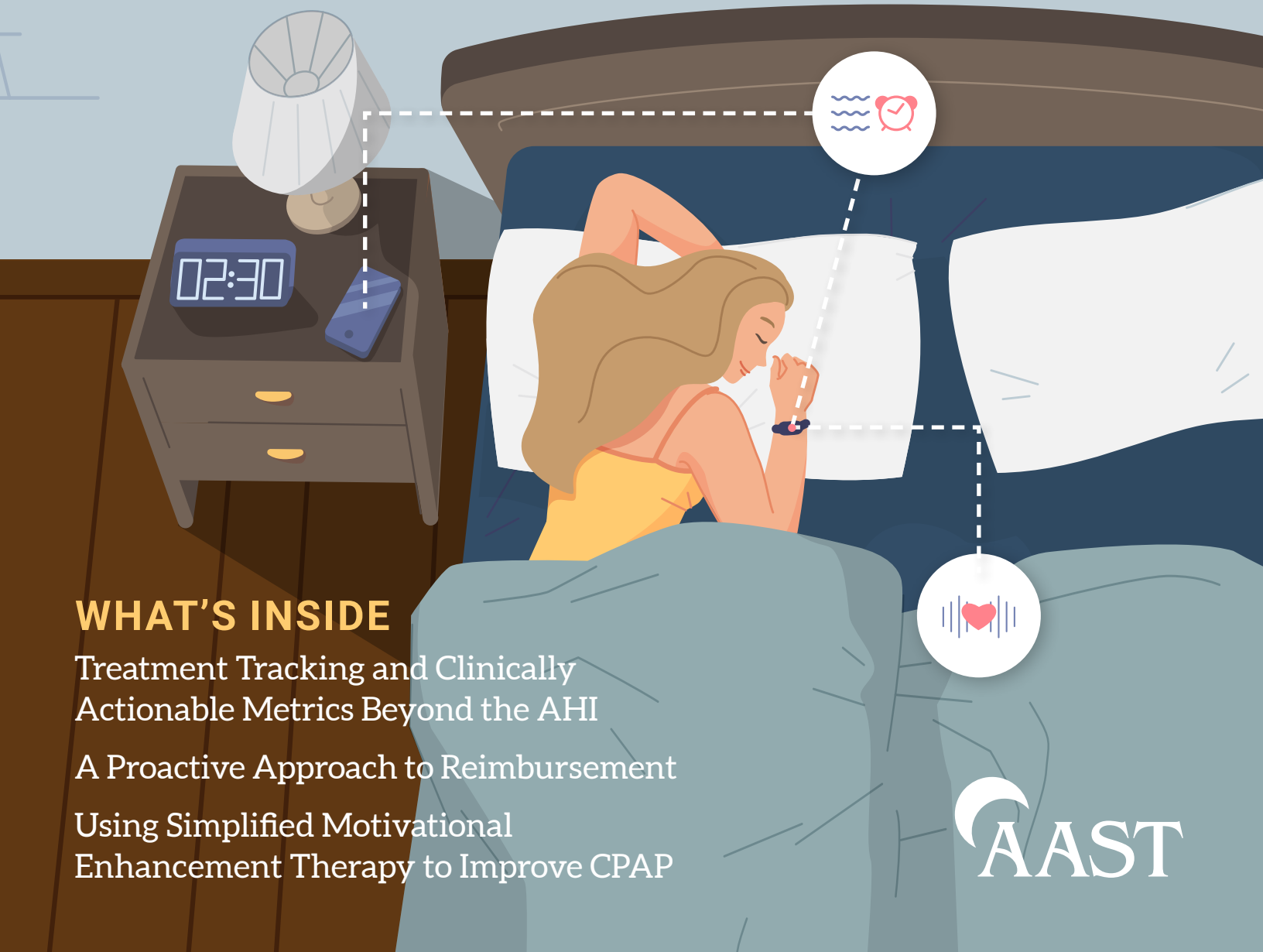
AZ2ZZ

QUARTER TWO 2023 / VOLUME 32 / NUMBER 02

Potential Up-and-Coming Developments *in Wireless Sleep Technology*



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AAST

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Wireless technology is increasingly being used to screen for obstructive sleep apnea (OSA). Despite the increased use of this technology, wireless technology is lagging when it comes to screening for and/or diagnosing non-OSA-related sleep problems and physiological features such as sleep position, snoring and sleep stages. Various devices are being developed to improve wireless polysomnography (PSG) monitoring, but some remain experimental for now.

DEPARTMENTS

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AAST THANKS ITS PRESTIGE PARTNERS

From AAST

Shine Bright With AAST Education

Summer is here, a time to soak in the sunshine and advance your sleep industry knowledge. From a workshop and e-Book to a new module series, check out what's in store for the season.

Certification in Clinical Sleep Health (CCSH) Designated Education Program

Make a splash in your continuing education goals and register for our next CCSH Designated Education Program event. Taking place in person Oct. 14-15 in Chicago, AAST's CCSH Workshop allows attendees to immerse themselves in 1.5 days of education and become eligible for the BRPT CCSH exam through Pathway 3 and earn 7.5 AAST continuing education credits (CECs) upon completion.

The workshop will include seven presentations encompassing various sleep topics such as sleep across the life cycle, circadian rhythms, sleep disorders, clinical evaluation and patient management and follow-up. Additionally, attendees will receive a physical and virtual copy of the AAST CCSH Workbook and online access to the presentation handouts, AAST CCSH Post-Test Exam and case-study learning module, which is comprised of eight patient scenarios.

Those interested can visit the CCSH Workshops webpage to learn more and register.

The Fundamentals of Virtual Patient Monitoring (VPM) e-Workbook

Adventure into the vital components of patient management, including leveraging data downloads, reporting tools and patient records navigation with the new VPM e-book. A companion piece to the Fundamentals of Virtual Patient Monitoring recorded modules, this 107-page e-workbook is ideally suited for those who are preparing for a role in patient care or the Certification in Clinical Sleep Health (CCSH) credential. The material focuses on identifying best practices for patient interviewing and assessment and developing the communication skills that are critical for patient management, a role that is increasingly moving to the CCSH.

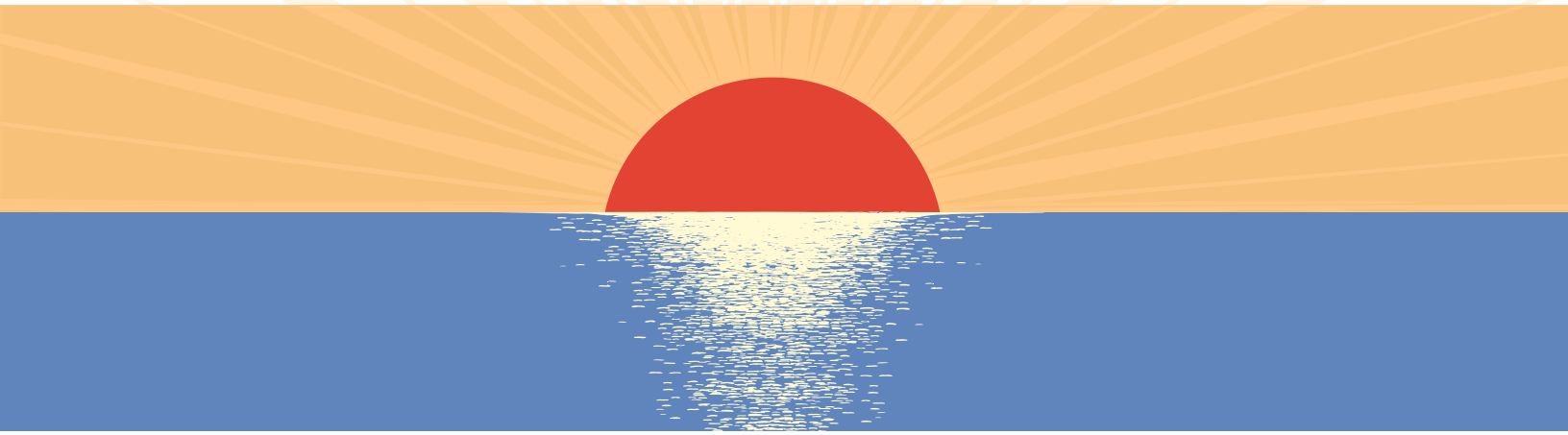
Available in a digital or physical format, those interested in purchasing a workbook can visit the Learning Center. Reminder: members receive a discounted rate on AAST education products.

Coming Soon: The Adult Scoring Series

AAST has been hard at working developing an adult scoring module series. The Adult Scoring Rules series will be a comprehensive review of the American Academy of Sleep Medicine (AASM) polysomnography (PSG) scoring criteria and be inclusive of the AASM Board of Directors approved changes in the newly released AASM Manual for the Scoring of Sleep and Associated Events, Version 3, to which all AASM-accredited sleep facilities are required to implement by Dec. 31, 2023.

This four-module series will include an overview of the development of standardized PSG scoring rules, sleep staging and arousals, respiratory event scoring, and limb movements, cardiac events and home sleep apnea test (HSAT) scoring.

AAST members are encouraged to watch their emails for additional details on the series throughout the summer.



President's Message

Making a Splash This Summer

By Laree J. Fordyce, RPSGT, RST, CCRP, CCSH, FAAST

It's hard to believe it's already summertime, but with the change of season well underway, I'm happy to share that AAST is making a splash and launching member-exclusive opportunities, education and an industry partnership.

AAST offers its members unique and rewarding lead roles in the association, including the opportunity to be a part of the AAST Board of Directors. On June 1, AAST launched its call for board of directors nominations. A great opportunity for those looking to be at the forefront of the community for sleep-care professionals, board members play vital roles in seeing through the success of AAST programs and the fulfillment of the association's mission. Beginning in early July, applications for up to three director-at-large positions will be reviewed by the 2023-2024 Nominations Selection Committee, with the slate announcement following suit in August.

For those that are interested in volunteering in a non-leadership capacity with AAST, details on volunteer opportunities for committees will be shared in the coming months.

Also happening this summer is the development of a member needs assessment. Done every two to five years, the needs assessment allows AAST members to share feedback on all things AAST. Members will be asked to assess the various AAST programs, education and resources, as well as share insights into their specific needs as a sleep-care professional in the industry. Please watch your emails for updates on the launch of the assessment in the coming months.

Shifting to education, I'm pleased to share that registration is now open for the fall Certification in Clinical Sleep Health (CCSH) event. The day-and-a-half workshop will be taking place Oct. 14-15, in Chicago and feature seven presentations on various topics such as clinical evaluation, patient management and incidence and prevalence of sleep disorders. This workshop is a great way for sleep industry professionals to earn CECs, become eligible for the Board of Registered Polysomnographic Technologists (BRPT) CCSH exam through Pathway 3 and unlock in-depth study materials.

I'm also happy to announce that AAST and Ensodata will be teaming up to develop an artificial intelligence (AI) and sleep module series. While in the early stages of development, the series will consist of two modules on what AI is in relation to sleep and the benefits of AI scoring.

Things are just starting to heat up at AAST. As always, if you have any questions or would like to learn more about a particular offering or membership perk, please don't hesitate to reach out to AAST HQ at info@aastweb.org or (312) 321-5191.

Instructions for Earning Credit

AAST members who read *A$_2$Zzz* and claim their credits online by the deadline can earn 2.00 AAST Continuing Education Credits (CECs) per issue, for up to 8.00 AAST CECs per year. AAST CECs are accepted by the Board of Registered Polysomnographic Technologists (BRPT) and the American Board of Sleep Medicine (ABSM).

To earn AAST CECs, carefully read the entirety of the Q2 issue of *A$_2$Zzz* and claim your credits online in the Learning Center. You must go online to claim your credits by the deadline of **Sept. 30, 2023**. After the successful completion of the learning assessment, your certificate will be available in the My CEC Portal acknowledging the credits earned.

COST

The *A$_2$Zzz* continuing education credit offering is an exclusive learning opportunity for AAST members only and is a free benefit of membership.

STATEMENT OF APPROVAL

This activity has been planned and implemented by the AAST Board of Directors to meet the educational needs of sleep-care professionals. AAST CECs are accepted by the Board of Registered Polysomnographic Technologists (BRPT) and the American Board of Sleep Medicine (ABSM). Individuals should only claim credit for the issues they read in full and evaluate for this educational activity.

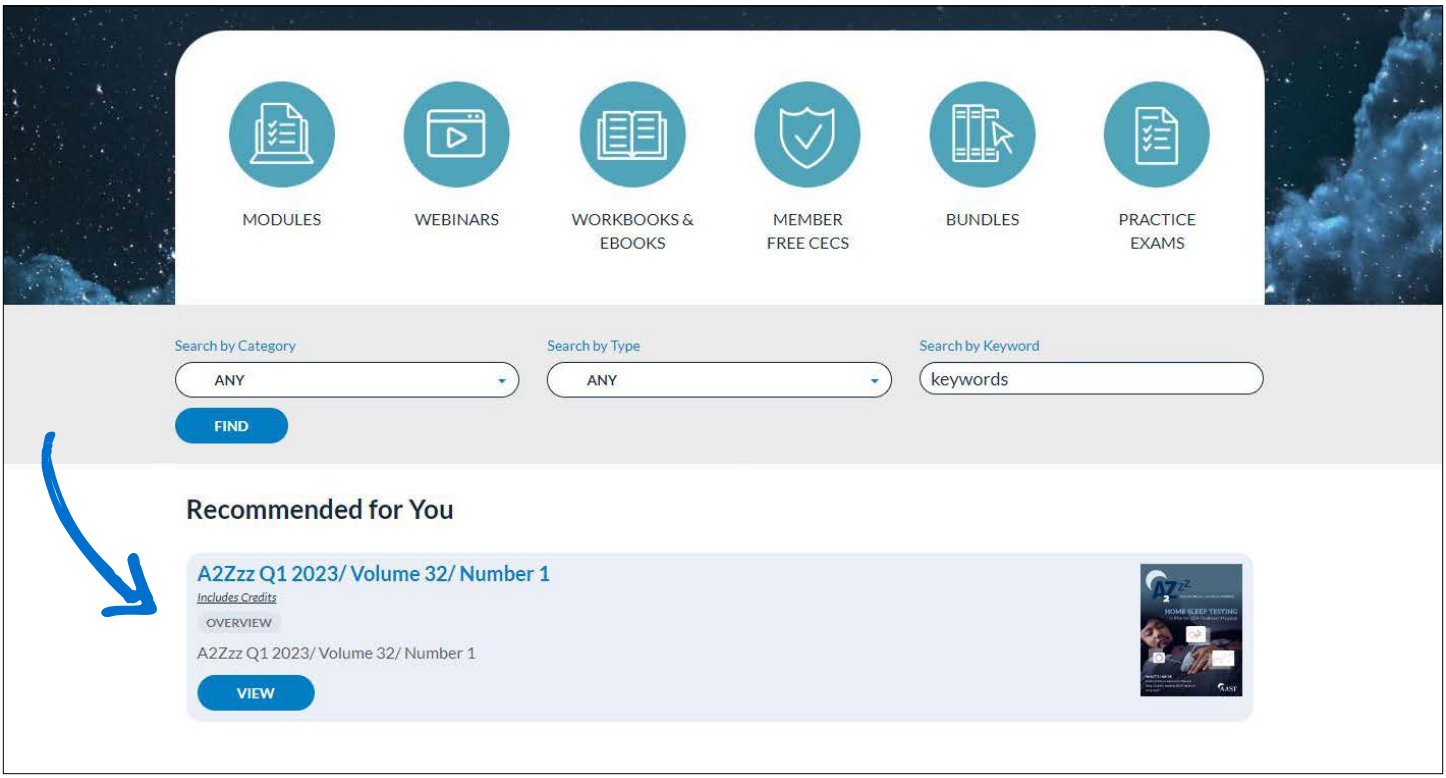
STATEMENT OF EDUCATIONAL PURPOSE & OVERALL EDUCATIONAL OBJECTIVES

A$_2$Zzz provides current sleep-related information that is relevant to sleep-care professionals. The magazine also informs readers about recent and upcoming activities of AAST. *A$_2$Zzz* should benefit readers in their practice of sleep or in their management and administration of a sleep disorders center.

READERS OF *A$_2$ZZZ* SHOULD BE ABLE TO DO THE FOLLOWING:

- Analyze articles for information that improves their understanding of sleep, sleep disorders, sleep studies and treatment options
- Interpret this information to determine how it relates to the practice of sleep care and medicine
- Decide how this information can improve the techniques and procedures that are used to evaluate sleep disorders patients and treatments
- Apply this knowledge in the practice of sleep care and medicine

You must go online to claim your CECs by the deadline of **Sept. 30, 2023**.



Potential Up-and-Coming Developments *in Wireless Sleep Technology*

By Regina Patrick, RPSGT, RST

Read more

In the sleep field, wireless technology is increasingly being used to screen for obstructive sleep apnea (OSA). Lagging behind is the use of wireless technology to screen for and/or diagnose non-OSA-related sleep problems such as restless leg syndrome/periodic leg movements (RLS/PLMs), however. Additionally, depending on the sleep monitoring system, other physiological features such as sleep position, encephalography (EEG), electrocardiology (ECG), snoring and sleep stages may not be monitored. Various devices are being developed to improve wireless polysomnography (PSG) monitoring, but some remain experimental for now.

Wireless monitoring in PSG typically combines radio detection and ranging (radar) technology — in particular, doppler radar — and Bluetooth and/or Wi-Fi technology. Radar technology involves emitting radio waves from a source to determine the distance a target object is from the signal source. The emitted signal bounces off of the target and returns to the source. The time required for the signal to return to the source reflects how far the target is from the signal source.

Doppler radar technology adds the element of the doppler effect (i.e., changes in the frequency and wavelength of reflected signals as a target moves toward or away from a signal source), which makes monitoring motions such as chest movements possible. In Bluetooth technology, radio waves are directly transmitted a short range (e.g., a few feet) from one object to a mobile device. In Wi-Fi technology, radio waves are used to provide wireless communication between computers, mobile devices and other devices. Additionally, Wi-Fi technology can provide internet access.

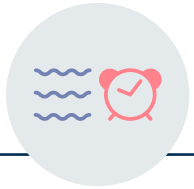
In a traditional PSG study, the myriad of sensors attached to a patient's head, outer canthus of each eye, near the nose and mouth and on the lower neck, chest, legs and finger may be uncomfortable and can therefore interfere with sleep during a sleep study. For these reasons, much research has focused on reducing the number of sensors. To date, current devices used in wireless PSG systems for in-laboratory or in-home studies still require attaching some sensors to the body. Therefore, scientists continue efforts to improve wireless PSG technology by making sensors contactless. Recent findings have shown some encouraging results.

Sound Analysis Algorithm

In 2015, Dafna et al.[1] developed the breathing sound analysis algorithm (i.e., a specialized mathematical formula), which allowed the preprocessing of audio signals (i.e., removing unwanted noise such as air conditioner or fan noises) and featured extraction (i.e., distinguishing between breathing and snoring) and estimation of the patient's sleep-wake pattern, based on the audio data obtained from a noncontact microphone placed approximately 3 feet away from a person's head. The algorithm's results were compared with those of PSG data, which were obtained simultaneously during the participants' sleep studies. Dafna found that the sensitivity (i.e., accurately detecting when a person was asleep) and specificity (i.e., accurately detecting when a person was awake) of the algorithm were 92.2% and 56.6%, respectively. The investigators further found that sleep latency, total sleep time, wake after sleep onset and sleep efficiency did not differ significantly between the algorithm and PSG data. Dafna concluded that sleep-wake activity and sleep quality parameters can be reliably estimated by using their developed algorithm.

However, a drawback of using breathing sound data is that the data cannot be used to distinguish between non-rapid eye movement (NREM) and rapid eye movement (REM) sleep. With that in mind, Rahman et al.[2] in 2015 described a radar-based device, which they called DoppleSleep, to track sleep-related physical and physiological features such as body and sublte chest movements, heart movements associated with breathing and heartbeats. DoppleSleep consists of a unit that collects and amplifies the raw radar signal and transmits the signal to a smartphone via Bluetooth for further processing. An application in the smartphone determines heart and breathing rates, movement estimation and sleep modeling. By using data derived from a wireless EEG headband device as a reference, Rahman found that the DoppleSleep device had a sensitivity of 89.6% for distinguishing between sleep and wake and a sensitivity of 80.2% for distinguishing between REM and non-REM. With such promising results, Rahman believes that the DoppleSleep device could potentially be used to monitor the sleep of patients without the need for wiring. However, it will require further improvements.

An application in the smartphone determines heart and breathing rates, movement estimation and sleep modeling.



In 2017, Chung et al.[3] developed an algorithm that uses multiple data types (i.e., breathing rate, breathing pattern, heart rate, body motion and snore sounds) to determine sleep stages to enhance the accuracy of sleep stage classification. To validate the possibility of commercializing their work, Chung compared the sleep stage results of their algorithm with those of a commercially available sleep monitoring device, ResMed S+ (ResMed, San Diego, California), which has a sleep-staging feature. In their study, volunteers with OSA were simultaneously monitored with the wireless system, which used Chung's algorithm, PSG monitoring with a portable, full PSG device and the ResMed S+ device. The researchers

found that the algorithm had significantly greater accuracy in detecting wake than the ResMed S+ device (60.0% vs. 43.8%). The algorithm and ResMed S+ detected NREM with an accuracy of 71.9%, and both had low accuracy in detecting REM sleep (algorithm, 26.0%; ResMed S+, 21.5%). The overall accuracy rate for detecting REM/NREM sleep and wake was 64.4% with the algorithm and 60.9% with ResMed S+ device. Based on their findings, Chung suggests their algorithm may provide higher accuracy in sleep stage detection.

Actigraphy

Actigraphy is another noninvasive method used to distinguish between sleep and wake based on the level of movement (i.e., low activity indicates sleep; high activity indicates wake). However, an actigraph placed on a limb does not give information regarding whether a person is prone, supine or lying on one side. To counter this factor, body position during sleep in current wireless, full PSG systems is determined via a small actigraph unit that is embedded in the PSG sensor unit that is attached to the chest or abdomen a placement that may hinder patients in sleeping prone.

In 2022, Kukwa and colleagues[4] described a small, wireless sensor developed by Clebre (Olsztyn, Poland) that can be placed at the suprasternal notch at the base of the front neck to determine body position. The Clebre device contains two acoustic channels to detect tracheal breathing sounds and a triaxial accelerometer (i.e., a device that detects vertical, horizontal and axial movements) to detect body position.[5] In addition, the device collects and analyzes heart rate and movement activity, and relays the information wirelessly to an application that is downloaded to a mobile phone.

In a validation study, Kukwa and colleagues[4] compared positions detected by the Clebre device versus positions recorded with a full, portable PSG system (NOX A1 PSG system; Nox Medical Inc., Reykjavik, Iceland). The Clebre device's accuracy in detecting supine and nonsupine positions was 96.9% and 97.0% respectively; its accuracy for right and left positions was 98.6% and 97.4%, respectively; and its accuracy in detecting the prone position was 97.3%. Based on these promising findings, Kukwa proposed that body positioning devices should be placed in the suprasternal notch rather than on the chest since this placement allows patients to sleep prone.

Current wireless EEG acquisition devices typically involve a patient wearing a headband or other type of headgear containing sensors that detect EEG signals. However, these devices may be uncomfortable for patients or hinder their movements. In 2015, Debener and colleagues[6] described a C-shaped device that encircles the back of the ear to record EEG signals. The device, called cEEGrid, is a flexible, thin strip that contains 10 embedded screen-printed electrodes, which are manufactured by printing different types of ink (containing carbon, silver, gold or platinum) onto a plastic or ceramic substrate and connected to a miniaturized amplifer. The information is then wirelessly transmitted to a smartphone.

Building on Debener's work, Sterr and colleagues[7] compared cEEGrid signal quality with the EEG signal quality on a portable PSG system. They found that both systems had comparable signal quality; the overall signal strength was lower for the cEEGrid device than for the portable PSG system. Other drawbacks of the cEEGrid were noise interference, lower spatial resolution and the electrode array comes only in one size, and therefore it may not fit comfortably for some patients. Scientists hope that when perfected, the cEEGrid could be beneficial for sleep recordings because it is easily applied and potentially may be self-administered in a home environment for home sleep studies.

In 2015, a student team at the University of British Columbia (Vancouver, Canada) developed a wireless electromyography (EMG) prototype that could be used to detect leg movements in patients suspected of having RLS/PLMs.[8,9] Their prototype consisted of a band containing electrodes that wrapped around a patient's leg and collects EMG data. The signal is transferred wirelessly by Bluetooth technology to an app on a mobile phone that converts the information to display a graph of the EMG signals on the phone's screen. (To see images of the device, visit ece.ubc.ca/better-diagnostic-tools-for-restless-legs-syndrome). The student team conducted a clinical trial of the prototype on pediatric and adult volunteers, and they found that the prototype was able to detect muscle tension that was not visible to the eye.[8] Thus, they concluded the prototype had excellent potential to enable the acquisition and analysis of EMG signals in patients suspected of having RLS or PLMs.

Current devices used in wireless PSG systems for in-laboratory or in-home studies still require attaching some sensors to the body.

Conclusion

Current wireless, full PSG systems that have been approved or cleared by the U.S. Food and Drug Administration (Silver Spring, Maryland) for clinical use are Onera Sleep Test System

(Onera Health, Palo Alto, California), Sapphire PSG (CleveMed, Cleveland Medical Devices Inc. Cleveland, Ohio) and Nox A1 (Nox Medical, Alpharetta, Georgia). They are "wireless" in that wires from sensors attached to a patient's body do not extend from the patient to a minibox. Sensors are instead attached to a patient's body, collect data and relay the data via radio waves to another device (e.g., smartphone) for processing, which enhances patient comfort. However, noncontact monitoring of sleep stages, EEG, body movement, etc., would be more ideal because this would allow patients to sleep most naturally in a sleep center or in their home setting. For now, scientists continue to do research to make this possible.

REGINA PATRICK, RPSGT, RST, *has been in the sleep field for more than 30 years. She is also a freelance writer/editor.*

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A Technologist's Guide to Performing Sleep Studies

Designed as an introductory resource, the *Technologist's Guide to Performing Sleep Studies* provides step-by-step instructions for collecting sleep study data from patients. It includes sections that cover suggestions for putting the patient at ease, reviewing the patient's symptoms and medications, attaching the sensors, preparing to record, biological calibrations, artifact detection and correction, and documentation.

Purchase *A Technologist's Guide to Performing Sleep Studies* eBook in the AAST Learning Center

AAST

Optimizing Patient Outcomes Requires More Than Single-Night Testing for Sleep Apnea

The Role of Treatment Tracking and Clinically Actionable Metrics Beyond the Apnea Hypopnea Index

By Sahil Chopra, MD, and Solveig Magnusdottir MD, MSc, MBA

Obstructive sleep apnea (OSA) is estimated to be the most prevalent sleep disorder, with approximately 34% of middle-aged men and 17% of middle-aged women in the general population expected to meet the diagnostic criteria for it.[1,2] Prevalence in patients with cardiovascular and cardiometabolic disease is higher, estimated as high as 40%-80%. In recent years there has been an increasing awareness of OSA but despite this, the disease remains frequently underdiagnosed or diagnosis is delayed, even in patients with moderate to severe symptoms.[3,4]

OSA is characterized by recurrent complete (apneas) and partial (hypopneas) obstruction of the upper airway, causing intermittent hypoxemia, autonomic fluctuation, arousals and sleep fragmentation, and is associated with consequences that negatively affect health and quality of life of undiagnosed patients. The most common consequences of untreated OSA are hypertension,[5,6] cardiovascular and cardiometabolic disease[7,8] and stroke,[9,10] all included in the group of the costliest diseases in the U.S. Additionally, OSA increases all-cause mortality,[11,12] and patients with undiagnosed OSA have higher rates of health care utilization and increased hospital readmissions, adding substantially to medical costs annually.[13-15] It is therefore of high importance to implement comprehensive, precision care in both diagnosis and treatment of OSA to improve patient outcomes.

Sleep is dynamic with sleep duration, the proportion of OSA severity and non-rapid eye movement (non-REM) and rapid eye movement (REM)-sleep changing from night to night.[16] Polysomnography (PSG) is still the reference standard, recording sleep and breathing to calculate the apnea hypopnea index (AHI), defined as the average number of apnea and hypopnea events per hour during sleep, to diagnose and classify OSA severity. The limitations of PSG are well understood with high cost, complexity, lack of access and the requirement for a trained specialist to interpret results. It would be unreasonable to expect patients or payers to do a multi-night PSG for the purpose of OSA diagnosis or treatment tracking. Therefore, use of various, limited channel home sleep apnea testing (HSAT) devices has been increasing. These devices are simpler to use, patients can sleep in their natural sleep environment when tested for OSA and the output is simpler to analyze, making the process less costly and cumbersome.

Recent studies report a relevant night-to-night variability of apnea events that may lead to misdiagnosis of patients suspected of OSA in both adults and children when sleep is evaluated for only one night.[17-19] A study by Punjabi et al., utilizing type-3 HSAT to calculate AHI reports a substantial within-patient variability and that "approximately 20% of patients with mild and moderate sleep apnea on the first night were misdiagnosed either as not having sleep apnea or as having mild disease."[20] A similar study by Tschopp et al. utilizing peripheral arterial tonometry (PAT) concluded that 24% of patients were misclassified when using devices for one night compared to AHI-average calculated from three-nights.[21] A meta-analysis by Roeder et al. reported "on average 41% (95% CI 27% to 57%) of all participants showed changes of respiratory events >10/hour from night-to-night" and "49% of participants changed OSA severity class at least once in sequential sleep studies."[18]

These devices are simpler to use, patients can sleep in their natural sleep environment when tested for OSA and the output is simpler to analyze, making the process less costly and cumbersome.

These results indicate that 1) misclassification and underdiagnosis of mild and moderate OSA are relatively common when based on a single-night study, and 2) single-night studies are imperfect, with multi-night testing possibly offering improvements in the diagnostic process. For this purpose, sleep-testing devices with a lower-cost structure offer more flexibility for multi-night testing for diagnosis and less burden for patients to use repeatedly if applicable for use for treatment tracking. Implementing multi-night testing should not only improve diagnostic accuracy, but additionally our understanding of the dynamics and variations of sleep and OSA severity over time. This will also offer the option to track responses to therapy that can be utilized as an adjunct to manage therapy for improvements in outcomes.

While some single-patient, multi-use disposable devices improve the diagnosis by capturing intra-night variability of AHI, it is no less important to track treatment efficacy

over time. Single-patient, non-disposable devices recently introduced to the market offer ease of use and cost-effectiveness.

The most novel of the disposable devices, Sunrise, is capable of recording three nights of sleep. The system utilizes mandibular jaw movements, pulse-rate and oxygen-saturation (SpO2) that is recorded during sleep with artificial intelligence (AI) powered algorithms to aid in evaluation of OSA.[22] Sunrise can be utilized in patients 18 years and older with suspicion of OSA (FDA K222262).

Multiple photoplethysmogram (PPG) sensor devices are also on the market that use the plethysmography-signal (PLETH) to measure pulsatile volume changes in the arteries of peripheral vasculature of the fingers.[23] These devices combine recordings of the PLETH signal with SpO2 and actigraphy to provide estimates of sleep and to calculate an AHI. The devices that are marketed in the group of using the PPG include WatchPAT,[24,25] which uses a pressurized probe with a PPG sensor and offers a multi-patient reusable device with single-use disposable sensor and a single-patient disposable, one-night sleep-testing option. WatchPAT is intended for use with patients 12 years and older (for OSA) or 17 years and older (for central sleep apnea [CSA]) suspected to have sleep-related breathing disorders (FDA K183559).

Another PPG sensor device is NightOwl®,[26,27] which is a reusable, single-patient, disposable device that offers the option of recording up to 10 nights of sleep testing. NightOwl is intended to aid in the evaluation of OSA in adult patients suspected of sleep apnea (FDA K213463).

A third option is the SleepImage System®,[28,29] that the FDA cleared as a software as a medical device (SaMD) and utilizes a simple device for data collection. Both devices offered currently can be utilized for diagnostic purposes, a ring-device that can be utilized for multiple patients for testing (Figure 1) and a patient-centric finger-tip device. Patients who are diagnosed with OSA/CSA can then continue to utilize the patient-centric device as instructed by their health care provider to track treatment efficacy (Figure 2). The SleepImage System is intended to aid in the evaluation of sleep disorders as well as diagnosis and management of sleep-disordered breathing (SDB) in children, adolescents and adults (FDA K182618). The Sleep Quality Index (SQI), sleep fragmentation, sleep duration and sleep stage calculations are based on cardiopulmonary coupling (CPC)[30,31] analysis of data derived from the PLETH-signal collected with the PPG sensor, including SpO2 information to calculate AHI.

Historically in OSA diagnosis and management, focus has been on defining and quantifying disease severity by calculating the AHI. OSA is characterized by repeated paused breathing, which causes transient hypoxemia and sleep fragmentation that may affect sleep quality at different severity levels like the hypoxemia. Alternative metrics have been proposed with the aim to better predict clinical consequences of OSA, including sleepiness, cardiovascular and cardiometabolic health and effects on quality of life.[32] These metrics include methods to better quantify the transient hypoxemia, apnea hypopnea event duration and hypoxic burden calculating the area under the oxyhemoglobin saturation curve.[33,34] Additionally they quantify sleep fragmentation by estimating arousal intensity,[35] the odds ratio product (ORP) quantifying sleep depth from analysis of electroencephalogram signal (EEG)[36] and the SQI calculated from automated CPC analysis of heart rate variability (HRV) and breathing.[37-40]

Figure 1. Reusable/multi-patient data-collection device.

Figure 2. Single-patient device for diagnosis of OSA that offers the option of treatment tracking when applicable.

Insomnia is common in the general population, with estimated 30%-50% of adults experiencing short-term insomnia.

Insomnia is common in the general population, with estimated 30%-50% of adults experiencing short-term insomnia and 10% chronic insomnia,[41] with prevalence of insomnia in patients with OSA higher or 46%-60%.[42] Patients suffering from both disorders, comorbid insomnia and sleep apnea (COMISA), are at greater cardiovascular risk[43,44] and higher impairments to daytime functioning and quality of life compared to those with either OSA or insomnia alone.[45] Therapy for both OSA and insomnia is more complex in patients with COMISA and often less effective.[46,47] Therefore, it is important to document both the hypoxemia as well as insomnia symptoms and sleep quality to optimize therapy outcomes. Diagnosis of insomnia is based on subjective self-reported symptoms, and the Insomnia Severity Index (ISI) has been suggested to screen for insomnia in patients with OSA.[48,49] However, sleep quality is a multi-dimensional construct with both subjective and objective components, which are not always concordant.

Complementary methods as mentioned in this article are available to assess sleep quality, as are objective methods like the SleepImage System SQI, which measures sleep quality presented on a scale of 0-100 with higher intra-individual variability of patterns of sleep stability in patients with insomnia.[50]

Having a defined unit of metric in medicine helps differentiate disease states from normal and categorize the severity of illness. It's important to both define the state of disease and track therapy efficacy over time to improve outcomes. The SQI has demonstrated a direct relationship with health outcomes in clinical studies; improving SQI in adults has positive effects on hypertension and stroke,[51,52] adiponectin levels[39] glucose disposal[53] and depressive symptoms.[54] Healthy-weight children with high sleep quality have better cardiometabolic health than healthy-weight children with low sleep quality.[39] Children with high SQI also have better quality of life, attention and executive function, and are more likely to have spontaneous remission of OSA than children with low SQI.[38] Both AHI and SQI need to be treated successfully to improve cardiometabolic health, behavior and quality of life.[40]

Additional utility for longitudinal sleep tracking may add value in continuous positive airway pressure (CPAP) management. CPAP-machine-detected respiratory events remains the approach to tracking CPAP efficacy. Although clinically convenient, studies have shown the difference in manual events and machine detected events to be clinically significant, especially during periods of unstable breathing.[55] The ability to identify such residual respiratory events could warrant further sleep evaluation and possibly improve outcomes. Using home sleep testing tools such as those noted in this article may unlock the potential for precise home CPAP optimization.

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A Proactive Approach to Reimbursement

A Systematic Review of Strategies to Reduce the Billing Nightmare

By Kathryn Hansen, BS, CPC, CPMA

Reimbursement challenges have tested a program's profitability in the past, and today is no exception. This year there are additional factors which will impact clinical and financial practices: the expanding influences from the 2023 Office of Inspector General (OIG) workplan, the implementation of the Requirements Related to Surprise Billing legislation and numerous reimbursement changes. Medicare has also published many billing updates for us to review and consider as we proceed with submitting billing claims for 2023. This article will provide an overview of key billing processes, which require an audit before submission of the claim.

The 2023 Medicare Physician Fee Schedule is a key resource for all providers and may be reviewed on your regional Medicare Administrative Contractor's (MAC) website. The MACs adjudicate or process Medical Part A and Part B claims for your geographic region and determine the Local Coverage Determination (LCD) criteria for reimbursement of the respective procedures billed using a Current Procedural Terminology (CPT) code.

The LCD defines documentation requirements to meet medical necessity determination. It includes the requirements of approved technical and clinical credentials and clinical expertise and credentialing to perform and interpret the respective procedure. Each year, the Centers for Medicare & Medicaid Services (CMS) publishes the "What's New Report" to document billing and coding changes, the indications for coverage of the procedure effective around Jan 1. It's important to verify the effective date of the revision and look for any date associated with termination of the original LCD preceding the change being referenced in the new update.

LCDs are not only for CMS or federal claims. Many commercial insurance companies follow changes in LCDs to create their own contracted coverage, reimbursement rates and documentation requirements. Another vital next step for review each year includes contract changes, which impact reimbursement for respective CPT codes.

Taking a more granular look at best practices for coding and reimbursement strategies, most denials are due to clerical errors on the claim such as wrong demographic data, incorrect birthdates, transposition of contract numbers, non-covered diagnoses codes or incorrect CPT codes.

To reduce these denials, an audit process is required before submitting the claim. Some providers use a third party — a clearinghouse — to review the claims. Published resources are also required to remain apprised of the billing rules and changes. I recommend investing in a current CPT manual published by the American Medical Association (AMA) to study code changes and new guidelines for correct coding. It will include information about the use of modifiers, which are two alpha-numeric characters appended to the CPT code, to convey additional information about the code used, any changes that occurred during the procedure or a more

complicated than normal procedure performed under unusual circumstances. If denials are associated with a diagnosis, obtain a current ICD-10-CM manual, published by the World Health Organization (WHO), which classifies diagnoses and the reason for visits in all health care settings, as well as which are appropriate for reimbursement based on documentation supporting the procedure and diagnosis.

Understanding Appropriate Code Use

Is CPT code 95806 the only code to use for a home sleep test (HST) monitored for four hours, provided by a hospital in the critical care unit and ordered as an emergency procedure?

Before we can answer that, we need to know if the payer requires a different CPT code or the appropriate G-code: G0398, G0399 or G0400. Since the monitoring lasted only four hours, a modifier 52 is added to the CPT code on the claim. This indicates the study is considered reduced services and does not meet the required duration of six hours as stated in the definition of CPT 95806.

Assuming the study is of adequate quality for interpretation and billing, the hospital will add another modifier, TC, to indicate the claim is submitted for the technical component of the procedure. The interpreting licensed provider will submit a claim with modifier 26 for professional services to interpret the clinical data and render a diagnosis. To learn if there are other codes or modifiers to append for the emergent condition or the location of services, a review of the CPT guidelines for 95806 is completed with analysis of the coding and billing guidelines referenced in the CMS standards, auditing for medical necessity confirmed through review of the clinical documentation and confirmation for what location of the services are approved for reimbursement. This is an important verification, as HSTs are routinely completed in the home, or a residential domicile verses the inpatient critical care unit. Careful study of the approved diagnosis confirms if the current diagnosis is excluded, since there are no guidelines to cover 95806 (the home sleep test) for emergent health conditions in inpatient settings. The scope of the HST does not conform with the current order for sleep testing.

Review of the clinical documentation is essential to identify the appropriate procedure based on the emerging health status of the patient. Consultation with the medical director or patient's attending provider is required to define the appropriate procedure to be completed for this patient's clinical status.

Hence, add a review of the LCD and compare this to contract changes for commercial carriers to your checklist of strategies for effective reimbursement. Include a review of the CPT codes, the guidelines assigned to respective codes, the indications for selected ICD-10-CM diagnostic codes and when to use modifiers, and validate the clinical documentation supports medical necessity for payment of the procedure and clinical diagnosis.

A key change for all programs starting in 2022 is compliance with the Surprise Billing legislation. Understanding required documentation and communication with patients is a pathway to preventing billing nightmares. The legislation requires providing the patient with a good faith estimate of charges and subsequent financial responsibilities prior to the provision of services. Some organizations have deemed themselves exempt from compliance with the legislation in error. It requires both providers and health plans to assist patients in accessing health care cost information. For a good review of the legislation, the American Hospital Association has posted a summary.

A key change for all programs starting in 2022 is compliance with the Surprise Billing legislation.

Billing and coding are not done in a silo. Enlist the assistance of the revenue integrity team, registration department, insurance contract specialists and clinical experts to complete a regular review of the sleep center's clinical documentation standards and billing practices.

With the changing landscape for clinical services, there are other opportunities to consider in the face of all these changes. Collaboration with third party payers, the patient, your referral network and educating the community will boost reimbursement for services. Effective financial processes are built on a patient-centric care continuum, with savings realized through innovative care delivery systems and effective care coordination. It requires a partnership with key stakeholders in the facility, the primary care network and other specialists to systematically manage the patient's care plan.

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The Reluctant Patient: Simplified Motivational Enhancement Therapy to Improve CPAP Adherence

By Susan Hoefs, RPSGT, CCSH

It is generally accepted that continuous positive airway pressure (CPAP) adherence is considered more than four hours per night during at least 70% of the nights in a 90-day trial and maintaining this adherence for as long as CPAP is prescribed.[1] While wearing CPAP longer than four hours each night does improve the signs and symptoms of obstructive sleep apnea (OSA), it is advised to wear the CPAP mask all the hours that the patient sleeps, including naps.

It's estimated that between 20% to 50% of CPAP users have poor or no adherence.[2] A great part of this lack of adherence is due to poor mask fit, incorrect pressure or algorithm, lack of education, not understanding the purpose of CPAP use, lack of family support and the absence of follow-up by the medical professionals involved in the diagnosis and initial CPAP setup.

Once it is ascertained that a patient has the correct mask and prescribed pressure, education and behavioral interventions become a priority.

It's estimated that between 20% to 50% of CPAP users have poor or no adherence.

The American Academy of Sleep Medicine (AASM) suggests that behavioral and/or troubleshooting interventions be given during the initial period of positive airway pressure (PAP) therapy in adults with OSA.[3] A simplified version of motivational enhancement therapy (MET) can be very effective for these interventions, and take less time compared to standard follow-up.

MET is a treatment often used by psychologists for drug and alcohol addiction.[4] It is a behavioral intervention devised on the principles of motivational interviewing and used to invoke inwardly motivated change.

An example of the success and simplicity of simplified MET was a 2013 study[5] using a brief, simplified protocol based on MET principals. The study included 83 patients randomized to a control group and a group that underwent the simplified MET protocol. The control group had standard education provided by a sleep technologist. The intervention group had the standard education provided by a sleep technologist but also had a simplified protocol of MET delivered by a psychologist during two, 20-minute appointments and six, 10-minute phone calls over a 32-week period. Patients in the MET group increased CPAP use by 99 minutes per night. Average nightly adherence for 6 months was 99.0 min/night higher with CPAP and MET compared with CPAP only. In a number of cases it was enough to get them past the four-hour requirement that Medicare and some insurances require.

Subjects with OSA who received motivational enhancement education in addition to usual care were more likely to show better adherence to CPAP treatment with greater improvements in treatment self-efficacy and daytime sleepiness. This difference in adherence remained consistent in a subset of patients followed for 12 months, suggesting that the beneficial effect of MET was retained after the intervention had been withdrawn. (For additional studies, see the related studies list at the end of this article.)

A Simplified MET Program

Sleep technologists and clinical sleep educators interested in adding a simplified MET program to the usual education offered to patients must first understand the basics of MET before determining if it would be a good fit for their patients. The basic outline of a simplified MET program is as follows:

Maintain a collaborative — rather than educational — style of interaction with the patient. Patients that have a hard time adjusting to CPAP often perceive the situation to be such that the technologist is telling them what to do instead of realizing that the technologist is simply trying to help the patient.

Discuss the patient's readiness to begin CPAP. The patient may feel an entire night of CPAP is overwhelming. As long as the patient continues to add minutes each night, start with a few hours, perhaps while sitting up reading.

Confirm the patient understands the health risks of OSA. There are a surprising number of patients that don't actually believe that they could succumb to any of the risks of untreated OSA. Some patients even have a risk factor such as Type 2 diabetes and still think it isn't related to OSA.

Determine if the patient believes CPAP reduces these risks. Once the patient accepts that the risks are real, do they actually believe CPAP can help reduce OSA symptoms?

Resolve the patient's ambivalence by establishing consistent CPAP usage

patterns. Discuss the minimum time that CPAP needs to be used to be considered adherence. The patient should understand that it is Medicare and insurance companies dictating these numbers. Further discuss the benefits of using CPAP regularly or throughout the entire night.

Increase the patient's confidence toward using CPAP regularly. Share success stories of CPAP users that started out just like they did.

Set goals for CPAP that the patient feels comfortable with. Perhaps start with a few hours with a schedule building up to four hours. Then celebrate reaching four hours and set a schedule to add more minutes little by little.

Determine a reward for accomplishing these goals. The patient may be more motivated by treating themselves to a manicure or spa treatment, buying a new tool or going to a movie. Sometimes just praise from the sleep technologist is enough.

Express empathy. Sleep technologists need to build trust and show that they understand that CPAP isn't always easy.

Develop discrepancy. Recognize the distance the patient needs to emotionally cover to meet their goal of wearing CPAP.

Avoid arguments. This is not easy. Give positive answers whenever possible.

Roll with resistance. If the patient is exhibiting resistance, try to go along with it rather than push back.

Support self-efficacy. Self-efficacy is defined as the way people view their own competence and achieve their own goals. Encourage the patient to realize they are capable of many things, including wearing a CPAP device.

As a last resort, ask the patient to just try wearing the mask. Ask them to wear it while watching television, reading a book or during a nap. CPAP treatment is intimidating because it is never ending and patients often ask if they will ever get off CPAP. Even with substantial weight loss, it's unlikely an OSA patient will be able to discontinue treatment. They may need a lower pressure or may have a bit of a respite, but as age and weight increase, so does OSA. As this can be a shock to patients, rather than presenting CPAP as a forever treatment, consider presenting it as a trial at first — something to try over the next 30 to 90 days.

First get through the trial, get it paid for and then worry about utilizing a CPAP device for the rest of their life.

The Importance of Understanding Medicare and Insurance Requirements

It's imperative to explain the Medicare or other insurance requirements to your patients. It's also important to explain the ramifications of failing the 90-day trial. If the patient decides at the end of the trial period they liked the CPAP experience but didn't complete enough hours to keep the CPAP device, Medicare won't pay for it. The important thing to keep in mind here is to first get through the trail, get it paid for and then worry about utilizing a CPAP device for the rest of their life.

Patients will give push back and might even say, "I'll just have the surgery." Explain that CPAP usage is still the first line treatment for OSA irrespective of the severity of the OSA.[6] Patients that prefer to try alternative treatments may not qualify for an oral appliance, surgery or other treatment due to weight, the severity of their OSA or other factors. CPAP is non-invasive and reversible.[4] Some of the other options are not and may not be covered by their insurance.

Conclusion

Patients can always try an alternative if CPAP isn't working for them. Implementing MET into the CPAP treatment can be and has been proven successful in improving adherence, as well as save both the sleep technologist and patient a great deal of time.

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