Encouraging CPAP Adherence: It Is Everyone's Job

Suzanne M Bollig RRT RPSGT REEGT

Obstructive sleep apnea (OSA) is a chronic disease treated effectively with the use of continuous positive airway pressure (CPAP) therapy. Patient adherence to prescribed CPAP is variable, however, leaving the undertreated OSA patient at risk of development or worsening of comorbid medical conditions, including hypertension and cardiovascular disease. The severity of disease and the presence of daytime sleepiness appear to have some predictive quality for subsequent adherence, though a search for consistent predictive factors related to CPAP adherence has proven elusive. Other influences, such as sex, age, socioeconomic status, and personality traits are less robust predictors. The use of sophisticated therapy modalities such as auto-titration or bi-level PAP units has been shown to improve adherence in certain subsets of OSA patients. Adverse effects such as nasal congestion, dry mouth, or skin irritation occur in approximately 50% of CPAP users, and addressing these adverse effects may improve adherence in some patients. More encouraging, studies on the use of intensive patient education and behavioral interventions have shown more positive effects on adherence, leading to the conclusion that improvement in patient adherence to CPAP therapy requires a multi-layered approach, using combined technological, behavioral, and adverse-effect interventions. *Key words: obstructive sleep apnea; OSA; continuous positive airway pressure; CPAP; adherence; patient education; behavioral interventions.* [Respir Care 2010;55(9):1230–1236.

Introduction

Adherence to a medical regimen is defined as the successful adoption of a treatment program and is dependent upon the patient's perceived balance between the costs and benefits of the treatment. Adherence to medical treatment in general has been found to be relatively unrelated to age, sex, education level, socioeconomic status, or personality.[1] Non-adherence to medical treatment plans is reportedly 20–40% with acute illness, 30–60% with chronic illness, and reaches 50–80% with preventive care.[2] According to the World Health Organization, 50% of patients suffering from chronic disease do not follow treatment recommendations.[3] In general, non-adherence rates for chronic illness treatment plans and lifestyle changes are high, with

Suzanne M Bollig RRT RPSGT REEGT is affiliated with the Hays Medical Center - Sleep and Neurodiagnostic Institute, Hays, Kansas.

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Correspondence: Suzanne M Bollig, RRT RPSGT REEGT, Hays Medical Center—Sleep and Neurodiagnostic Institute, 2500 Canterbury Drive, Suite 108, Hays KS 67601. E-mail: suzanne.bollig@haysmed.com.

20% of prescriptions not filled, 50% of patients making important mistakes in taking medications, 50–60% of patients failing to keep appointments, and with more than 50% of patients who begin programs for lifestyle changes not completing them.[4] Adherence to continuous positive airway pressure (CPAP) therapy is often less than ideal and mirrors the rate of adherence seen with other complex medical regimens, with up to 50% of obstructive sleep apnea (OSA) patients abandoning therapy within one year.[5,6]

Expectations for CPAP Adherence

OSA is a chronic illness with links to important comorbidities such as hypertension, heart failure, cardiac dysrhythmias, stroke, and diabetes.[7,8] CPAP is the most commonly prescribed treatment for OSA and has beneficial effects, including normalizing sleep architecture, reducing daytime sleepiness, enhancing daily functioning, mood elevation, decreased automobile accidents, decreased blood pressure, and cardiovascular events.[9] Despite the identified benefits, CPAP therapy is limited in its success because it is not curative, requires nightly use, may be socially embarrassing, and requires the use of noisy/bulky equipment that requires regular maintenance.

In theory, the mechanics of CPAP therapy are simple, but optimal CPAP therapy use is complex. Following an initial encounter, a sleep study is ordered and, ideally, the results are reviewed with the patient. The patient then receives a prescription for the equipment and is probably provided an hour of education. A follow-up appointment with the physician is scheduled, and the patient is expected to adhere to the ordered therapy. The abstract numbers supplied to the patient during the review of study results may have little impact on their appreciation for the importance of their disease. "You snore and stop breathing X times per hour" will impress some. A graph of oxygen desaturations may provide the patient with slightly more insight. A video of them snorting or gasping may create a slightly more lasting impression. Essentially, in order to set the stage for treatment adherence, patients need to understand why they want or should wear CPAP. As clinicians we often have high expectations of patients. After a consultation and a positive sleep study, patients are expected to understand the impact of sleep apnea on their health and the value of CPAP therapy. Oftentimes a delay in CPAP equipment delivery will give the patient a conflicting message. With an hour or two of education and some written instructions, the sleep-deprived OSA patient is expected to remember all the functions of the equipment, mask, and headgear, and use CPAP for 7 to 8 hours nightly.

Defining CPAP Adherence

The definition of CPAP adherence differs among clinicians and often makes the interpretation or comparison of published research data problematic. Although the expectation for CPAP use is during all hours of sleep, few OSA patients achieve that lofty goal. The most frequently cited definition of CPAP adherence was established in work by Kribbs et al, with CPAP adherence defined arbitrarily as use $\geq$ 4 hours for 70% of nights monitored.[10] In a recent national coverage determination, the Centers for Medicare and Medicaid Services adopted the 4 hours of use on 70% of nights as their measure of acceptable adherence. Documentation of achieving this minimal use pattern for a consecutive 30-day period within the first 12 weeks of prescribed therapy is required for continued reimbursement by Centers for Medicare and Medicaid Services for CPAP equipment in the home.[11] More recent publications have established that increased hours of use are likely to further improve symptoms, depending on the clinical outcome measure. Weaver and her colleagues conducted a multicenter study[12] to determine if a relationship between hours of CPAP use could be associated with achieving normal levels of sleepiness and daily functioning in patients diagnosed with OSA who were candidates for CPAP therapy. Clinical status outcomes were collected both before and after 3 months of therapy, using the Epworth Sleepiness Scale, the Multiple Sleep Latency Test, and the Functional Outcomes of Sleep Questionnaire.

The Epworth Sleepiness Scale is a well validated tool used to assess subjective sleepiness by posing a series of questions designed to elicit one's perception of the likelihood of falling asleep during certain regular wake activities. Patients rate themselves on a scale of 0–3 for each of 8 questions, and the scores are totaled. A score greater than 10 is generally considered to indicate a level of pathological sleepiness.

The Multiple Sleep Latency Test is an objective measure of sleepiness, whereas the patient is allowed four 20-min opportunities to fall asleep at 2-hour intervals throughout the day. The patient is monitored with polysomnography and sleep latency (time to fall asleep) is calculated for each nap opportunity. A value of 7.5 min to sleep latency was chosen as the cut point for this study.

The Functional Outcomes of Sleep Questionnaire measures functional status with a 30-item questionnaire divided into 5 domains that examine the impact of being sleepy or tired on daily activities. Mean item scores are generated for each domain, producing a total score of 5 to 20. A score of 17.9 was chosen as the cut point for an abnormal value in this study.

The final outcome of the Weaver et al study was a clear association in the number of hours of daily CPAP use and the normalization of 3 commonly used measures of sleepiness and functional status. Sixty-six percent of those who had abnormal Epworth Sleepiness Scale scores before CPAP use normalized to a score $<$ 10, and on average used CPAP 5.1 hours (one hour more per night than the

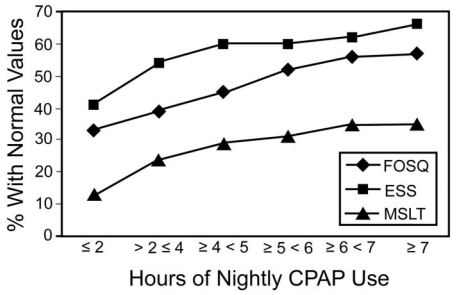

Fig. 1. Cumulative proportion of participants obtaining normal threshold values on the Epworth Sleepiness Scale (ESS), Multiple Sleep Latency Test (MSLT), and Functional Outcomes of Sleep Questionnaire (FOSQ). A cumulative proportion function was applied to the data. CPAP = continuous positive airway pressure. (From Reference 12, with permission.)

non-responders). Thirty-five percent of the participants who had abnormal Multiple Sleep Latency Test scores prior to treatment normalized to > 7.5 min, and on average used CPAP 5.1 hours per night (1.2 h longer than the non-responders). Fifty-seven percent of those participants with abnormal Functional Outcomes of Sleep Questionnaire scores prior to CPAP therapy normalized to values > 17.9 with the average use of 5.1 hours of CPAP (one hour longer than non-responders). While improvement in measures of sleepiness were expected to improve with effective CPAP therapy, an intriguing result of the study was the establishment of use thresholds above which further improvements in the 3 measures were unlikely to occur. The threshold level of nightly CPAP use was 4 hours with the Epworth Sleepiness Scale, 6 hours with the Multiple Sleep Latency Test, and 7.5 hours with the Functional Outcomes of Sleep Questionnaire (Fig. 1). The study showed that the definition of adequate use not only differs with the outcome measure used, but some patients normalize with substantially less use, whereas others do not normalize even with 7 to 8 hours of nightly CPAP use. The best measure of adherence to CPAP therapy may be less a static number but best based on the perceived benefits and measurable outcomes for OSA patients.

Predicting CPAP Adherence

A number of studies have attempted to identify contributing factors and predictors for CPAP adherence. While some studies have found relationships between sex, age, severity of disease, symptoms of sleepiness, and socioeconomic status to subsequent adherence to CPAP therapy, the findings are inconsistent.[13] An early study by Sin et al found that female sex, older age, and improvement in Epworth Sleepiness Scale scores were associated with an increase in CPAP adherence.[14] A more recent study reported findings that a younger age and African-American race were related to poorer adherence, but no association with sex or disease severity was found.[15] Finally, while there is evidence that improvement in self-reported daytime sleepiness is associated with long-term CPAP use, there is only weak evidence that OSA severity as measured by apnea-hypopnea index is associated with improved adherence.[9]

With few consistent clinical predictors of CPAP adherence, recent attention has turned to the evaluation of psychological and socioeconomic factors for help in determining CPAP adherence tendencies. Two recent studies reported that lower socioeconomic status was closely associated with both the low initial acceptance of prescribed CPAP therapy and the low continued adherence with therapy.[16,17] Those authors suggested that specific tailoring of CPAP support and patient-education programs is probably required to increase adherence to therapy in this population.

Psychological variables were examined as possible predictors of CPAP adherence in a study by Wild et al.[18] Using Wallston's model of social cognition, psychological variables of health value, health locus of control, and self-efficacy were evaluated. The Health Value Scale provides a general measure of the value an individual places on their health. The Locus of Control Scale measures generalized beliefs in relation to health along 3 dimensions: internality (own internal control of health), chance (external control of health outcomes), and powerful others (belief that others such as health professionals have control). The Self-Efficacy Scale assesses an individual's belief in their own abilities to deal with obstacles or setbacks. The study showed that these psychological factors were predictive of increased adherence to CPAP therapy. Wild et al suggested that these cognitive constructs and beliefs are important aspects of motivation and correlate with health behaviors. More importantly, he stated that these were not stable personality traits but that they could be modified with positive experiences. He postulated that evaluating these factors would possibly be more productive in improving adherence behaviors than looking at non-changeable demographic factors.

A Type D (distressed) personality is a combination of negative affectivity (negative emotions) and social inhibition (tendency to inhibit expression of emotions, along with insecurity and tension), and has been shown to have a correlation with cardiovascular morbidity and mortality. Recently a Swedish study looked at the incidence of Type D personality in OSA patients and looked for a correlation between the Type D personality and the perceived adverse effects of CPAP therapy that might affect adherence.[19] Thirty percent of the OSA patients studied had a Type D personality, consistent with prevalence data for other chronic illnesses such as cardiovascular disease. More importantly, the study found that patients with a Type D personality had significantly higher complaints of adverse effects from CPAP therapy and reported a higher rate of

Table 1. CPAP Adherence Factors

Greater Adherence	Less Adherence
Severe OSA (≥ 30 events/hour)	Mild OSA
Resolution of sleepiness, other symptoms	Young and/or single adult
Co-morbid illness	High PAP level
Early benefit (≤ 7 d)	Claustrophobia
Comfortable mask	Ill-fitting mask
Automatically titrated PAP vs bi-level PAP vs CPAP	No/limited patient education
	No/limited physician or family support
Humidifier use	
Wife shares the bed	Denial: no "ownership" of the problem
Older patient; female	
Bed partner, physician, staff education/ support	Lack of understanding
	Skin irritation
Self-referral	Nasal obstruction
Self-management of chronic illness	Persistent symptoms
Behavioral readiness to change	Depressive symptoms
	Lack of self-efficacy
	Dementia, decreased cognition, language barrier
	Lack of health insurance

OSA = obstructive sleep apnea
PAP = positive airway pressure
CPAP = continuous positive airway pressure
(Adapted from Reference 20.)

continued sleepiness than non-D personalities, despite comparable levels of disease severity. The final results were that 50% of the patients with Type D personality used their CPAP less than 4 hours per night, compared to 16% of the non-D personalities tested. Those authors speculated that prompt attention to their complaints of adverse effects and a well-developed self-management approach would be especially important for Type D personality patients. Factors that have been known to affect CPAP adherence are multiple and listed in Table 1.[20]

Improving CPAP Adherence

General approaches to improving CPAP adherence include technological, behavioral, and adverse-effect interventions. Technological interventions include auto-titrating PAP, bi-level positive pressure, and flexible pressure delivery. These more sophisticated modes of PAP therapy are not associated with significant improvement in adherence overall, though some studies report that certain subsets of patients may benefit from them over conventional fixed CPAP pressure.[21] Heated humidification and pressure ramp features may also be of benefit in alleviating the more common complaints of nasal congestion and high pressures, though none of these interventions has been shown to definitely or consistently increase adherence.[9] According to Weaver, "Patient perception of symptoms and improvement in sleepiness and daily functioning may be more important in determining patterns of use than physiologic aspects of disease severity.[9]

Behavioral interventions include patient education, and systematic desensitization and sensory awareness for claustrophobia, which has been shown to negatively affect adherence.[10] Cognitive behavioral therapy and motivational enhancement therapy have been found to positively influence the self-management of chronic illness and behavioral readiness to change. Newer studies suggest that cognitive behavioral therapy and standard education could increase CPAP use by 2.9 hours.[22,23] The most consistent improvement in CPAP adherence is seen with the use of multiple layers of patient-clinician interactions.

As early as 2002, Sin et al published data indicating that superior adherence for CPAP therapy was achievable with a well designed program that provided intense patient education prior to CPAP use, using an educational video depicting information on OSA, symptoms, health consequences, and pathophysiology, and including a detailed explanation of the CPAP device.[14] Information provided in the video was reinforced by a specially trained nurse, and reading materials were provided on OSA, CPAP, troubleshooting tips, and a follow-up schedule. Following the initiation of CPAP therapy, the patient was instructed to communicate with the nurse daily by telephone for the first week. The patient was also seen in follow-up at 2 weeks, 4 weeks, 3 months, and 6 months. At each visit, adherence data were downloaded from the machine and results were reviewed with the patient. In addition, any concerns or complaints of adverse effects were promptly addressed. The result of the program was an 84% adherence of ≥4 hours of CPAP therapy per night over the first 6 months of therapy. The study concluded that a high adherence rate for CPAP therapy was achievable in an environment of patient education, intense follow-up, and integrated care.

Regular clinician follow-ups are essential in improving CPAP adherence. The clinical assessment should include review of subjective use, the patient's response to CPAP, adverse effects, and any other limitations to therapy. Because subjective reports of CPAP use tend to overestimate actual use,[10] there should also be an objective assessment of downloaded data, including hours/frequency of use, mask leaks, and residual respiratory events. Finally, the clinician should troubleshoot any identified issues with early intervention and schedule further follow-ups. Table 2 lists some of the more common patient problems associated with CPAP use, and potential solutions.

The Respiratory Therapist's Role in Promoting Adherence

The respiratory therapist (RT) has a unique opportunity to assist the OSA patient in the development of adherence to CPAP therapy. The RT can interact with OSA patients at multiple points throughout their care, including during testing and diagnosis, PAP titration and treatment, and

Table 2. Common Problems and Solutions

Problem	Possible Cause(s)	Possible Solution(s)
Nasal irritation/congestion/rhinorrhea	Dry air	Heated humidification
	Chronic rhinitis	Nasal decongestants
	Nasal allergies	Nasal steroids
		Antihistamines
		Primary-care physician referral
Dry throat and/or mouth	Dry air	Heated humidification
	Mouth leak	Chin strap
		Full face mask
Painful pressure in ears	High airway pressure	Verify PAP level
	Nasal congestion	Decrease PAP level
		Trial of automatically titrated or bi-level PAP
		Nasal decongestants
		Nasal steroids
Gastric bloating and/or chest discomfort	Air swallowing	Decrease PAP level
	High airway pressure	Trial of automatically titrated or bi-level PAP
Claustrophobia	Anxiety	Desensitization
	Mask interface	Anxiolytic
		Optimize mask fit
Nasal pressure sores	Poor mask fit	Readjust head-gear
		Change mask size or style
		Apply skin protection
		Reassess patient education on mask fit
Eye irritation	Mask air leak	Readjust head-gear
		Change mask size or style
		Reassess patient education on mask fit
Skin creases	Improperly adjusted head-gear	Readjust head-gear
		Change mask size or style
		Reassess patient education on mask fit
Skin irritation	Sensitivity to mask interface	Trial using nasal pillows
	Improperly adjusted head-gear	Readjust head-gear
	Heat rash	Lower temperature on humidifier
		Trial using nasal pillows or skin protector
Air leak	Excessive mask/head-gear wear	Replace mask and/or head-gear
	Poor mask fit	Change mask/nasal pillows
	Improperly adjusted head-gear	Readjust head-gear
	Excessive air pressure	Verify pressure setting
		Consider pressure change
		Consider auto or bi-level mode
	Facial hair interference	Trial with nasal pillows
		Shave

PAP = positive airway pressure
(Adapted from Reference 20.)

follow-up monitoring and care. RTs are employed not only in acute hospital settings or diagnostic facilities, but also in home-medical-equipment and durable-medical-equipment companies, as well as in physician offices.

As part of formal respiratory therapy education, the RT is familiar with patient education-techniques and is in a good position to provide OSA patients with information regarding their illness, and education on the use of prescribed therapy. The RT working with OSA patients and PAP therapy has the technical and clinical background to troubleshoot interface selection and fitting, to perform equipment adjustments, and to assist the physician in evaluating and modifying the treatment plan.

The evaluation and treatment of sleep-related breathing disorders have become increasingly complex, due in part to technological advancements of both treatment modalities and diagnostic equipment. Many of the patients referred for diagnostic sleep testing have multiple comorbidities and may not respond to conventional CPAP therapy or interventions. The medical complexity of patients re-

ferred for sleep testing as well as the increasingly sophisticated equipment requires that the clinician be well versed not only in the testing and monitoring of sleep but in the treatment of sleep disorders as well.

Sleep-related breathing disorders, including obstructive sleep apnea, are addressed in standard texts used by respiratory therapy education programs; however, the level of sleep-specific education and the student's clinical exposure to sleep-disorders testing and treatment may differ substantially among programs. As the specialized nature of sleep disorders and their treatment has become evident, a number of associate degree respiratory therapy education programs and electro-neurodiagnostic education programs have opted to attach polysomnography certificate programs onto the established RT or electro-neurodiagnostic program. These programs build on the core classes required by the RT or electro-neurodiagnostic degree programs; however, it is important to note that the actual curriculum and number of required class hours for the add-on programs differ and are not mandatory for the graduate. Standalone associate degree programs for polysomnography have increased in number, with 27 programs currently listed on the Commission of Accreditation of Allied Health Education Web site.[24] I would encourage all RTs working in the sleep field to consider taking a sleep credentialing exam. The attainment of a sleep specialty credential helps the clinician demonstrate to the healthcare consumer, prospective employers, and third-party payers that a certain level of expertise has been documented.

Summary

From the time of the initial encounter with the patient, a team effort is needed to enhance CPAP adherence. The team may consist of the patient and family/bed partner, home-medical-equipment provider, RT, sleep center staff, sleep center physician, primary care physician, and a home nursing service if applicable. Adherence is dependent on layers of information providing the patient with ongoing education, written instructions, demonstration of equipment, and the timely addressing and troubleshooting of the patient's concerns and problems. Staff knowledgeable in managing sleep disorders should be readily accessible and be able to provide feedback and troubleshoot equipment issues in addition to providing a mask-fitting service.

Interactions during the follow-up visits may benefit from application of the technique of motivational interviewing, which is a client-centered counseling style that elicits behavior change through exploration and resolution of ambivalence.[20] The clinician assesses CPAP adherence by addressing topics including frequency of use, nightly duration of use, patient's knowledge of equipment operation, care of the humidifier, and mask comfort. The clinician should inquire as to changes in symptoms and bed partner response, changes in medical conditions, changes in weight, and should review downloaded device data. CPAP adherence is dependent on building the layers of patient-clinician relationship through sleep center follow-up, telephone follow-ups, and home visits by home-medical-equipment, RT, or home nursing service. Support and continued education through the primary care physician office, support groups, and potential internet resources is also key. The timing of follow-up visits is crucial, as prompt attention to early adverse effects, concerns, or patient fears will help to set the pattern of therapy adherence that is normally established in the early days of therapy. The timing of follow-ups should probably be in the first few days after treatment is initiated, and then routinely at around 6 weeks, 3 months, 6 months, and yearly.

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Discussion

Kuna: In evaluating patient adherence to CPAP clinically, we focus primarily on average hours of daily CPAP use. But we obtain a lot of other information from CPAP downloads, including patterns of use. Some people skip days and then use it adequately on other days. Other people take the mask off in the middle of the night and don't put it back on. What has been your experience with this information that might be used to improve CPAP adherence?

Bollig: Some of the downloads do bear that out, and I would say that the most common finding I've seen in my patients is that they take off their CPAP part way through the night. They apparently aren't using it in the final hours of their sleep time, which most of us recognize could be the most vulnerable time for them, as it is probably a time when dream sleep is occurring. We need to address patterns of use with our patients and certainly to encourage them to put it back on after the requisite trip to the bathroom in the middle of the night; that's something my senior patients do on a regular basis. I believe encouragement is necessary, and I think it comes down to patient education, letting them know what is occurring at various times of night and how the CPAP is beneficial. Encouraging them to use it throughout the entire night rather than just at isolated times is very important.

With all that said, I still always tell my patients that *any* amount they use it is still good, and—while I'd like to see them use it for 7 or 8 hours per night—even if they are only able to use it for 2 or 3 hours, I would continue to encourage them on that and to build on that so we can get to a better adherence. Most of the studies[1,2] show that anything under about 4 hours will have limited benefit in the majority of users, and with more than 4 hours you start to see substantial benefit. Some individuals benefit with less and some require more, but it seems like that 4-hour mark is what the research indicates.

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Quan: My clinical observation is that a lot of people flip the thing off in the middle of the night, but they don't realize they've done it. So educating them to put it back on can be a difficult thing when they don't even remember flipping it off in the first place. Another observation is that there seems to be a lot more recognition that comorbid insomnia occurs with people who have OSA, and some data[1] suggest that you have to address that either pharmacologicallyor behaviorally to get people to use their CPAP.

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Bollig: I agree. One of the studies used a hypnotic,[1] especially during the first few weeks of PAP therapy, which significantly helped with adherence. In some cases they may need that long-term.

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Minkley:* I want to mention the insomnia issue in association with education. Some of my clinical experience is that it's a perceived insomnia initially. Because these people were "good sleepers"—they could fall asleep anywhere, like at work or at a stoplight—now that we've treated them and they get some consolidated sleep, it takes them 5–10 minutes to fall asleep and they perceive that as insomnia. So from their perspective we didn't fix them, we made them worse. Once they understand that that's normal and have them work through that, it seems to be a big bridge to help the insomnia problem.

Gay: In deference to Terri Weaver's recent work,[1] we should discuss this 4-hour-a-night target adherence "voodoo," because that's what it really is. Ultimately, that was an observation from the old Kribbs data[2] and how that data got distributed. It wasn't supposed to be about who did better or who did worse the minute they cracked over a magical 4-hour time frame. It became so ingrained in the literature that people think there is something magic about 4 hours, but we now know from Terri's study that more is better. The number of trials that use that 4-hour end point—hey, I'm guilty of it—has left a lot of people with the idea that you can tell patients, "You've got to get 4 hours," and then you're doing well. I think that should be challenged because of the way that it got into the literature and that we all believe this blindly or at least use that data to tell patients what to do. I don't think it's the right thing to tell them.

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Carlin: One of the things we've seen when it comes to adherence relates to physician practice patterns. Over the last year at our center I evaluated about 150 new patients who were "failing" PAP therapy. During the initial interview I asked the question, "Has your primary care provider reviewed the results of your sleep study with you?" Ninety percent of those patients never had their primary care physician review their sleep study results with them. In speaking with other sleep physicians I've found that the same holds true in their practices.

I suspect there are several reasons for this gap in the review of the test results, including that the primary care provider does not feel comfortable discussing the results with the patient, the patient has simply forgotten that such a discussion has occurred, or the patient has not yet had a follow-up visit with the primary care provider to go over the test results. I suspect that the lack of review of the test results (and a lack of review of the implications of the planned therapy) may impact overall adherence, but this will need to be researched.

My question is whether starting a patient who has been diagnosed with OSA on PAP therapy as soon as possible (for example, on the morning following the PAP-titration study) is a good idea, particularly regarding overall therapy adherence? Do any of you distribute the PAP equipment on the morning following the CPAP trial? If so, how has that been received by your patients? It has been well received in our area, particularly from the patients; they love it.

Gay: In the evidence review we tried to answer that question about the benefit of getting patients quickly to CPAP after the diagnosis,[1] but the closest we could get was to look at 2-night studies versus a split-night study, where basically most of those patients not only had their diagnostics studied but had their titration done the same day, so they were much more likely to get their CPAP quickly. Unfortunately, as much as I want to agree with you, I can't show you any good data that show that. For 20 years at Mayo we have seen the patient the morning after their study, and if they have an indication for CPAP, they're walking across the street to get their CPAP the same day, and I have to believe that's good for them.

1. Gay P, Weaver TE, Loube D, Iber C. Evaluation of positive airway pressure treatment for sleep related breathing disorders in adults. Sleep 2006;29(3):381-406.

Mokhlesi: We have observational data[1] that we're trying to publish. We studied 410 patients in whom we have data on the first 30 days of CPAP therapy. At our institution any specialist can order a sleep study, follow up with the patient, and subsequently order CPAP therapy. Since we have limited clinic availability, the sleep specialists were unable to see patients in clinic for follow-up up to 2 months after initiation of CPAP therapy. Using a regression model we looked at all predictors of adherence described in the literature, plus a few other potential predictors that we wanted to test. When we introduced into the model the specialty of the physician ordering the sleep study and CPAP equipment (sleep specialists versus everybody else), all the other predictors became insignificant. Keep in mind that the only encounter the sleep specialists had with the patient before ordering

* Pamela Minkley RRT RPSGT CPFT, Home Healthcare Solutions, Philips Respironics, Monroeville, Pennsylvania.

CPAP was the initial consultation to schedule the patient for a polysomnogram. So it's not like the sleep specialist was seeing the patient on day 3 or day 7 or even at one month to troubleshoot the CPAP device and emphasize adherence.

After adjusting for other demographics, body mass index, apnea-hypopnea index, gender, age, depression scale, sleepiness scale, level of education, and polysomnography variables, 3 variables independently predicted adherence: physician specialty, with sleep specialist getting 70 minutes more CPAP adherence per night; Medicaid insurance status as a marker of poverty, with close to 40 minutes less adherence per night; and African-American race, with also close to 40 minutes less adherence per night. Again, it's not a randomized study, but with 410 patients. . . .

1. Mokhlesi B, Knutson K, Ghods F, Pamidi S, Geroulis S, Rashid A. Non-sleep specialists ordering CPAP, African American race, and Medicaid insurance status are independent predictors of reduced CPAP adherence in patients with OSA (abstract). Sleep 2010; A0344.

Parthasarathy: Along the same lines, we recently published a large observational study[1] that showed that the lack of the certification or credentials of the specialists or sleep centers and lack of health insurance were associated with greater CPAP discontinuation. Nasal congestion also increased the hazard ratio for discontinuation of CPAP. So those were the variables that stood out, and I think it's very important when you're talking about adherence to see what factors you're talking about: race or age or gender or zip code, and which are modifiable. If they're not modifiable, then there's nothing you can do about it, so I think our attention should focus on modifiable risk factors.

I was curious to find out, Suzanne, that if you had a patient with an Epworth score of 16 and moderate to severe OSA, and you give them CPAP, you really don't know if they're going to use it. How comfortable are you with giving a sleepy apneic a sedative prescription, hoping that they'll use the CPAP at night to protect themselves? Would you give a sedative to a patient who's sleepy when you require the CPAP for the first 2 weeks of therapy?

1. Parthasarathy S, Haynes PL, Budhiraja R, Habib MP, Quan SF. A national survey of the effect of sleep medicine specialists and American Academy of Sleep Medicine accreditation on management of obstructive sleep apnea. J Clin Sleep Med 2006;2(2): 133-142.

Quan: And you don't know if they're going to use it or not.

Parthasarathy: Right. Outside of the purview of research.

Bollig: I would be uncomfortable with that scenario. Luckily, I don't have to make that decision: our sleep physician does. But on the whole I've not found that hypnotics help much. Many of our patients are already on hypnotics, and our goal is to try to get them off the hypnotics and treat their real sleep disorder. I think that a person's first experience with CPAP, whether it be during the actual titration study or during their first few days, can be a predictor with how comfortable they will be and how they will adhere long-term, so I think we do have to entertain that possibility of an individual who does have some sleep-onset insomnia issues and yet you feel is going to be adherent, but you have to consider the patient you're working with.

D'Angelo:† With the new CMS [Centers for Medicare and Medicaid Services] rules for adherence for Medicare patients, can you share any experience on adherence in the Medicare versus non-Medicare populations? Are we addressing them differently? Are we following them differently? Are our protocols different? Are we seeing adherence improvements in the Medicare population?

Bollig: In our service we implemented the same review and adherence monitoring for all patients, because we're ordering the same therapies and doing the same follow-ups no matter who the third party-payer is. We did not see any adherence improvement in the Medicare versus non-Medicare patients, but our population base is becoming younger, and that may be skewing our results, because I do believe there's more of an adherence issue with non-Medicare patients.

Pierson:‡ I have a question that relates indirectly to adherence, but also goes back to our discussion of polysomnography and other diagnostics. What assessment is needed during follow-up to determine whether the CPAP prescription and setup are still appropriate? We've talked a lot about adherence and finding out whether they're doing what we've prescribed for them, but what are the current recommendations for retesting at any point beyond simply talking to the patient?

Minkley: In the AASM [American Academy of Sleep Medicine] practice guidelines for polysomnography the indication for retesting is a return of symptoms; retesting is not routine.

I'm concerned about looking at adherence as a number. It's so easy to look at, but we have the technology to look at a lot of other information, and efficacy is not usually mentioned in conjunction with adherence. You won't get good adherence if you look

† Mark D'Angelo, Sleep Therapy, Philips Respironics, Monroeville, Pennsylvania.

‡ David J Pierson MD FAARC, Division of Pulmonary and Critical Care Medicine, Department of Medicine, Harborview Medical Center, University of Washington, Seattle, Washington.

only at 4-hour use and the apnea-hypopnea index is still high, or if you look at the download information and the patient is having periodic breathing and appears to be arousing from that, and it doesn't get channeled to a physician to look at that and perhaps alter the therapy and get it corrected. Long-term adherence and outcomes could suffer.

What I've seen is a big disconnect in "Whose patient is this?" because everybody's clinics are jam-packed. One time I calculated how much time would it take if our sleep physicians actually did one follow-up visit for results and one follow-up visit for every patient for adherence and efficacy, and there wasn't enough clinic time in the world, and they would have had to hire 3 physicians just to take care of that minimal buy-in. So most of the patients, I believe, are lost to follow-up. The concern is that now the DMEs [durable medical equipment companies] will crank out this 4-hour thing and just look at the numbers and say, "OK at 3 months there's good adherence so I can get paid," and then if the patient puts it in a closet in a few months after that because they weren't followed, eventually our outcomes studies are going to show that none of this is effective therapy, but it's really that the follow-up wasn't effective.

Pierson: Part of my question was related to the natural history of the disease: does the behavior of the apnea and its need for therapy evolve over time, or are changes only signaled by a return of symptoms or drastic changes in body weight and that sort of thing?

Gay: There have been 2 randomized controlled trials[1,2] that I think help answer your question about the effect of re-titration. The first, a case series, sent first-time users out on their CPAP; they were titrated over 2 nights, and then they brought them all back 2 weeks later and re-titrated them and found that on average they could get the same result with a pressure of about 2 cm H_2O less, probably because with initial adaptation they would relieve some upper-airway edema. They randomized half the patients to change to the lower pressure, and the other half to keep the same pressure, then brought them back after 3 months, and it didn't make any difference. This maybe addresses the initial behavior of the apnea therapy.

The interesting study was with Bob Ballard and Pat Strollo. We took hard-core non-compliers after many months, and these patients who are resistant at that time are very difficult to deal with. We know that if you're months out and they're not very compliant, if you do all the same things again (we played them whale music, we changed the mask, we did everything that you would normally do when you bring them back), you can rescue very few of those.

So we asked a second question: Is there something about committing yourself to another study? So those who still weren't compliant after the standard attempts had a second sleep study and were randomized to CPAP or a different device; in this case it was a Bi-Flex auto (Respironics, Murrysville, Pennsylvania). When we had them come back after 3 months, twice as many patients had much better adherence, just by showing them a different device. It probably was not just about doing another study, because the CPAP pressure really didn't change very much in the CPAP arm.

1. Sériès F, Marc I, Cormier Y, La Forge J. Required levels of nasal continuous positive airway pressure during treatment of obstructive sleep apnoea. Eur Respir J 1994;7(10): 1776-1781.
2. Ballard RD, Gay PC, Strollo PJ. Interventions to improve compliance in sleep apnea patients previously non-compliant with continuous positive airway pressure. J Clin Sleep Med 2007;3(7):706-712.

Quan: Dr Pierson, the longitudinal data from the Cleveland Family Study[1] and the Sleep Heart Health Study[2] showed a slow increase in respiratory disturbance index over 4 or 5 years, but there are some people who get better and some people who rapidly get worse. The general trend is slow progression.

As for Sai's question, I've given hypnotics to people with bad sleep apnea. I think if you're using current ones as opposed to the older ones, then respiratory depression is not a problem in most cases.

1. Redline S, Schluchter MD, Larkin EK, Tishler PV. Predictors of longitudinal change in sleep-disordered breathing in a nonclinic population. Sleep 2003;26(6):703-709.
2. Silva GE, An MW, Goodwin JL, Shahar E, Redline S, Resnick H, Baldwin CM, Quan SF. Longitudinal evaluation of sleep-disordered breathing and sleep symptoms with change in quality of life: the Sleep Heart Health Study. Sleep 2009;32(8): 1049-1057.