A systematic literature review on economic evidence for continuous positive airway pressure (CPAP) adherence in obstructive sleep apnea (OSA)

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Melike Deger[1], Raju Gautam[2], Anoushka Pathak[3], Ratna Pandey[3], Fatima Sert[4], Kate Cole[4], Ankit Ghildiyal[5]

[1]Resmed Science Center, Munich, Germany; [2]ConnectHEOR, London, United Kingdom; [3]ConnectHEOR, Delhi, India; [4]ResMed Science Center, San Diego, CA, USA; [5]Resmed Science Center, Didcot, Oxfordshire, United Kingdom

INTRODUCTION

- Obstructive sleep apnea (OSA) is the most common form of sleep-disordered breathing, with repetitive upper airway obstruction during sleep causing disrupted breathing, intermittent hypoxemia and sleep fragmentation.[1]
- The economic burden of OSA is substantial, spanning direct healthcare costs, indirect productivity losses and societal outcomes.[2]
- Continuous positive airway pressure (CPAP) is the gold-standard treatment for OSA, with robust clinical efficacy across multiple domains.[3]
- Adherence is a critical determinant of therapeutic success and is linked to better clinical and economic outcomes, yet only 46–83% of patients achieve adequate use (≥4 h/night).[4]

OBJECTIVE

To summarize the economic evidence for adherent and non-adherent groups to CPAP therapy in adults with OSA.

METHODS

A systematic literature review (SLR) followed Cochrane Collaboration standards[5] and PRISMA guidelines,[6] using pre-defined PICOS criteria (Table 1).

Sources searched
Jan 2005 – Oct 2025, English only

Embase® | MEDLINE® | PubMed | Conferences | HTA reports

Table 1: Inclusion criteria for the review

Parameter	Inclusion criteria	
Population	Adults (≥18 years) with OSA alone or with other comorbidities	
Intervention	PAP therapy (i.e., APAP, BPAP, CPAP) alone or as an add-on to other therapies	
Comparator	No treatment; alternative therapies*	
Outcomes	**Economic:** total and incremental cost; total and incremental QALY; cost/QALY; cost/event avoided; budget impact; HCRU; IMV	**Crash-related and productivity:** ER visits; hospitalizations; rehabilitation; productivity lost (missed workday, disability); absenteeism; presenteeism
Study design	Economic evaluation; trial-based economic analysis	
Language	English language articles	
Time frame	Full articles: January 2005 to October 6, 2025; conference abstracts: January 2023 to September 2025 (annual) or last 2 editions (biennial)	

**Alternative therapies include EPAP valves, oral appliances, surgical interventions, lifestyle modifications, and standard care.*

RESULTS

Of the 28 adherence-reporting studies, 12 stratified HCRU and costs by adherence. **All 12 linked adherent CPAP use to significantly lower total healthcare expenditure, fewer ER visits and fewer inpatient hospitalizations** than non-adherence, consistently across general OSA and populations with CVD, AF, T2D, COPD, depression and heart failure.

Of 1,422 records, 70 studies (78 records) and five HTA reports were included; **28 reported CPAP adherence** (**Figure 1**).

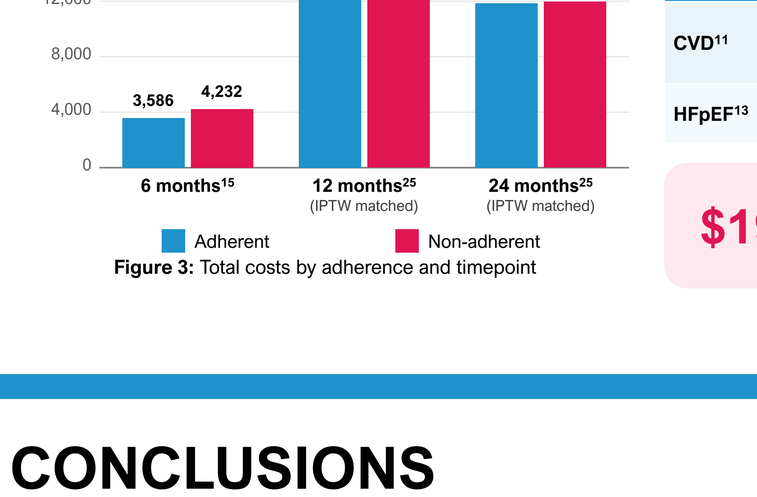
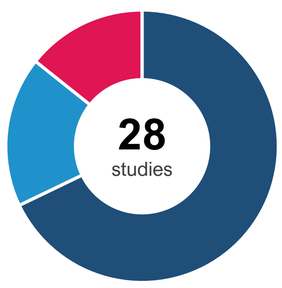


Figure 1: PRISMA flow chart

Most included studies were costs and HCRU analyses (**Figure 2**).



- **Costs and HCRU analysis:** 19 (68%)
- **Model-based analysis:** 5 (18%)
- **Trial-based analysis:** 4 (14%)

Figure 2: Types of economic evaluations

20/28 studies were **US-based**; others from Europe, Canada, Australia and Colombia

Adherence definitions varied, dominated by the CMS criterion (**Table 2**).

Table 2: Definition of adherence across included studies

Study	Adherence or compliance definition
US: An 2023,[7,8] Billings 2013, Kim 2023,[15] Kirsch 2019,[16] Malhotra 2023,[18] Sharma 2024,[22] Sterling 2022,[23] 2023,[24] 2024,[25,26] Wickwire 2024,[28] 2025,[30] 2023[31], Cistulli 2023[13], Sert-Kuniyoshi 2025[21] **Others:** Bailly 2024 (France),[10] Català 2016 (Spain),[12] Martins 2021 (Portugal),[19] Streatfeild 2019 (Australia)	**References the CMS definition:** CPAP use ≥4 hours per night on 70% of nights during a consecutive 30-day period, anytime during the first 3 months of initial usage.
Ayas 2006, USA[9]	Assumed a general compliance rate of 70% based on literature
Bock 2022, USA[11]	Adherent: evidence of CPAP treatment or supply fills on or after day 91 of initiation
Fatima 2023, Canada[14]	Not explicitly detailed; study focus is patient recruitment for fixed or auto-titrating CPAP
Lojander 2008, Finland[17]	Usage hours from counter; poor compliance defined as <1 h/night
McMillan 2015, UK[20]	Objective machine download; tertiles analysed (e.g., third tertile: mean 6.4 h/night, range 4.6–8.6)
Robles 2023, Colombia	Compliance 100% in base case; device discontinued for patients who do not comply during follow-up
Tan 2015, USA[27]	Fully adherent: ≥6 h/night; partially: 4–6 h/night; non-adherent: <4 h/night (Medicare policy)
Wickwire 2022, USA[29]	Proxy based on CPAP machine charges: high (>12), partial (4–12), low (<4)

**CMS: Centers for Medicare & Medicaid Services;*

Cost outcomes

Adherent patients had lower total costs than non-adherent patients at all timepoints (**Figure 3**), with a consistent trend in comorbid populations such as heart failure and CVD (**Table 3**).

Figure 3: Total costs by adherence and timepoint

Table 3: Annual cost reduction in comorbid adherent patients

Population	Cost outcomes (adherent)
CVD[11]	• 40% annual cost reduction • Inpatient expenditure reduced by $745 • Outpatient expenditure reduced by $2,290
HFpEF[13]	• Total healthcare cost reduced to $12,732 from $15,610

$195 **per-member-per-month** cost reduction over 24 months in CPAP initiators vs non-initiators (28,220 Medicare beneficiaries)[30]

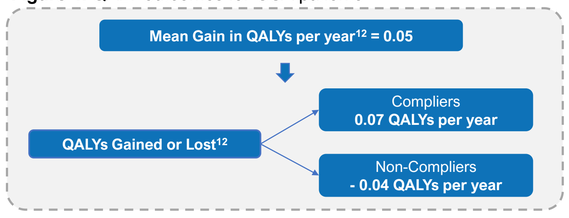
HCRU outcomes

Adherence was associated with QALY reductions across moderate to severe OSA (Figure 4) and HCRU reductions in comorbid AF, COPD and depression populations (**Table 4**).

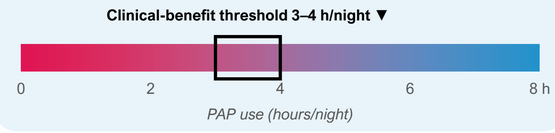
Table 4: HCRU outcomes in comorbid populations (short–medium term, 1–2 years)

Atrial fibrillation	Depression[28]	COPD[23]
Year 1[26] • 36% lower all-cause ER visit rate • 44% lower hospitalization rate • Total-cost reduction of $2,719 **Year 2**[26] • 27% hospitalization risk reduction • 38% ER-visit risk reduction • Total-cost reduction of $2,065	**2 years** • 34% reduction in all-cause ER visits • 44% reduction in all-cause hospitalizations	**2 years** • 1.8 adherent users per one all-cause hospitalization avoided • 4.1 adherent users per one severe acute exacerbation avoided

Figure 4: QALY outcomes for OSA patients



Dose–response: hospitalization risk fell with increasing PAP use up to 8 h/night over 3-, 12- and 24-month horizons[32]



CONCLUSIONS

1. **High CPAP adherence is associated with lower HCRU and costs** compared with low adherence, highlighting the potential value of interventions that improve adherence and may help reduce the economic burden of OSA.
2. Strategies that **promote sustained adherence** and efficient models of care delivery may maximize the health and economic value of CPAP therapy.
3. Given considerable heterogeneity in study designs, healthcare settings and adherence definitions, findings should be interpreted cautiously.

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CONTACT INFORMATION

Melike Deger (melike.deger-wehr@resmed.de)

Abbreviations: AF: atrial fibrillation; APAP: automatic PAP; BPAP: bilevel PAP; CMS: Centers for Medicare & Medicaid Services; COPD: chronic obstructive pulmonary disease; CPAP: continuous PAP; CVD: cardiovascular disease; EPAP: expiratory PAP; ER: emergency room; HCRU: healthcare resource utilization; HFpEF: heart failure with preserved ejection fraction; HTA: health technology assessment; IMV: incidence of motor vehicle crashes; IPTW: inverse probability of treatment weighting; OSA: obstructive sleep apnea; PAP: positive airway pressure; PICOS: population, intervention, comparator, outcomes, study design; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; QALY: quality-adjusted life year; SLR: systematic literature review; T2D: type 2 diabetes; US: United States; USD: US dollars. **Funding:** The funding for this study was provided by Resmed.