Continuous Positive Airway Pressure Adherence in Obstructive Sleep Apnea: A Comprehensive Review

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Received: 28 October 2024, **Accepted:** 17 November 2024, **Published:** 20 November 2024

Abstract

Background: Obstructive sleep apnea (OSA) is a prevalent chronic respiratory disorder characterized by recurrent episodes of upper airway obstruction during sleep, leading to intermittent hypoxemia, sleep fragmentation, and increased cardiovascular and metabolic risk. Continuous positive airway pressure (CPAP) therapy remains the gold standard for the treatment of moderate to severe OSA, with proven benefits on symptom control, quality of life, and long-term morbidity. However, the effectiveness of CPAP is closely tied to adherence, which remains a significant clinical challenge worldwide. Reported non-adherence rates range between 30–60%, with many patients discontinuing use within the first year of therapy.

This review aims to provide a comprehensive overview of CPAP adherence in OSA, focusing on its determinants, barriers, and strategies for improvement. We summarize the epidemiology of OSA, the therapeutic rationale for CPAP, and the impact of adherence on clinical outcomes. Patient-related factors such as age, sex, psychological state, and perception of disease severity are examined alongside device-related determinants including mask fit, pressure tolerance, and side effects. Socioeconomic and cultural aspects, healthcare provider influence, and system-level determinants are also considered. Technological advancements such as auto-titrating devices, heated humidification, and remote telemonitoring have demonstrated potential to enhance compliance, but challenges persist in long-term engagement.

Furthermore, behavioral and educational interventions are explored, with evidence highlighting the role of structured education, motivational interviewing, and multidisciplinary support in improving adherence. Emerging approaches such as personalized medicine, integration of artificial intelligence, and novel interface designs represent future directions to optimize therapy.

In conclusion, CPAP adherence in OSA is a multifactorial issue that requires individualized patient-centered strategies, technological support, and systemic interventions. A better understanding of the interplay between patient, device, and healthcare factors can inform tailored strategies that maximize CPAP effectiveness and reduce the global burden of untreated OSA.

Keywords: *Continuous Positive Airway Pressure , Adherence , Obstructive Sleep Apnea*

Introduction

Obstructive sleep apnea (OSA) is a chronic disorder with increasing global prevalence, affecting nearly 1 billion individuals worldwide. It is strongly associated with cardiovascular disease, metabolic syndrome, neurocognitive impairment, and impaired quality of life. Continuous positive airway pressure (CPAP) is widely regarded as the most effective treatment for moderate to severe OSA, with substantial evidence demonstrating reductions in daytime sleepiness, improvement in neurocognitive performance, and decreased risk of cardiovascular morbidity and mortality. Despite its proven efficacy, CPAP therapy faces a major limitation: patient adherence.[1].

Adherence is commonly defined as the consistent use of CPAP for at least four hours per night on 70% of nights, yet many patients fail to meet even this minimal threshold. Rates of non-compliance range from 30–60%, with the highest dropout rates occurring within the first few weeks of initiation. This challenge limits the real-world effectiveness of CPAP and diminishes the anticipated health benefits. Barriers to adherence are multifactorial, encompassing patient-related characteristics, device-specific issues, psychosocial and cultural influences, as well as the nature of healthcare delivery systems.[2].

While prior research has investigated individual aspects of CPAP adherence, there remains a need for a comprehensive review that integrates epidemiological data, determinants of adherence, and emerging strategies to address these challenges. The aim of this review is to synthesize current evidence on CPAP adherence in patients with OSA, emphasizing the interplay between patient, device, and healthcare system factors, and to highlight future directions for improving long-term compliance.[3].

Epidemiology of Obstructive Sleep Apnea (OSA)

Obstructive sleep apnea is a highly prevalent sleep-related breathing disorder affecting adults and children globally. According to large-scale meta-analyses, nearly one billion adults aged 30–69 years are estimated to have OSA, with moderate-to-severe disease affecting approximately 425 million individuals. This prevalence increases in parallel with obesity, urbanization, and aging demographics, making OSA a major emerging public health concern [1].

The prevalence of OSA varies by sex and age. Men are two to three times more likely to develop OSA compared to women, although this sex disparity narrows after menopause, suggesting hormonal influences on upper airway stability. The incidence rises significantly with age, with prevalence rates exceeding 30% in adults over 60 years. However, younger populations are not spared, particularly in regions with high obesity rates [2].

Obesity is the most important modifiable risk factor for OSA. A 10% weight gain is associated with a sixfold increase in OSA risk, largely due to fat deposition around the pharyngeal airway, which exacerbates collapsibility. Central obesity, as measured by neck and waist circumference, is particularly predictive of OSA severity. The ongoing global obesity epidemic has therefore driven a parallel rise in OSA prevalence, especially in low- and middle-income countries undergoing nutritional transition [3].

OSA is also influenced by craniofacial structure and ethnicity. For example, East Asian populations demonstrate a high prevalence of OSA despite lower body mass index compared with Western populations, due to narrower craniofacial anatomy. Conversely, in populations of African descent, higher obesity rates and soft tissue factors play a dominant role. These ethnic variations highlight the complex interaction between anatomical and metabolic risk factors [4].

Beyond adults, pediatric OSA is increasingly recognized, affecting 1–5% of children worldwide. Adenotonsillar hypertrophy is the most common cause, though obesity is an emerging risk factor in adolescents. Pediatric OSA is associated with behavioral problems, impaired cognitive development, and cardiometabolic disturbances, underscoring the need for early diagnosis and intervention [5].

Pathophysiology of OSA and Role of CPAP Therapy

Obstructive sleep apnea arises from recurrent episodes of upper airway collapse during sleep. The pharyngeal airway is a collapsible structure lacking rigid support, and its patency depends on a balance between intraluminal pressure and surrounding tissue forces. During sleep, decreased neuromuscular

activity in the pharyngeal dilator muscles, particularly the genioglossus, predisposes the airway to collapse. This vulnerability is exaggerated in individuals with predisposing anatomical features such as retrognathia, enlarged tonsils, or excess peripharyngeal fat [6].

Airway obstruction in OSA leads to intermittent hypoxemia and hypercapnia, which trigger surges in sympathetic nervous system activity. These repetitive events cause blood pressure variability, increased heart rate, and systemic inflammation. Over time, this pathophysiology contributes to the development of hypertension, arrhythmias, insulin resistance, and atherosclerosis. Sleep fragmentation caused by repeated arousals further worsens neurocognitive outcomes, including impaired memory, reduced attention span, and mood disturbances [7].

Several anatomical and non-anatomical factors interact to determine OSA severity. Anatomical predispositions include craniofacial morphology, enlarged soft tissue structures, and central obesity. Non-anatomical contributors include ventilatory control instability (loop gain), low arousal threshold, and impaired upper airway muscle responsiveness. This multifactorial basis explains why OSA severity can vary widely even among patients with similar body mass index or airway anatomy [8].

Continuous positive airway pressure (CPAP) therapy remains the gold standard for treating moderate to severe OSA. CPAP delivers a constant stream of pressurized air via a mask, acting as a pneumatic splint that prevents upper airway collapse during sleep. By maintaining airway patency, CPAP eliminates apneic and hypopneic events, restores oxygenation, and stabilizes sleep architecture. The result is a marked improvement in daytime alertness, reduced blood pressure, and improved cardiovascular outcomes [9].

The benefits of CPAP extend beyond symptom relief. Randomized controlled trials have shown that effective CPAP therapy reduces motor vehicle accidents, lowers the incidence of atrial fibrillation recurrence after ablation, and improves insulin sensitivity in patients with metabolic syndrome. Additionally, neuroimaging studies reveal partial reversal of gray matter loss in brain regions affected by chronic hypoxemia after consistent CPAP use. These findings reinforce CPAP's role not only in managing symptoms but also in modifying long-term disease risk [10].

Despite its effectiveness, the success of CPAP depends on adherence. Even partial use of CPAP provides some benefit, but optimal cardiovascular and cognitive outcomes are achieved only when therapy is used consistently for at least 6 hours per night. Thus, understanding the underlying pathophysiology underscores the rationale for CPAP therapy while emphasizing the critical importance of patient adherence to achieve its full benefits [11].

Clinical Benefits of CPAP Adherence

The clinical benefits of continuous positive airway pressure (CPAP) therapy are closely tied to adherence, as the physiological effects of OSA are mitigated only with consistent nightly use. The most immediate and well-documented benefit is the reduction of excessive daytime sleepiness, which is a hallmark symptom of OSA. Patients adhering to CPAP often report improved alertness, energy, and mood within days to weeks of starting therapy. These improvements significantly enhance work performance, daily functioning, and overall quality of life [12].

Cardiovascular protection is another key outcome associated with CPAP adherence. OSA is an established risk factor for hypertension, arrhythmias, myocardial infarction, and stroke, largely mediated by intermittent hypoxemia and sympathetic overactivation. Studies have demonstrated that adequate CPAP use lowers both systolic and diastolic blood pressure, particularly in patients with resistant hypertension. Furthermore, CPAP therapy has been shown to reduce nocturnal arrhythmias, lower atrial fibrillation recurrence rates, and decrease long-term cardiovascular mortality in compliant patients [13].

Neurocognitive function is significantly affected by OSA due to chronic sleep fragmentation and intermittent hypoxemia, which impair memory, attention, and executive functioning. Adherent CPAP users exhibit marked improvements in cognitive performance, particularly in memory consolidation and attention span. Neuroimaging studies show reversal of structural and functional brain changes, including restoration of hippocampal and frontal lobe activity, after consistent CPAP use. These findings

underscore the neuroprotective effects of adherence [14].

Metabolic improvements also depend on CPAP adherence. OSA contributes to insulin resistance and metabolic syndrome through sympathetic activation, inflammation, and sleep disruption. Several trials have shown that consistent CPAP use improves insulin sensitivity and glucose control in patients with type 2 diabetes. Additionally, long-term adherence has been associated with reductions in systemic inflammation markers such as C-reactive protein and interleukin-6, thereby lowering cardiometabolic risk [15].

Another critical benefit of CPAP adherence is the reduction in accident risk, particularly road traffic accidents. OSA patients are at a two- to seven-fold increased risk of motor vehicle accidents due to excessive sleepiness. Studies consistently demonstrate that compliant CPAP use significantly lowers accident risk, bringing it close to levels seen in the general population. This effect highlights CPAP's public health importance beyond individual patient outcomes [16].

Long-term survival benefits are also linked to adherence. Prospective cohort studies indicate that OSA patients who remain adherent to CPAP have improved all-cause survival compared with untreated or non-adherent individuals. This survival advantage is particularly notable among patients with severe OSA and coexisting cardiovascular disease. These findings emphasize that adherence to CPAP not only alleviates symptoms but also alters the natural history of OSA and its comorbidities [17].

Definition and Measurement of Adherence

Adherence to continuous positive airway pressure (CPAP) therapy is typically defined as usage for at least four hours per night on 70% of nights. This definition, endorsed by regulatory and insurance agencies, has become the standard threshold in both clinical practice and research. However, growing evidence suggests that this minimal criterion may not fully capture the therapeutic dose required for optimal outcomes, particularly in reducing cardiovascular and neurocognitive complications. Several studies indicate that longer nightly use, ideally six to seven hours, is necessary to achieve maximal benefit [18].

Historically, adherence was assessed through patient self-reporting, which has significant limitations. Self-reported use tends to overestimate adherence, as patients often report intended rather than actual usage. With technological advances, objective adherence monitoring has become the standard. Modern CPAP devices are equipped with internal microprocessors that record nightly usage, mask leaks, residual apnea-hypopnea index (AHI), and pressure settings. These data can be downloaded or transmitted remotely, offering accurate and detailed adherence profiles [19].

Telemonitoring has further revolutionized adherence measurement. Many CPAP devices now transmit data wirelessly to cloud-based platforms accessible by healthcare providers. This real-time feedback allows for early detection of non-compliance and timely interventions, such as counseling or equipment adjustments. Studies have demonstrated that patients whose adherence is monitored remotely tend to use CPAP more consistently compared with those relying on standard follow-up care [20].

Beyond hours of use, qualitative aspects of adherence are increasingly recognized. For example, intermittent or fragmented CPAP use may not provide the same clinical benefits as continuous nightly use. Similarly, mask-on time may not equate to effective therapy if significant air leaks or residual events occur. As such, modern adherence assessment incorporates both duration and efficacy metrics, ensuring that patients not only wear the device but also achieve effective treatment [21].

The measurement of adherence also has implications for healthcare policy and insurance reimbursement. In many health systems, coverage for CPAP devices is contingent upon documented adherence, typically requiring patients to meet the four-hour-per-night threshold within the first 90 days of therapy. While this policy encourages early compliance, it may disadvantage patients who require longer acclimatization periods. This has sparked debate over whether adherence should be defined by rigid thresholds or individualized based on clinical outcomes [22].

Global Patterns and Prevalence of CPAP Adherence

Adherence to continuous positive airway pressure (CPAP) therapy varies widely across the globe, with

estimates suggesting that only 40–70% of patients achieve the minimum usage threshold of four hours per night at one year. Despite CPAP being the gold-standard treatment for moderate to severe OSA, dropout rates remain high, with up to 50% of patients discontinuing therapy within the first year. This wide variability reflects not only patient-related factors but also healthcare system differences, cultural influences, and access to supportive interventions [23].

In high-income countries, such as the United States, Canada, and much of Europe, adherence rates tend to be higher due to greater availability of diagnostic facilities, structured follow-up programs, and insurance coverage. However, even in these settings, younger patients, those with milder OSA, and individuals without significant daytime symptoms often demonstrate poor compliance. By contrast, older adults and patients with cardiovascular comorbidities are generally more motivated to persist with therapy, given their higher perception of disease severity [24].

In low- and middle-income countries, CPAP adherence is often substantially lower. Financial barriers, limited access to sleep laboratories, and lack of healthcare infrastructure hinder both diagnosis and long-term management. Additionally, cultural perceptions play an important role; in some regions, CPAP use is stigmatized, being perceived as a marker of severe illness. Patients may also face difficulties in obtaining replacement masks or maintaining devices, further reducing adherence in resource-constrained settings [25].

Geographic variations also reflect healthcare delivery models. For example, in countries with universal healthcare systems such as France, large-scale national programs that provide CPAP devices and follow-up free of charge have demonstrated relatively higher adherence rates. In contrast, in privatized healthcare models, adherence is often influenced by reimbursement policies and out-of-pocket expenses, creating inequities in long-term outcomes. These differences highlight the influence of health policy on CPAP usage patterns [26].

Adherence trends have also evolved over time. Earlier studies from the 1990s and 2000s reported higher dropout rates, but more recent evidence indicates gradual improvement, partly due to technological innovations such as auto-titrating CPAP devices, heated humidification, and telemonitoring. Nevertheless, despite these advances, real-world adherence remains suboptimal, underscoring the need for continued efforts to address the multifactorial barriers to sustained CPAP use [27].

Patient-related Factors Affecting Adherence

Demographics

Demographic characteristics such as age, sex, and body mass index influence adherence to CPAP therapy. Older patients generally demonstrate higher adherence compared with younger individuals, possibly due to a greater burden of symptoms, higher prevalence of comorbidities, and increased health awareness. Younger patients often perceive OSA as less threatening and may view CPAP as inconvenient or socially stigmatizing, resulting in lower long-term compliance [28].

Sex differences also play a role. Men have historically shown higher adherence than women, although this gap is narrowing as awareness of OSA in women increases. Women frequently report mask discomfort, cosmetic concerns, and anxiety about device noise affecting their partners, which can limit adherence. On the other hand, women with severe symptoms, especially postmenopausal women, tend to adhere well when appropriate education and support are provided [29].

Body mass index (BMI) is a strong risk factor for OSA, but its association with adherence is less consistent. Some studies report that obese patients are more likely to persist with CPAP due to severe symptoms, while others suggest that obesity contributes to discomfort with mask fit and worsens self-image, which may discourage use. These conflicting findings highlight that BMI alone does not determine adherence, but rather interacts with other psychological and cultural factors [30].

Psychological and Behavioral Aspects

Psychological health is a major determinant of CPAP adherence. Patients with untreated depression or anxiety often struggle with initiation and long-term use, as emotional distress reduces motivation and tolerance for therapy. Conversely, those with higher levels of self-efficacy and internal health locus of

control are more likely to comply, viewing CPAP as a proactive way to improve their health. Interventions that address psychological well-being alongside CPAP training have been shown to improve adherence outcomes [31].

Behavioral factors, including readiness to change and motivation, also determine whether patients sustain therapy. Many patients discontinue CPAP within the first two weeks of initiation if they experience side effects or do not perceive immediate benefits. Early positive reinforcement from healthcare providers and family members has been shown to improve persistence during this critical acclimatization period. Techniques such as motivational interviewing and cognitive behavioral therapy are particularly effective in addressing ambivalence and reinforcing adherence [32].

Sleep hygiene practices further influence CPAP use. Patients with irregular sleep schedules, shift work, or coexisting insomnia may find it difficult to integrate CPAP into their nightly routine. This highlights the importance of personalized behavioral counseling and, when needed, treatment of comorbid sleep disorders to optimize adherence [33].

Perception of Disease Severity

Perceived severity of OSA strongly affects adherence. Patients who experience pronounced daytime sleepiness, loud snoring, or witnessed apneas are more motivated to continue therapy, as they directly recognize the benefits of CPAP in alleviating these symptoms. In contrast, individuals with mild or asymptomatic OSA often struggle with motivation, perceiving CPAP as burdensome relative to their symptom profile [34].

Comorbid conditions such as hypertension, cardiovascular disease, or diabetes can reinforce adherence, as patients understand the systemic risks of untreated OSA. Education plays a key role here—patients who are informed about the link between OSA and long-term health risks, including stroke and myocardial infarction, are more likely to view CPAP as essential rather than optional. This demonstrates the need for tailored education that emphasizes both symptomatic relief and preventive benefits [35].

Cultural attitudes toward illness also shape perception. In some populations, OSA is viewed primarily as a nuisance (snoring), rather than a medical condition with serious consequences. Such misconceptions reduce motivation to comply with CPAP. Community-based education and family involvement can counteract these perceptions, reframing CPAP as a life-saving intervention rather than simply a device to reduce snoring [36].

Device-related Factors Affecting Adherence

Mask Type and Fit

The interface between patient and device is one of the strongest determinants of CPAP adherence. Poor mask fit leads to air leaks, skin irritation, and noise, which can significantly disrupt sleep quality for both patients and their bed partners. Masks that fit poorly often require repeated adjustments throughout the night, discouraging long-term use. Conversely, properly fitted masks improve comfort, reduce leaks, and promote adherence [37].

Different mask types offer varying degrees of comfort and tolerance. Nasal masks and nasal pillow interfaces are generally preferred due to their minimal contact and greater comfort, particularly among patients without nasal obstruction. However, in individuals with chronic nasal congestion or habitual mouth breathing, full-face masks are often required. While these provide effective therapy, they may cause more discomfort and pressure sores, contributing to reduced adherence in some patients [38].

Personalized mask selection and fitting sessions have been shown to improve adherence rates significantly. Allowing patients to try multiple mask options and providing training on adjustment techniques helps minimize discomfort and anxiety. Advances in mask technology, including lightweight materials, softer silicone seals, and customizable straps, have further improved tolerability and long-term compliance [39].

Pressure Settings

Therapeutic pressure requirements vary among patients, with higher pressures often causing discomfort. Fixed-pressure CPAP devices may be difficult to tolerate, particularly for patients requiring pressures

above 12 cm H_2O. High pressure can cause sensations of suffocation, difficulty exhaling, and aerophagia, all of which discourage continued use. These challenges are a leading reason for early discontinuation in CPAP-naïve patients [40].

Auto-titrating CPAP (APAP) devices represent a significant advancement in addressing pressure-related intolerance. APAP continuously adjusts the delivered pressure based on real-time detection of airflow limitations, apneas, and hypopneas. By providing lower average pressures over the night, APAP improves comfort and reduces side effects while maintaining therapeutic efficacy. Studies consistently demonstrate higher adherence rates with APAP compared with fixed-pressure devices, especially in patients requiring higher baseline pressures [41].

Bilevel positive airway pressure (BiPAP) devices are another option for patients intolerant to standard CPAP. By delivering different pressures during inhalation and exhalation, BiPAP reduces the sensation of breathing against resistance and improves comfort. This is particularly beneficial for patients with comorbid respiratory disorders such as chronic obstructive pulmonary disease (COPD) or obesity hypoventilation syndrome [42].

Side Effects and Comfort

Side effects remain a common barrier to adherence. Nasal congestion, dryness, and rhinorrhea are frequently reported, often resulting from unconditioned airflow. Heated humidification has proven effective in reducing these symptoms, significantly improving comfort and long-term compliance. Patients who use humidifiers are more likely to report satisfaction and sustained therapy use compared with those without humidification [43].

Claustrophobia and psychological discomfort with mask use also limit adherence. Some patients experience anxiety when wearing the mask, particularly during initial adaptation. Gradual desensitization protocols, including short daytime practice sessions, can help overcome these barriers. Supportive counseling and reassurance from healthcare providers further reduce anxiety and encourage persistence [44].

Other device-related issues include skin irritation, pressure sores, and dental discomfort. Innovations such as gel cushions, memory-foam seals, and improved strap designs have minimized these problems. Additionally, patient education on mask hygiene and replacement schedules ensures that side effects related to wear and tear are prevented. Addressing these comfort-related issues promptly is critical to maintaining adherence [45].

Socioeconomic and Cultural Influences on Adherence

Socioeconomic status plays a crucial role in CPAP adherence. Patients from lower-income backgrounds are less likely to access sleep diagnostic services, obtain CPAP devices, or maintain therapy due to cost-related barriers. In many healthcare systems, the upfront cost of devices and recurring expenses for mask replacements or humidifier accessories are significant obstacles. Even in countries with insurance coverage, high co-payments or limited reimbursement can reduce long-term adherence. Financial burden therefore remains one of the strongest non-medical predictors of poor compliance [46].

Health literacy is another socioeconomic determinant. Patients with limited understanding of OSA and CPAP therapy often fail to appreciate the long-term health risks of untreated disease, perceiving therapy as unnecessary. Misconceptions such as “CPAP is only for snoring” or “using a machine means my lungs are weak” contribute to poor motivation and eventual discontinuation. Tailored education programs designed for patients with varying literacy levels, delivered in culturally appropriate formats, have been shown to improve understanding and adherence [47].

Cultural attitudes toward illness and therapy also strongly influence CPAP use. In some cultures, medical devices are stigmatized, leading patients to hide their CPAP machines from family or community members. This stigma can discourage consistent nightly use. On the other hand, in collectivist societies where family involvement in healthcare is emphasized, CPAP adherence can be enhanced when spouses or family members actively encourage and support therapy. Thus, family-centered education and counseling are particularly valuable in these contexts [48].

Geographical disparities further compound socioeconomic and cultural challenges. In rural and underserved regions, limited access to sleep laboratories and follow-up services reduces the likelihood of sustained adherence. Patients may be forced to travel long distances for care, which discourages routine follow-up. Telemedicine initiatives and mobile sleep clinics have emerged as promising solutions to bridge this gap, improving access and supporting long-term compliance even in resource-constrained settings [49].

Immigrant populations face unique barriers to CPAP adherence. Language difficulties, cultural differences in health beliefs, and lack of familiarity with medical technology contribute to reduced acceptance and persistence. Studies show that culturally tailored interventions, including multilingual educational materials and community-based support, significantly enhance adherence among immigrant groups. These findings highlight the importance of culturally sensitive approaches in addressing disparities in CPAP use [50].

Healthcare Provider and System-Related Factors

Healthcare providers play a central role in shaping patient adherence to CPAP therapy. The initial interaction during diagnosis and initiation strongly influences patient attitudes toward therapy. Patients who receive clear explanations about the nature of OSA, its health consequences, and the benefits of CPAP are more likely to commit to long-term use. Conversely, when counseling is brief, technical, or focused solely on equipment, patients may fail to appreciate the necessity of adherence, leading to early discontinuation [51].

Follow-up practices are equally critical. Early follow-up visits within the first two weeks of CPAP initiation have been shown to significantly increase adherence, as this is the period when most patients encounter side effects such as mask discomfort or nasal congestion. Providers who address these issues promptly reinforce patient motivation and prevent premature dropout. In contrast, lack of structured follow-up contributes to unresolved problems, frustration, and abandonment of therapy [52].

The role of sleep technologists and respiratory therapists is also vital. These professionals often provide hands-on education, device fitting, and troubleshooting. Patients who receive comprehensive training on mask adjustment, device cleaning, and coping strategies for side effects demonstrate higher confidence and better adherence. Ongoing telephone support and home visits by trained staff further enhance compliance by providing continuous reinforcement [53].

Healthcare system organization significantly affects CPAP adherence. In countries with integrated sleep medicine programs, where diagnosis, device provision, and follow-up are coordinated, adherence rates tend to be higher. Conversely, fragmented systems where patients must navigate multiple providers for care often result in poor adherence. Insurance reimbursement policies also play a role—systems that cover CPAP devices, mask replacements, and follow-up services encourage persistence, while restrictive policies deter patients from continuing therapy [54].

Telemedicine has emerged as a powerful system-level tool for supporting adherence. Remote monitoring of CPAP use allows providers to identify non-compliance early and intervene proactively. Randomized controlled trials have shown that telemedicine-supported patients achieve higher adherence rates compared with those receiving standard care. Furthermore, telehealth reduces the burden of frequent clinic visits, particularly for patients in rural areas, while maintaining continuous provider oversight [55].

The quality of provider–patient communication also cannot be overstated. Shared decision-making, where patients actively participate in choosing their device type, mask, and support strategies, fosters a sense of ownership and responsibility. Patients who feel heard and involved in treatment decisions are more likely to remain adherent. In contrast, a paternalistic approach that fails to consider patient preferences often undermines motivation and compliance [56].

Behavioral and Educational Interventions

Educational interventions form the foundation for improving CPAP adherence, as they address gaps in patient understanding about obstructive sleep apnea (OSA) and its consequences. Patients who receive

structured education about the health risks of untreated OSA—such as hypertension, cardiovascular disease, and neurocognitive decline—are more likely to recognize the necessity of therapy. Simple didactic education, however, is often insufficient; interactive, patient-centered approaches that encourage questions and active participation have been shown to yield better adherence outcomes [57].
Behavioral strategies play a complementary role by targeting motivation and self-management. Motivational interviewing, which focuses on exploring patient ambivalence and reinforcing personal reasons for treatment, has proven particularly effective in enhancing CPAP adherence. Unlike directive counseling, motivational interviewing fosters autonomy and empowers patients to integrate CPAP into their daily lives. Similarly, cognitive behavioral therapy (CBT) addresses maladaptive beliefs, anxiety, and claustrophobia associated with mask use, thereby improving tolerance and persistence [58].
Early interventions during the acclimatization period are especially important. Most patients decide whether to continue or abandon CPAP within the first two weeks of therapy. Programs that provide intensive support during this critical window—such as daily phone calls, problem-solving sessions, and encouragement—significantly increase the likelihood of long-term adherence. Conversely, patients left unsupported during this period often discontinue therapy due to unresolved discomfort or perceived lack of benefit [59].
Peer and family support also enhance behavioral engagement. Group-based education sessions allow patients to share experiences and coping strategies, normalizing the challenges of CPAP use. Involving spouses or partners in educational sessions improves adherence, as they often serve as motivators and troubleshooters at home. Studies have shown that spousal support, in particular, is one of the strongest predictors of sustained nightly use [60].
Technology-enabled behavioral interventions are gaining traction. Smartphone applications, video tutorials, and online forums provide ongoing education and reminders outside clinical settings. These platforms allow patients to track their progress, receive feedback, and engage with communities of other CPAP users. Evidence indicates that patients who use such digital tools report greater satisfaction and higher adherence compared with those relying solely on in-person support [61].
A combination of educational and behavioral interventions appears to be most effective. Programs that integrate structured education, motivational counseling, family involvement, and technology-based reinforcement consistently outperform single-modality interventions. This multimodal approach ensures that patients are not only informed but also motivated and supported, addressing the diverse challenges that undermine CPAP adherence [62].

Long-term Adherence Challenges

Maintaining CPAP adherence over the long term is a persistent challenge, even among patients who initially adapt well to therapy. Longitudinal studies reveal that adherence tends to decline after the first six months of use, with many patients gradually reducing nightly duration or abandoning therapy altogether. Common reasons for this decline include waning motivation, mask deterioration, or unresolved side effects such as nasal congestion or skin irritation. This attrition underscores the need for ongoing monitoring and support beyond the initial adjustment phase [63].
Psychological fatigue with therapy—often described as “CPAP burnout”—is another major barrier to long-term adherence. Patients may initially experience symptomatic improvement, but as the novelty of therapy wears off, they begin to perceive CPAP as burdensome. Feelings of dependency on a machine for sleep, concerns about device stigma, or a desire to “take a break” from treatment contribute to lapses in adherence. Without reinforcement from providers or family members, these lapses often become permanent discontinuation [64].
Lifestyle changes can also interfere with long-term adherence. Travel, relocation, and changes in household dynamics (such as new partners or caregiving responsibilities) may disrupt established routines of CPAP use. Although travel-sized CPAP devices are now available, not all patients can afford them, leading to periods of non-use during trips. Furthermore, patients undergoing weight loss, whether

through lifestyle modification or bariatric surgery, may believe they no longer require CPAP, even if their OSA persists. This perception often results in premature therapy discontinuation [65].

Device-related challenges accumulate over time. Masks, headgear, and tubing naturally degrade, leading to increased air leaks and discomfort if not replaced regularly. Patients without insurance coverage or adequate follow-up may continue using worn-out equipment, which reduces therapy effectiveness and satisfaction. Similarly, pressure requirements may change with aging, weight fluctuation, or new comorbidities, necessitating re-titration. Failure to adjust therapy to these evolving needs contributes to long-term dropout [66].

Comorbidities further complicate adherence in the long term. Patients with progressive illnesses such as chronic obstructive pulmonary disease (COPD), heart failure, or neurodegenerative disorders may struggle to continue CPAP due to worsening symptoms or physical limitations. Additionally, the presence of insomnia or restless legs syndrome can reduce tolerance for CPAP, as patients associate the device with fragmented sleep rather than improvement. Addressing these comorbid conditions is essential for sustaining adherence [67].

Finally, lack of continuous follow-up and reinforcement remains one of the strongest predictors of declining long-term adherence. Many healthcare systems discharge patients after the initial months of therapy, assuming ongoing use will be sustained. In reality, without periodic reassessment, troubleshooting, and motivational reinforcement, long-term adherence drops substantially. Structured long-term care models—such as annual checkups, telemonitoring, and community-based support programs—are necessary to counteract this decline [68].

Strategies for Enhancing Adherence

Improving CPAP adherence requires a multifaceted approach that addresses patient, device, and healthcare system-related barriers. Personalized mask fitting remains one of the most effective strategies. Ensuring that patients are fitted with the most comfortable and effective interface—whether nasal, full-face, or nasal pillows—significantly reduces mask-related discomfort and air leaks, two of the most common reasons for discontinuation. Providing opportunities to trial different mask types before long-term use improves satisfaction and reduces early dropout [69].

Early and intensive support during the initiation phase is critical. Studies have shown that interventions provided within the first two weeks of therapy—such as frequent phone calls, home visits, or telemonitoring—dramatically increase long-term adherence. This is because most patients who abandon CPAP do so within the first month due to unresolved side effects or lack of perceived benefit. Addressing issues proactively at this stage fosters confidence and establishes positive routines [70].

Educational reinforcement should not be a one-time event but an ongoing process. Patients benefit from periodic refresher sessions that review the risks of untreated OSA, the benefits of CPAP, and strategies for managing side effects. Educational materials tailored to different literacy levels and cultural backgrounds ensure that information is accessible to diverse populations. Visual aids, interactive workshops, and digital learning platforms have all been effective in sustaining knowledge and motivation [71].

Behavioral strategies complement educational interventions. Motivational interviewing, cognitive behavioral therapy (CBT), and goal-setting approaches help patients integrate CPAP into their lifestyles. Patients who set personalized goals and track their progress demonstrate higher persistence compared to those receiving standard care. Similarly, CBT addresses maladaptive beliefs about CPAP, reducing anxiety and improving tolerance. These strategies highlight the importance of psychological support alongside medical management [72].

Family and peer support are also powerful tools for enhancing adherence. Involving spouses or partners in CPAP education fosters a supportive home environment, where partners encourage nightly use and assist with troubleshooting. Peer-support groups, either in person or online, allow patients to share experiences, normalize challenges, and celebrate successes. Evidence suggests that patients who

participate in such groups demonstrate higher long-term adherence compared with isolated individuals [73].

Technological innovations have opened new avenues for adherence enhancement. Telemonitoring enables providers to detect non-compliance in real time and intervene promptly. Automated text message reminders, smartphone apps, and digital dashboards allow patients to track their nightly usage and receive feedback. When combined with provider oversight, these tools have been shown to significantly improve both short- and long-term adherence. Such technologies also reduce the need for frequent in-person visits, making them cost-effective and accessible [74].

Healthcare system-level strategies are equally important. Policies that ensure financial support for CPAP devices, accessories, and follow-up care reduce socioeconomic disparities in adherence. Structured care models that include routine follow-up, multidisciplinary input, and integrated telehealth support improve outcomes across diverse patient populations. Ultimately, adherence strategies must be individualized, combining education, behavioral support, technology, and healthcare system engagement to achieve sustained long-term use [75].

Continuous positive airway pressure (CPAP) therapy remains the cornerstone of treatment for moderate to severe obstructive sleep apnea (OSA), with well-documented benefits on symptom relief, cardiovascular outcomes, neurocognitive function, and overall survival. However, these benefits are directly dependent on patient adherence, which continues to represent one of the greatest challenges in sleep medicine. Despite decades of progress in technology and clinical practice, real-world adherence rates remain suboptimal, with nearly half of patients discontinuing therapy within the first year.

The determinants of adherence are multifactorial, encompassing patient-related characteristics, device-related factors, socioeconomic influences, and healthcare system dynamics. Demographic features, psychological health, and perceptions of disease severity shape patient motivation, while mask fit, pressure tolerance, and side effects affect comfort and usability. Beyond the individual, socioeconomic status, cultural attitudes, and system-level support strongly influence long-term persistence with therapy. These complexities highlight that adherence cannot be addressed by a single solution but requires an integrated, personalized approach.

Over the years, educational and behavioral interventions have proven essential in improving adherence. Structured education, motivational counseling, and early support during the initiation phase are especially critical in determining whether patients continue or abandon therapy. Family involvement, peer support, and technology-driven reinforcement further enhance persistence, underscoring the need for holistic, patient-centered care models.

While technological advances such as auto-titrating devices, heated humidification, and telemonitoring have alleviated many barriers, they alone are insufficient without parallel efforts to address behavioral, cultural, and socioeconomic obstacles. Sustained adherence requires continuous engagement from healthcare providers, proactive follow-up, and health system policies that ensure access and affordability.

In summary, CPAP adherence in OSA is a dynamic process shaped by the interplay of multiple factors. Addressing it requires more than prescribing a device—it demands education, behavioral reinforcement, technological support, and systemic healthcare interventions. By adopting a multidisciplinary, personalized, and patient-centered approach, clinicians and health systems can maximize the therapeutic potential of CPAP and reduce the global burden of untreated OSA.

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