,000 Western European adults with OSA provide real-world benchmarks of sleep, physical activity, and physiology and reveal descriptive differences between females and males.

Development of a female-specific obstructive sleep apnoea (OSA) screening questionnaire

Authors: Alison Wimms, Shuying Yu, Nina Wiklund, Daniela Gautschi, Jeff Armitstead.

Institution: Resmed Sleep Science Centre, global

INTRODUCTION

Women with OSA are at increased risk of being missed or misdiagnosed because their symptoms and disease presentation often differ from men. Existing screening questionnaires may lack sensitivity for detecting OSA in women.

Aim: To develop and evaluate a female-specific screening questionnaire for identifying women at risk for OSA.

METHODS

Development included: (1) analysis of symptom data linked to home sleep test outcomes to identify predictors of OSA in women; (2) targeted literature review of sex differences in symptoms and comorbidities; and (3) expert consultation.

In a prospective pilot study, adults undergoing diagnostic testing for suspected OSA in Australia, the US and China completed the questionnaire before their sleep study.

Data Analysis and Validation

OSA was defined as an AHI ≥ 5 derived from home sleep apnea testing .

Predictor variables were selected using LASSO regression, followed by multivariable logistic regression to develop the risk score. Model performance was assessed using predefined thresholds for sensitivity ($\geq 85\%$) and specificity ($\geq 45\%$).

Internal validation was performed using bootstrapping techniques to ensure the robustness of the finalised risk score

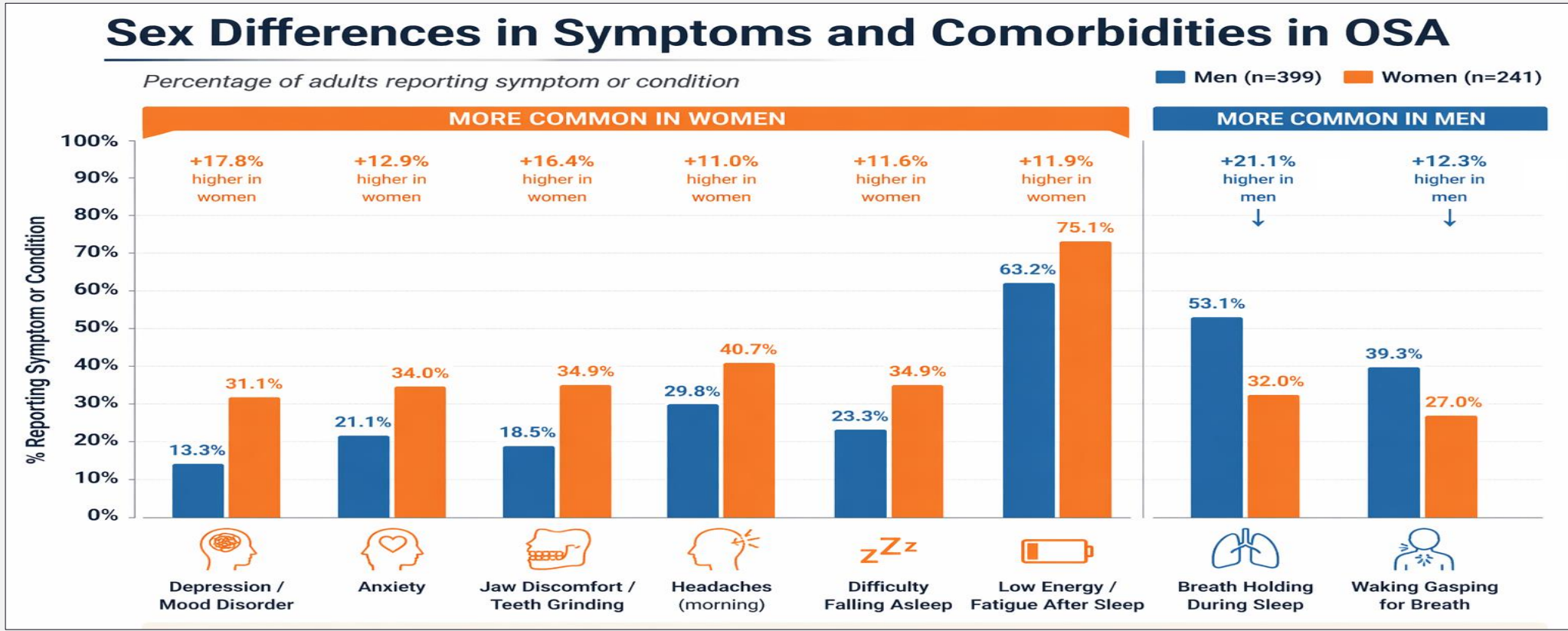
RESULTS

A total of 641 participants were included

Characteristics	% / (mean (SD)) years; range
Sex (n=641)	38% female
Age (n=241)	51.6 (16.2); 18-86
BMI (n = 237)	30.8 (7.7); 15.6-62.9
AHI (n = 178)	18 (21.1); 0.4-110

Men demonstrated higher AHI (27 vs. 18), ODI (25 vs. 16), snoring (94% vs. 89%), and witnessed apneas (53% vs. 32%) than women.

Table 1: Summary of items assessed in the questionnaire
Age
BMI
Menopausal status
Assessment of daytime symptoms of tiredness, such as fatigue, lack of energy, feeling of being unrested
Assessment of various insomnia metrics (difficulty falling asleep, difficulty staying asleep etc)
Presence of snoring
Witnessed apneas
Assessment of morning symptoms such as dry mouth, and jaw pain.
Frequency of sleep disruption from pain
Frequency of morning headaches
Presence of hypertension
Comorbid conditions such as hypertension, diabetes, heart failure, mood disorders, hyperlipidaemia, thyroid conditions, GERD, Asthma, RLS



LASSO regression identified age, body mass index (BMI), menopausal status, hypertension, and nocturnal gasping/choking symptoms as key predictors of OSA risk in women.

The preliminary results of this female-OSA screener demonstrate strong predictive performance of OSA risk: sensitivity 85%, specificity 64%, AUC 0.83.

CONCLUSION

This female-specific OSA screening questionnaire shows promise in predicting OSA risk.

Additional data from non-clinical populations are required to improve dataset balance and enhance model generalizability in the development of a female OSA screener.



ACKNOWLEDGEMENTS

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We thank the collaborators involved in the development of the screener: Esther Schwarz, Jean-Louis Pépin, Erna Sif Arnardóttir, Eva Lindberg, Swapna Mandal, Jonna Morris, Marisa Bonsignore, Elisa Perger, Carolina Lombardi, Manuel Sanchez-de-la-Torre, Lizette Venekamp, Özen K. Basoglu, Timo Läppinen, Susana Sousa, Raphael Heinzer, Martino Pengo, Jenny Theorell-Haglöw, Dora Triché, Neus Salord, Lichuan Ye, Francesca Facco, Nancy Stewart, Monica Mallampalli, Diego Mazzotti, Sanjay R. Patel, Sophia Schiza

Smartphone-based multimodal digital biomarkers for detection of obstructive sleep apnea

Authors: Alison Wimms, Alvin Lim Zhi Guang, Tingting Zhang, Vishakha Bansal, Hongjiang Yu, Arpit Joshi, Rakesh Prakash, Daniela Tellez, Andrew Partington, Yi Dayton, Yang Yan, Yu Heng Goh, Zhuo Zeng, Ethan Farrugia, Liam Davies, Dominica Leaver, Jinting Xiao, Jaykumar Soni, Lisa Erikli, Sarah Pongrass, Jeff Armitstead, Bikash Ranjan Bhoi, Juliette Barker, Michael Hogg, Fiza Mughal, Ji Hae Jang, Rakesh Chovatiya, Ankit Yadav, Freya Liu, Harshpinder Singh, Christopher Gill, Liam Holley.
Institution: Resmed Science Centre, Global

INTRODUCTION

Obstructive sleep apnea (OSA) remains underdiagnosed due to limited access to sleep testing and associated costs. Scalable, low-cost tools are needed to improve early detection.

AIMS

To develop a smartphone-based application integrating multimodal digital biomarkers to predict OSA risk

METHODS

The MinuteDx app integrates:

- (1) risk-based questionnaires;
- (2) facial imaging to quantify craniofacial and neck morphology;
- (3) video recordings reviewing speech, blinking, and swallowing to assess visual and acoustic markers associated with upper airway and neuromuscular traits; and
- (4) Cardiopulmonary coupling as a surrogate of autonomic function.

In a prospective pilot study, adults undergoing diagnostic testing for suspected OSA in Australia, the US and China completed the app prior to a sleep study.

Multimodal features were extracted using AI-based analysis and combined to estimate OSA risk from daytime signals

Models were developed using stratified train/test splits and 5-fold cross-validation. Performance was evaluated using receiver operating characteristic (ROC) analysis.

Outcomes were compared with home sleep test derived apnea-hypopnea index (AHI).

RESULTS

Over 700 participants have been enrolled, and 586 participants analysed from the USA and Australia

Table 1: Participant Demographics	
Gender (%)	38% female
Age (Mean ± SD)	48± 16
Ethnicity (%)	59% non-Hispanic white 25% Asian
AHI (mean± SD)	22.3 ± 22.9

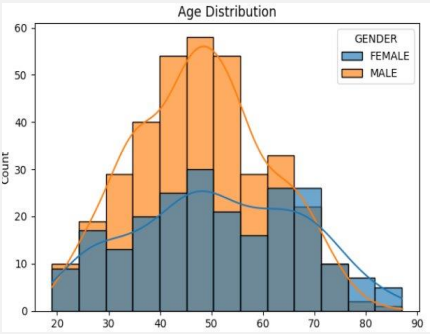


Figure 1: Age Distribution

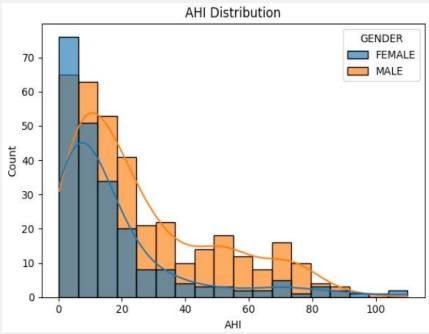


Figure 2: AHI Distribution

Model inputs

1) Questionnaires

- Ordinal and categorical features are extracted from a range of symptom and clinical questions, which users add directly into a phone app.

Sleep Quality

Overall sleep profile

How the user describes their sleep

Sleep disturbance, duration, satisfaction

Insomnia Pattern

Sleep initiation / maintenance

Difficult falling or staying asleep

Difficult type, frequency, history, sleep interference, sleep anxiety

OSA / Night Symptoms

Breathing-related night symptoms

Signals associated with OSA risk

Snoring, snoring loudness / position, hold breath, gasping, wake-up symptoms

Daytime Impact

Sleepiness and daily burden

How poor sleep affects daytime function

Daytime sleepiness, sleepiness extent, daytime problems, nap frequency, most energetic time

Clinical / Context

Risk factors and modifiers

Conditions or behaviours linked to sleep risk

High BP, heartburn, comorbidities, pain-related sleep trouble, sleeping aids

2) Facial imaging

- Facial measurements are extracted from ‘selfie’ photographs, using the phone camera

Euclidean Features

Euclidean Distance

Straight-line distances between facial points.

Upper face depth, mid face depth, nose-width

Geodesic Features

Geodesic Distance

Curve distances between facial points.

Upper face depth, mid face depth, nose-width

Angular Features

Angular Features

Angle between facial points

Midface width angle, lower face width angle

Fatigue Features

Tiredness & Fatigue

Markers of fatigue and reduced alertness,

Eyelid droop, under eye darkness, facial tone, skin texture

3) Video assessment

- Speech features are extracted from short videos, using the phone microphone and camera

Time Domain

Loudness and Noise

How strong / raspy the voice is

RMS energy, Zero Crossing Rate

Frequency Domain

Airflow and Obstruction

Spectral patterns of breathing

High Freq/Low Freq energy, Spectral Spread/Skew etc.

MFCC

Vocal-tract/airway traits

Airway & resonance characteristics

MFCC 1-13

Pauses

Vocal Fatigue/Continuity

Number/duration of silences

Total/Max/Mean pause dur, number of pauses

Speech Rate

Tempo / breath effort proxy

Fast / slow delivery

Mean/Std of speech rate

4) Cardiopulmonary coupling

- Variations in heart rate are measured during paced breathing activities, and lung mechanics are calculated by measuring displacement and velocity through phone accelerometry

Heart Mechanics

Heart Mechanics

Heart rate variability (HRV)

Lung Mechanics

Lung Mechanics

Tidal Volume Proxy, Chest Velocity, Inspiration & Expiration Time, Duty Time

Preliminary modelling (n=586) combining all four modalities demonstrated ability to reach 80% sensitivity and 60% specificity, and AUC-ROC 0.77 for detecting OSA defined as AHI ≥5.

CONCLUSION

A smartphone-based multimodal approach demonstrates strong potential for accurate, scalable detection of OSA using non-contact assessments. Early results support its potential as a home or clinic-based, low-cost diagnostic solution. A larger prospective validation study across diverse populations is warranted to confirm clinical performance and generalizability.

ACKNOWLEDGEMENTS

This study was funded by Resmed, and all authors are employees of Resmed.



Gender-Specific Patterns in PAP Adherence, Usage and Therapy Outcomes: Insights from a Large Real-World European Cohort

C. Schoebel¹, M. Deger², H. Woehrlé³, C. Woodford⁴, M. Arzt⁵, A. Ghildiyal⁶, F. Zeman⁷, S. More⁴

¹ Center for Sleep- and Telemedicine, West German Lung Center at University Hospital Essen, Ruhrlandklinik, Essen (Germany); ² ResMed Science Center - Munich (Germany);

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⁶ ResMed Science Center - Oxfordshire (United Kingdom); ⁷ University Hospital Regensburg - Regensburg (Germany)



298,089
European
adults with
OSA



73%
Male
217,668



26%
Female
78,786



~1%
Prefer not
to say
1,635



365
Days
follow-up
from first
use date



myAir™
Real-world
data from
myAir™
digital
platform

BACKGROUND



Gender-related differences in positive airway pressure (PAP) adherence and treatment outcomes in obstructive sleep apnoea (OSA) remain insufficiently characterised. Real-world data enables detailed comparison of behavioural and effectiveness patterns by gender.



OBJECTIVE

To compare gender-specific patterns in PAP adherence, usage, treatment effectiveness and behavioural outcomes in a large European real-world cohort of patients with obstructive sleep apnoea (OSA).

METHODS



We analysed 365-day PAP usage in 298,089 European adults using a privacy-transparent app myAir™ paired with PAP devices (AirSense™ 11).



All patients had ≥1 year of connected data from therapy initiation.



Outcomes included adherence, discontinuation, nightly usage, residual AHI, leak, therapy timing and interruptions, stratified by gender.

N = 298,089

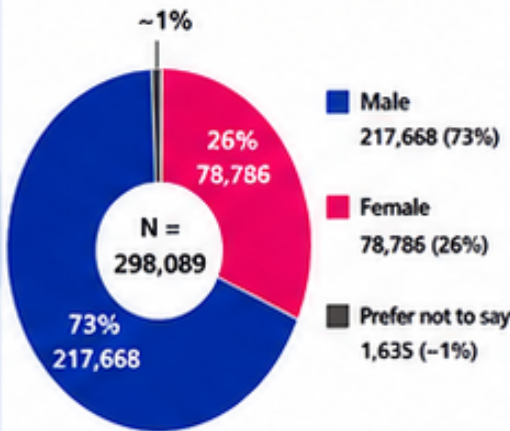
This analysis included myAir™ users who provided consent for the collection and use of their data through the myAir™ application.

*The group includes patients with recorded PAP usage data but no therapy use on the respective night or during the therapy period, excluding long-term nonadherent or equipment use adherence and outcomes.

BASELINE CHARACTERISTICS

Characteristic	Male N = 217,668 (73%)	Female N = 78,786 (26%)	Prefer not to say N = 1,635 (~1%)
Age at therapy initiation, Mean ± SD, Median (IQR)	52.71 ± 12.26 53 (44, 62)	54.35 ± 12.56 55 (46, 63)	49.26 ± 11.14 49 (39, 57)
Mode of PAP therapy (mode at first use date), n (%)			
AutoSet	166,450 (76%)	62,269 (79%)	1,390 (85%)
CPAP	51,618 (24%)	16,510 (21%)	245 (15%)
Therapy termination (>30 days) at 365 days, n (%)		38,246 (18%)	16,246 (21%)
Days to therapy termination (>30 days) at 365 days, Mean ± SD, Median (IQR)		103.21 ± 78.76 97 (49, 172)	98.65 ± 78.68 82 (45, 159)

1 Cohort composition



RESULTS

2 PAP usage patterns (365 days)

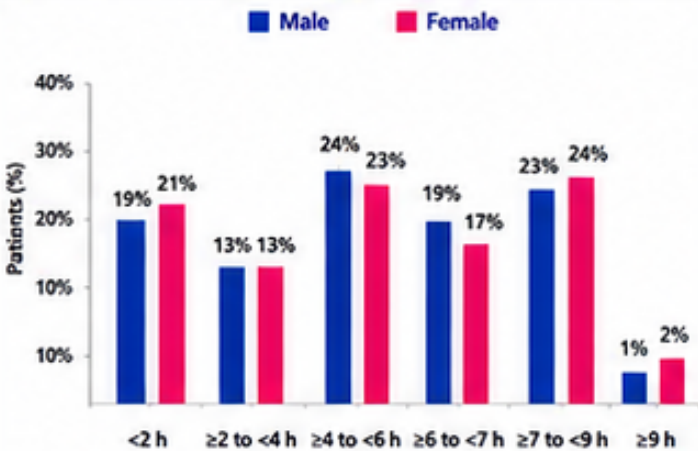
Average usage (all nights) (Mean ± SD)	Usage on nights used (Mean ± SD)
	
4.91 ± 2.57	6.03 ± 1.79
4.87 ± 2.68	6.09 ± 1.86

Weekday vs. weekend usage (mean h) (Days, all nights, Mean ± SD)		
	Weekday	Weekend
Male	4.93 ± 2.54	4.86 ± 2.70
Female	4.85 ± 2.65	4.81 ± 2.77

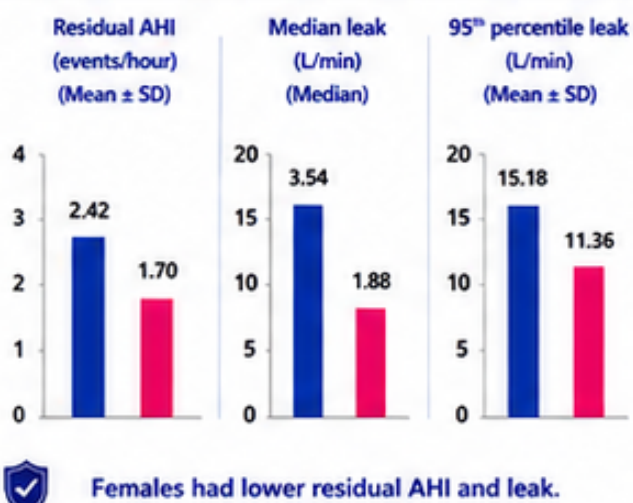
KEY FINDINGS

- Overall adherence was similar (≥4 h/night: 69% men vs 69% women).
- Therapy discontinuation was higher in females (21% vs 18%), despite similar adherence, with similar mean time to termination (100 vs 111 days).
- Females used PAP slightly longer on nights used (6.09 vs 6.03 h).
- Females achieved lower residual AHI (1.70 vs 2.42 events/h).
- Females had lower leak: mean and median leak reduced, 1.38 vs 2.54 L/min; and mean 95th percentile leak 11.36 vs 15.18 L/min.
- Interruption frequency was similar (~2 per night), while mean interruption duration was slightly shorter in females (18.67 vs 19.30 min).
- Therapy start and end times were earlier in females.

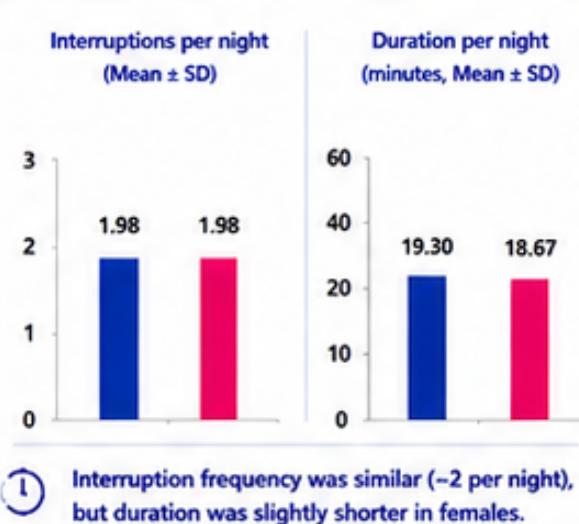
3 Usage distribution (first 365 days)



4 Therapy effectiveness (first 365 days)



5 Interruptions (first 365 days)



6 Therapy timing (first 365 days)

	Therapy start time (hh:mm:ss)			Therapy end time (hh:mm:ss)	
	Mean ± SD	Median (Q1, Q3)		Mean ± SD	Median (Q1, Q3)
Male	00:01:26 ± 01:21:27	23:51:01 (22:09:56, 00:41:27)	 Women started and ended therapy earlier.	Male	06:02:21 ± 01:56:17 06:21:11 (05:10:53, 07:12:18)
Female	23:47:05 ± 01:18:38	23:38:16 (22:58:28, 00:24:33)		Female	05:30:01 ± 01:57:09 05:53:22 (04:58:34, 07:13:33)
Prefer not to say	00:15:21 ± 01:46:25	23:34:54 (23:11:18, 00:59:35)		Prefer not to say	06:02:51 ± 01:49:04 06:38:08 (05:14:14, 07:34:08)

CONCLUSION

Despite similar PAP adherence, females had lower residual AHI and leak, and slightly shorter use duration. Earlier therapy timing and gender-specific behavioural patterns indicate gender-specific behavioural differences relevant for personalized PAP support.

Disclosure: This study was sponsored by ResMed.



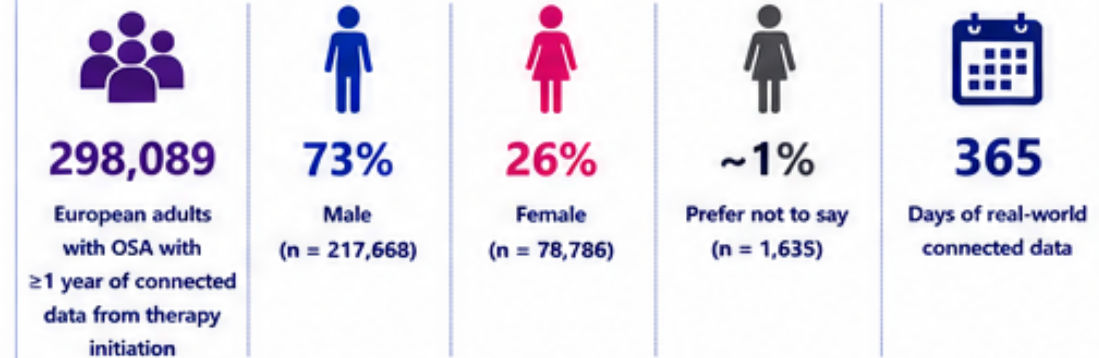
Long-Term Real-World Evaluation of PAP Utilisation Patterns and Therapy Effectiveness in a Large European Population Using Connected Health Data

Adherence, Digital health, Sleep

H. Woehrle¹, M. Deger², M. Arzt³, S. More⁴, C. Schoebel⁵, C. Woodford⁴, F. Zeman⁶, A. Ghildiyal⁷

¹Lung Center Ulm – Ulm (Germany); ²ResMed Science Center – Munich (Germany); ³Department of Internal Medicine II, University Hospital Regensburg – Regensburg (Germany); ⁴ResMed Science Center – Halifax (Canada); ⁵Center for Sleep- and Telemedicine, West German Lung Center at University Hospital Essen, Ruhrlandklinik – Essen (Germany); ⁶University Hospital Regensburg – Regensburg (Germany); ⁷ResMed Science Center – Oxfordshire (United Kingdom)

COHORT OVERVIEW



BACKGROUND

Understanding long-term positive airway pressure (PAP) behaviour in obstructive sleep apnoea (OSA) requires real-world data on adherence, nightly use and behavioural patterns beyond standard compliance metrics.

AIMS

To evaluate long-term PAP utilisation patterns and therapy effectiveness using real-world data from connected devices in a large European population.

METHODS

We analysed 365-day PAP usage from 298,089 European adults using a patient engagement app (myAir™) connected to PAP devices (AirSense™ 11).

All patients had ≥1 year of connected data from therapy initiation.

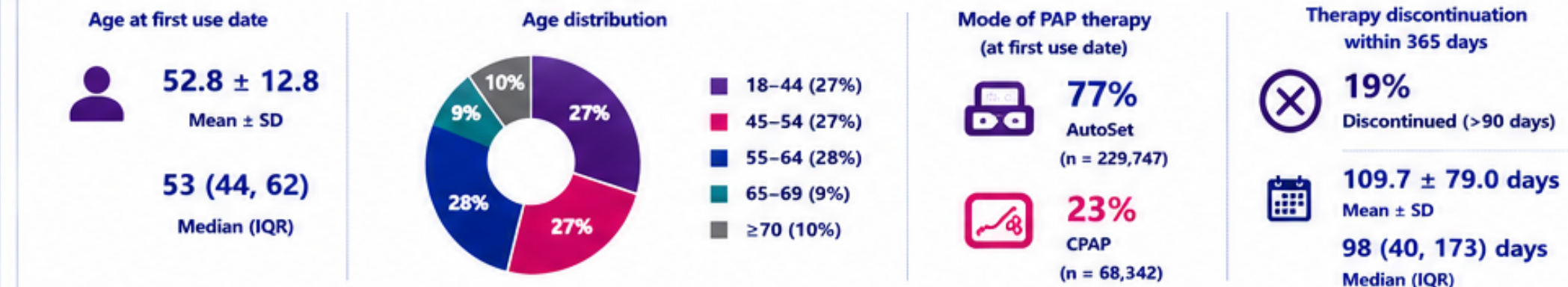
Outcomes included adherence, discontinuation, residual AHI, leak, therapy timing, weekday-weekend patterns and interruptions.

Changes between the first and last 90 days were assessed in users with data in both periods.*

*This analysis included myAir™ users who provided consent for the collection and use of their data through the myAir™ application.

N = 298,089

BASELINE CHARACTERISTICS

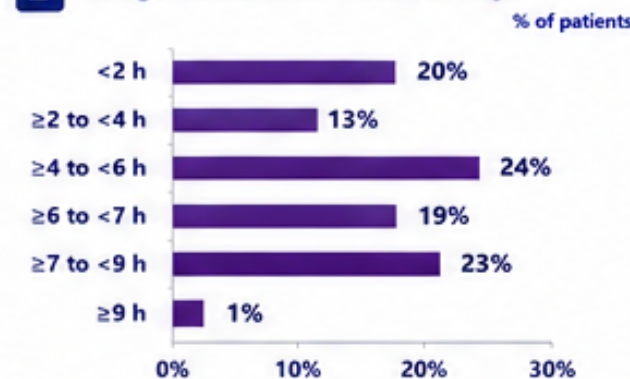


1 Nightly usage (average hours)

	All nights Mean ± SD Median (IQR)	On nights used Mean ± SD Median (IQR)
First 365 days	4.90 ± 2.60 6 (3, 7)	6.04 ± 1.81 6 (5, 7)
First 90 days with use in last 90 days*	5.61 ± 2.13 6 (4, 7)	6.23 ± 1.67 6 (5, 7)
Last 90 days	4.69 ± 2.96 6 (2, 7)	5.40 ± 2.77 6 (4, 7)

Average nightly use decreased slightly from the first 365 days to the last 90 days, but remained meaningful.

2 Usage distribution – first 365 days

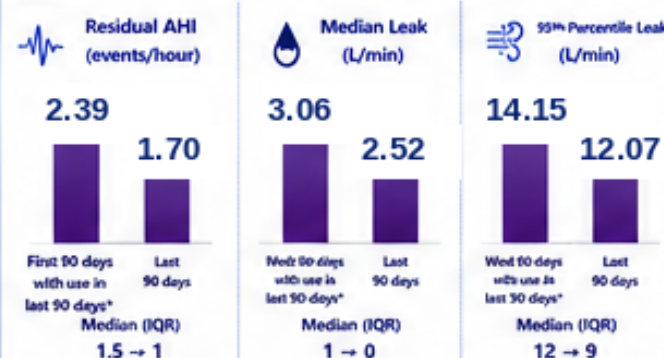


65% of patients averaged ≥4 h/night in the last 90 days.

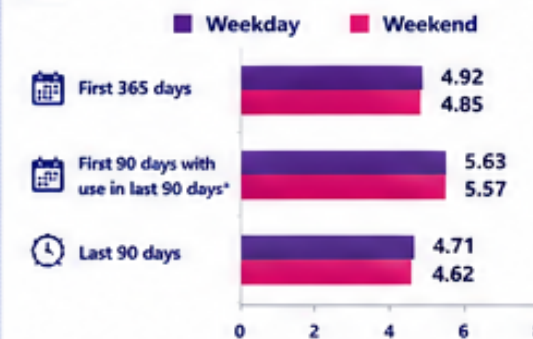
3 Nights with ≥4 h of PAP use



4 Therapy effectiveness (continuing users*)

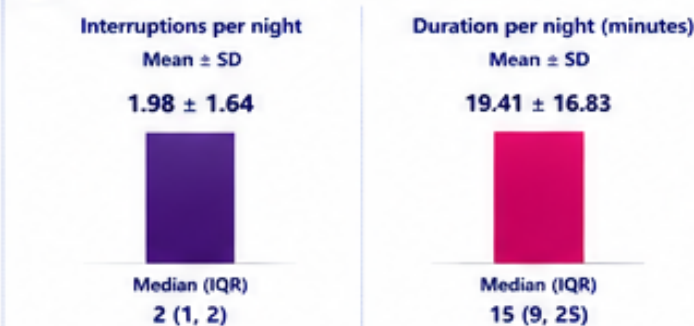


5 Weekday vs weekend usage (average hours)



Weekday-weekend differences were small across all time periods.

6 Interruptions (first 365 days)



Interruptions remained stable at ~1.7–2 per night.

7 Therapy timing (first 365 days)



KEY TAKEAWAYS

- Nearly one in five patients (19%) discontinued PAP therapy within a year (mean time to termination: ~110 days).
- Nightly use remained meaningful with 65% of patients averaging ≥4 h/night in the last 90 days.
- Treatment effectiveness improved: residual AHI decreased from 2.39 to 1.70 events/h and mean patient-level median leak from 3.06 to 2.52 L/min (in continuing users).
- Weekday-weekend differences in usage were small across all time periods.
- Interruptions remained stable at ~1.7–2 per night.
- Median therapy start and end times were 23:48 and 06:22.
- Real-world connected data provide valuable insights to support personalised PAP care.