Background

Two broad categories of biometric devices are available for the testing and diagnosis of obstructive sleep apnea (OSA). In-lab polysomnography (PSG), the current gold-standard for defining the presence and severity of OSA, is a very common medical procedure in the United States. According to conservative estimates more than 1 million PSGs are performed in the United States annually. The test is typically carried out as an in-facility procedure lasting one or more nights and requiring the oversight of a technologist. An in-home sleep test (HST) typically involves portable biometric devices that are applied by patients and worn overnight, unattended by a technologist. These two types of tests differ in a several important ways including: (i) range of data collected; (ii) reliability of the test for assessing different levels of OSA severity; (iii) perceived acceptability by patients; and (iv) cost. These differences will be briefly reviewed here.

Range of Data Collected

In-lab PSG provides an opportunity for extensive data collection. Type I (attended by a technologist) and type II (unattended by a technologist) devices typically include sensors capable of measuring:

- EEG
- EOG
- ECG/heart rate
- Chin EMG
- Limb EMG
- Respiratory effort at thorax and abdomen
- Air flow from nasal cannula thermistor and/or X-Flow (AASM recommends RIP technology)
- Pulse oximetry
- Additional channels for CPAP/BiPap levels, CO2, pH, pressure, etc.

An HST with a Type III portable monitor, unattended with a minimum of four channels must include the following channels:

- 2 respiratory movement/airflow
- 1 ECG/heart rate
- 1 oxygen saturation

An HST, on the other hand, is only considered valid and reliable for detecting moderate/severe OSA (AHI > 15/hour). Among those patients whose HST test result is OSA-negative, are both true negatives, as well as others who actually suffer from low/moderate OSA (false negatives).

Perceived Acceptability by Patients

From the point of view of the patient, an HST is less complicated, more comfortable and more convenient than an in-lab PSG. When given the option, most patients state a clear preference for the in-home procedure.

Comorbidities

HSTs are contraindicated for individuals who suffer from significant comorbid conditions due to the tendency for these conditions to degrade the accuracy of the tests, rendering the results biased. In-home diagnostic HSTs are not recommended for individuals suspected of having OSA if any of the following comorbidities are present:

- Moderate-to-severe pulmonary disease, such as chronic obstructive pulmonary disease (COPD)
- Moderate-to-severe neuromuscular/neurodegenerative disorder causing restrictive lung diseases (e.g., kyphoscoliosis, myasthenia gravis, amyotrophic lateral sclerosis [ALS], polio, polymyositis, Guillain Barré syndrome)
- Congestive heart failure, class III or IV
- Obesity hypoventilation syndrome, previously documented
- Pulmonary hypertension
- Additional sleep disorders other than OSA (e.g., central sleep apnea, parasomnias, narcolepsy, REM behavior sleep disorder)

Rationale for OSA Prediagnostic Review and Triage Program

Recently published literature recognizes that, while in-facility sleep studies (i.e., attended polysomnographies) are the gold standard for diagnosing OSA, the level of precision which these tests provide is unnecessary in more than 50 percent of the tests currently being implemented. When patients have significant OSA (AHI > 15/hr), unattended in-home tests are a valid, reliable and more cost-effective diagnostic option. In such cases – and when there is no evidence of complications related to comorbidities – the more costly and intrusive in-facility studies are unnecessary. However, simply diverting all referrals to in-home testing is not an optimal solution since patients with
Obstructive Sleep Apnea (OSA) Diagnostic Management

When OSA risk status is accurately assessed prediagnostically, how does optimal screening and triaging work procedurally for those patients who are suspected by their physicians of having OSA?

Since unattended in-home tests are capable of validly diagnosing significant OSA (AHI > 15/hr) but are less accurate when a patient’s OSA is mild-to-moderate, the ideal screening tool would identify patients at elevated risk of moderate/severe OSA prediagnostically and direct them to in-home testing. All others would then be directed to in-lab testing to determine if they either have low/moderate OSA or are OSA true negatives. This approach would reduce the unnecessary double testing that results when patients with low-to-moderate OSA (or who are actually OSA-negative) are directed to in-home testing as a standard first step and then retested in-lab. It also reduces the unnecessary use of in-lab testing among individuals with moderate/severe OSA who could have been accurately diagnosed with simpler in-home methods.

How to Assess a Patient’s Prediagnostic Risk of Having Moderate/Severe OSA

Until recently, identifying patients who are at increased risk of having moderate/severe OSA prior to diagnostic testing had proven to be a challenge. Research had shown that available algorithms designed to predict OSA diagnostic test outcomes (such as the Modified Neck Circumference Algorithm or the STOP-BANG Algorithm) had low predictive validity. Similarly, clinical judgment alone was found to be of limited utility. Recognizing the need for more accurate prediagnostic methods of predicting elevated OSA risk, research was carried out and new findings recently published. A new algorithm based upon seven clinical variables has been shown to be far more accurate in predicting OSA risk status than anything previously available, including clinical judgment alone.

Recent Clinical Research Leading to the Development of the Prediagnostic OSA Triaging Program

A collaborative team of clinical sleep specialists carried out a research program designed to develop and test a new methodology for OSA assessment. This included an analytical algorithm for identifying patients who have a high likelihood of having moderate/severe OSA. Their work involved the building, testing and validating of new analytic tools based upon actual clinical cases from their practices. Their work was peer-reviewed and recently accepted for publication in the Annals of the American Thoracic Society (see reference 17). The resulting methods adhere strictly to the criteria of the American Academy of Sleep Medicine. The program developed for Humana by HealthHelp, which was designed to facilitate clinical review for diagnostic services related to OSA, was based directly upon this pivotal research.

The seven variables which make up this algorithm include:

- Age
- History of hypertension
- History of diabetes mellitus
- Body mass index
- Neck circumference (in inches)

Plus patient’s self-reported Likert ratings based upon the following statements:

- I am told I snore in my sleep.
- I am told I stop breathing in my sleep.

Analysis of the seven data points for each patient according to this algorithm yields a recommendation for in-lab PSG or in-home test based on the calculated likelihood of having moderate/severe OSA.
References


