Home Sleep Studies - Pediatric

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This Medical Policy document describes the status of medical technology at the time the document was developed. Since that time, new technology may have emerged, or new medical literature may have been published. This Medical Policy will be reviewed regularly and be updated as scientific and medical literature becomes available; therefore, policies are subject to change without notice.

DESCRIPTION

Note: *This policy applies only to pediatric individuals 17 years old or less.*

Obstructive Sleep Apnea (OSA)

Obstructive sleep apnea (OSA) is characterized by episodes of complete or partial upper airway obstruction during sleep, often resulting in gas exchange abnormalities and disrupted sleep. Untreated OSA in children and may be associated with learning and behavioral problems, cardiovascular complications, and impaired growth (including failure to thrive). OSA occurs in 1% to 5% of children. It can occur at any age and may be most common in those between two and six years of age.

Adenotonsillar hypertrophy and obesity, defined as a BMI greater than the 90th percentile for the weight/height ratio, are the major risk factors for obstructive sleep apnea (OSA) in otherwise healthy children. The contribution of each of these risk factors varies among individuals and also tends to vary with age. Other risk factors for OSA include medical, neurological, skeletal or dental conditions that reduce upper airway size,

affect the neural control of the upper airway, or impact the collapsibility of the upper airway. Examples include the following:

- Achondroplasia
- Cerebral palsy
- Craniofacial anomalies (e.g., retrognathia, micrognathia, midface hypoplasia)
- Down syndrome
- Family history of OSA
- History of low birth weight
- History of prematurity and multiple gestation
- Muscular dystrophy or other neuromuscular disorders
- Mucopolysaccharidoses (e.g., Hunter syndrome or Hurler syndrome)
- Myelomeningocele
- Orthodontic problems (e.g., high narrow hard palate, overlapping incisors, cross bite)
- Prader-Willi syndrome

Clinicians should incorporate questions about sleep into routine health assessment for children of all ages because parents may not volunteer information about their child's sleep or may not appreciate the potential relationship between sleep problems and daytime behavior. Children with sleep disorders may present with different symptoms than adults. Most children with obstructive sleep apnea may present with daytime attentional or behavioral problems rather than overt sleepiness. Even within the pediatric age group, the clinical manifestations of sleep problems may vary bv age and developmental level. A school aged child with excessive sleepiness may exhibit motor over-activity, inattentiveness or irritability and may worsen certain medical or psychiatric problems. In adolescents sleep problems may coexist with anxiety or depression

A thorough sleep and medical history provides the foundation for diagnosis and management of sleep problems. A variety of checklists and questionnaires are available to supplement the history. One of the best validated questionnaires is the Sleep-Related Breathing Disorder (SRBD) scale from the Pediatric Sleep Questionnaire (PSQ). The SRBD generates a score that correlates OSA related impairment of behavior, quality of life and sleepiness. The SRBD scale contains a four-item sleepiness subscale that has been validated against the multiple sleep latency test (MSLT), the total score on the PSQ ranges from 0.0 to 1.0, and a score of $\geq$ 0.33 suggests high probability for presence of OSA. Another questionnaire that may be utilized as an initial screening tool, is the 8-item screening tool I'M SLEEPY which was developed for primary care physicians to screen for pediatric OSA. This type of screening can help identify patients who should be evaluated with a more detailed sleep history. The history should include details about the duration and frequency of the problem, temporal profile of onset (abrupt, gradual, intermittent), and degree of variability from night to night. Most chief complaints can be placed into one (or more) of four categories:

- Abnormal movements or behaviors before or during sleep
- Difficulty initiating or maintaining sleep
- Excessive daytime sleepiness
- Snoring or other breathing problems during sleep

Parents are generally asleep during the night, they may struggle to provide a full history, as they may witness only portions of nighttime events. Some parents may generate diaries or logs of sleep problems, and the widespread availability of home video cameras and smartphones have increased the opportunity for physicians to observe episodes of abnormal movement or behavior.

A physical examination should be completed and is directed towards identification of causes of sleep disorders or conditions associated with sleep pathology. The examination includes a general physical examination, oropharynx/airway examination and neurological examination.

Signs and symptoms of OSA in children and adolescents include the following:

- **History**
  - Attention deficit/hyperactivity disorder (ADHD)
  - Behavioral problems
  - Cyanosis
  - Daytime sleepiness
  - Frequent snoring ($\geq$ 3 nights/week)
  - Gasps/snorting noises/observed episodes of apnea Labored breathing during sleep
  - Headaches on awakening
  - Learning problems
  - Sleep enuresis (especially secondary enuresis- which is enuresis after at least 6 months of continence)
  - Sleeping in a seated position or with the neck hyperextended

- **Physical Examination**
  - Adenoidal facies (dentofacial growth anomaly caused by long term adenoid hypertrophy)
  - Failure to thrive
  - High arched palate
  - Hypertension
  - Micrognathia/retrognathia
  - Tonsillar hypertrophy
  - Underweight or overweight

Thorough assessment and treatment of children and adolescents with sleep disorders can require a multidisciplinary approach. For suspected obstructive sleep apnea (OSA) if

polysomnography is indicated, this can be arranged by the sleep physician. An overnight supervised polysomnography (PSG) in a sleep laboratory/facility remains the gold standard diagnostic test to diagnose, exclude or assess obstructive sleep apnea (OSA) severity in children and adolescents. The international Classification of Sleep Disorders, Third Edition (ICSD-3) defines pediatric OSA as an AHI $\geq$ 1 or a pattern of obstructive hypoventilation defined as at least 25% of total sleep time with hypercapnia ($PaCO_2$ > 50 mm Hg) in association with snoring, flattening of the nasal pressure waveform, or paradoxical respiratory efforts. Although snoring and obstructive sleep apnea are generally the most common indications for evaluation, 25% of pediatric patients referred for evaluation of a sleep disorder may have a suspected non-respiratory condition.

Home Sleep Studies

Home sleep studies (home sleep apnea test) is performed in the home (unattended), the portable monitoring device measures oxygen saturation (oxygen level), heart rate, airflow and breathing effort and it will also record time spent snoring and the patient's sleep position. The morning after the home sleep study, the monitor is dropped off at the location where the device was received, and a sleep specialist will analyze the information. Home sleep studies are an alternative to facility-based sleep studies (polysomnography) and are frequently performed in adult patients. Home sleep studies (home sleep apnea test) in pediatric patients has been evaluated in the diagnosis of obstructive sleep apnea, however, home sleep studies are difficult in children as they tend to move frequently during sleep resulting in artifact, and young children or those with limited comprehension may remove sensors during the night. The clinical use of home sleep studies in the pediatric population is not recommended due to insufficient evidence.

(2017) Kirk et al. American Academy of Sleep Medicine (AASM) commissioned a task force of 8 experts in sleep medicine to review the available literature on the use of an HSAT (home sleep apnea test) to diagnose obstructive sleep apnea (OSA) in children. The task force developed the position statement based on a thorough review of these studies and their clinical expertise. The purpose of the position paper is to establish the American Academy of Sleep Medicine's (AASM) position on the use of a home sleep apnea test (HSAT) for the diagnosis of obstructive sleep apnea (OSA) in children (birth to 18 years of age). The AASM position statement states, "use of a home sleep apnea test is not recommended for the diagnosis of obstructive sleep apnea in children. The ultimate judgement regarding propriety of any specific care must be made by the clinician, in light of the individual circumstances presented by the patient, available diagnostic tools, accessible treatment options and resources."

Based on the literature review included in the American Academy of Sleep Medicine (AASM) position paper the following information was provided regarding the task forces review of the available peer reviewed medical literature:

Limited Channel Home Sleep Apnea Testing

SleepImage System

The SleepImage System is cloud-based software as a medical device that generates AHI from data recorded with a single photoplethysmogram sensor. The SleepImage algorithms calculate heart rate variability, respiration, and oxygen saturation with cardiopulmonary coupling analysis.

(2020) Hilmisson et al. compared results calculated by the SleepImage System with manually scored PSG in 805 children 5 to 9.9 yrs of age who participated in the Childhood Adenotonsillectomy Trial (CHAT). The CHAT study included 1244 habitually snoring children who were referred for PSG. A total of 805 children had successfully collected data from the sensor, while 439 did not. Kappa was 0.81, 0.89, and 0.91 for mild, moderate, and severe sleep apnea, respectively. A proposed benefit is that this would be easier for children compared to a test requiring multiple sensors in a sleep laboratory and improve access. Further study in a wider population is needed to evaluate whether this system might be a suitable method for evaluating sleep parameters in the home.

Technical Feasibility of Home Sleep Apnea Tests (HSATs) in Children

Data suggest that an HSAT may be technically feasible in the pediatric population under carefully controlled conditions (e.g., electrodes placed by a trained clinician). However, the likelihood of success may be significantly reduced if sensors are placed by caregivers instead of trained professionals or when more stringent criteria are used to define acceptable studies. Additional data examining the use of an HSAT in real-life settings with standardized recording channels and criteria for success is required to accurately determine feasibility of HSATs in children.

Validity of Home Sleep Apnea Tests (HSATs) in Children

There are limited published data comparing HSATs to the gold standard of PSG in children. In total these validation studies report data from 208 children in whom the gold standard of PSG was directly compared with HSATs for the diagnosis of OSA; however, an HSAT was only performed at home in 2 of the studies. Overall, these validation studies reported a relatively wide range of sensitivities and specificities that varied to some extent with severity of OSA.

Identifying Arousals and Hypoventilation

The AASM Scoring Manual identifies separate respiratory rules for the scoring of pediatric sleep studies. This includes the option to score a hypopnea if the event is associated with an arousal, rather than just a 3% oxygen desaturation, which requires EEG monitoring. The pediatric respiratory rules also recommend monitoring hypoventilation in children during a diagnostic study, which requires CO2 monitoring. An ideal HSAT would capture all of these parameters:

- Ability to estimate total sleep time (e.g., actigraphy)
- Arousal identification (i.e., EEG)

- Body position
- CO_2 monitoring
- Electrocardiogram
- Nasal airflow pressure
- Oronasal thermistry
- Oxygen saturation
- Respiratory excursion

Only two of the studies described included EEG monitoring, and none of the studies included CO2 monitoring for the scoring of hypoventilation. In general, the devices used to perform an HSAT do not include EEG or end-tidal or transcutaneous CO2 monitoring and, therefore, are unable to score arousals or monitor hypoventilation. The lack of EEG and CO2 monitoring may result in significantly underestimating the presence and severity of disease in children, which may result in differing diagnoses and clinical management strategies in children using an HSAT, as compared to decisions based on PSG.

Use of Home Sleep Apnea Tests (HSATs) in Children with Comorbidities or Very Young Children

None of the available studies evaluating the feasibility or validity of HSATs included children with comorbid medical conditions. HSATs have been used in a few other small studies of children with comorbid conditions, but the validity and feasibility of the tests were not the focus of those reports. Finally, the review of the literature identified no validation studies for the use of HSATs in infants and young children (< 2 years old). These populations present unique challenges to diagnostic testing, and the consequences of misdiagnosing or underdiagnosing are potentially more severe. The lack of validation and feasibility testing in these populations contributed to the recommendation against using HSATs for the diagnosis of OSA in children.

Conclusion

In contrast to the recently published AASM clinical practice guideline on the diagnostic testing for adult OSA, an objective evaluation of the available literature does not support the use of HSATs for the diagnosis of OSA in children, due mostly to a lack of sufficient validation in the home, and insufficient monitoring available in most devices used to conduct an HSAT. The task force identified several areas for future research, including the need to define optimal physiologic parameters to be measured in individual patients, develop additional tools to assess sleep/wake status, validate an ideal HSAT device against PSG, create a diagnostic algorithm to identify ideal candidates for an HSAT, and establish appropriate alternatives to PSG.

In summary, data are currently insufficient to support using HSATs for the diagnosis of OSA in children.

(2020) The American Academy of Sleep Medicine issued a position statement on the appropriate clinical use of home sleep apnea testing (HSAT). This updated position

statement included the following on the use of HSAT for the diagnosis of OSA in children: “An objective evaluation of the available literature found that an HSAT may be technically feasible in carefully controlled conditions when electrodes are placed on a child by a trained clinician. However, there is insufficient evidence to support the efficacy of an HSAT when used at home to assess a child’s breathing during sleep.”

Summary of Evidence

Based on the review of the peer reviewed medical literature, the evidence is limited comparing home sleep studies to facility-based polysomnography which is the gold standard in the diagnosis of obstructive sleep apnea in children. The literature is also limited in comparing home sleep studies to polysomnography in children with comorbidities or in young children (< 2 years of age), in this population of patient’s home sleep studies present a unique challenge to diagnostic testing in which the consequences of misdiagnosing or underdiagnosing are potentially more severe. Studies that focused on the feasibility of using home-based sleep studies in children suggest that home sleep studies may be technically feasible in the pediatric population under carefully controlled conditions (e.g., electrodes placed by a trained clinician). However, additional data examining the use of home sleep studies in real-life settings with standardized recording channels and criteria for success is required to accurately determine the feasibility of this testing. In addition to the paucity of literature supporting the use of home sleep studies in children, there are unique challenges associated with conducting home sleep studies in this patient population: the body sizes of children can vary significantly; and the cognitive and emotional maturity of children is less predictable than that of adult patients, this makes it difficult to identify patients who will be able to tolerate the numerous sensors that must be worn throughout the night to obtain a valid and accurate test. Further studies are needed in the pediatric population to compare home sleep studies to facility-based polysomnography (PSG), to define optimal physiologic parameters to be measured in individual patients, develop additional tools to assess sleep/wake status, create a diagnostic algorithm to identify ideal candidates from home sleep study testing and establish appropriate alternatives to PSG. In 2020, the American Academy of Sleep Medicine (AASM) issued a new position statement on the use of home sleep apnea testing for the diagnosis of obstructive sleep apnea (OSA) and this position statement included the following on the use of HSAT for the diagnosis of OSA in children: “An objective evaluation of the available literature found that an HSAT may be technically feasible in carefully controlled conditions when electrodes are placed on a child by a trained clinician. However, there is insufficient evidence to support the efficacy of an HSAT when used at home to assess a child’s breathing during sleep.” The use of home sleep studies in the pediatric population is not recommended due to insufficient evidence to determine the effects of this testing on net health outcomes.

Practice Guidelines and Position Statements

American Academy of Pediatrics (AAP)

(2002; Updated 2012) The American Academy of Pediatrics published guidelines on the diagnosis and management of uncomplicated childhood OSA associated with

adenotonsillar hypertrophy and/or obesity in an otherwise healthy child treated in the primary care setting.

- All children or adolescents be screened for snoring, and PSG is performed in children or adolescents with snoring and symptoms or signs of OSA as listed in the guideline. If PSG is not available, an alternative diagnostic test or referral to a specialist may be considered (option). The estimated prevalence rates of OSA in children or adolescents ranged from 1.2% to 5.7%. Adenotonsillectomy was recommended as the first-line treatment for patients with adenotonsillar hypertrophy, and patients should be reassessed clinically postoperatively to determine whether additional treatment is required. High-risk patients should be reevaluated with an objective test or referred to a sleep specialist. CPAP was recommended if adenotonsillectomy was not performed or if OSA persisted postoperatively. Weight loss was recommended in addition to other therapy in patients who are overweight or obese, and intranasal corticosteroids are an option for children with mild OSA in whom adenotonsillectomy is contraindicated or for mild postoperative OSA. (*Accessed March 2022*)

American Academy of Sleep Medicine (AASM)
(2020) The American Academy of Sleep Medicine released a position statement regarding the appropriate clinical use of home sleep apnea test (HSAT). This updated position statement included the following on the use of HSAT for the diagnosis of OSA in children:

- "The use of an HSAT is not recommended for the diagnosis of OSA in children. An objective evaluation of the available literature found that an HSAT may be technically feasible in carefully controlled conditions when electrodes are placed on a child by a trained clinician. However, there is insufficient evidence to support the efficacy of an HSAT when used at home to assess a child's breathing during sleep."

(2017) The American Academy of Sleep Medicine (AASM) issued a position paper for the use of home sleep apnea test (HSAT) for the diagnosis of OSA in children, which states:

- The use of a home sleep apnea test is not recommended for the diagnosis of obstructive sleep apnea in children.
- *For the purpose of this position statement, children are defined as individuals < 18 years of age.*
- The clinical use of HSATs in pediatric populations is not recommended due to insufficient evidence. Specifically, there is limited literature comparing HSATs to PSG, the gold standard, in children. The task force was unable to identify literature on the use of HSAT devices that monitor CO_2 or have the ability to identify arousals, measurements that have been viewed as critical in pediatric populations. Additionally, the task force identified limited literature comparing HSATs to PSG in children with comorbidities or in young children.

- Ideal HSAT Parameters
  - Ability to estimate total sleep time (e.g., actigraphy)
  - Arousal identification (i.e., EEG)
  - Electrocardiogram
  - Oxygen saturation
  - Body position
  - Respiratory excursion
  - Nasal airflow pressure
  - Oronasal thermistry
  - CO_2 monitoring

In addition to the paucity of literature supporting the use of HSATs in children, there are unique challenges associated with conducting HSATs in children that contributed to the position against its use. The body sizes of children can vary significantly, even within a narrow age range, and the cognitive and emotional maturity of children is less predictable than that of adult patients. This makes it difficult to identify patients who will be able to tolerate the numerous sensors that must be worn through the night.

In summary, data are currently insufficient to support using HSATs for the diagnosis of OSA in Children. However, it is worthwhile to continue developing and validating HSAT devices for this population. Current barriers to undergoing PSG include factors to 1) economics (e.g., insurance deductible, parent time off of work), 2) access to care (e.g., long wait, distance to facility, higher altitudes), 3) social situations (e.g., inconvenience, single parent). If an appropriate HSAT device could be shown to be a suitable alternative to PSG, it could potentially circumvent many of these barriers and improve the quality and efficiency of care for pediatric patients with OSA. (*Accessed March 2022*)

PRIOR APPROVAL

Not applicable

POLICY

Home sleep studies (home sleep apnea test) are considered **investigational** in pediatric patients (age 17 years old and less) due to insufficient evidence to determine the effects on net health outcomes.

Based on review of the peer reviewed medical literature there is limited evidence comparing home sleep studies (home sleep apnea test) to facility-based polysomnography which is the gold standard in the diagnosis of obstructive sleep apnea in children. The literature is also limited in comparing home sleep studies to polysomnography in children with comorbidities or in young children (< 2 years old). There is lack of validation and feasibility testing in this patient population which contribute to the recommendation against using home sleep studies for the diagnosis of obstructive sleep apnea (OSA) in children.

In 2020, the American Academy of Sleep Medicine (AASM) issued an updated position statement on the use of home sleep apnea testing for the diagnosis of obstructive sleep apnea (OSA) which states: "there is insufficient evidence to support the efficacy of a home sleep apnea test (HSAT) when used at home to assess a child's breathing during sleep." Further studies are needed in the pediatric population to compare home sleep studies to facility-based polysomnography (PSG), to define optimal physiologic parameters to be measured in individual patients, develop additional tools to assess sleep/wake status, create a diagnostic algorithm to identify ideal candidates from home sleep study testing and establish appropriate alternatives to PSG. The use of home sleep studies in the pediatric population is not recommended due to insufficient evidence to determine the effects of this testing on net health outcomes.

PROCEDURE CODES AND BILLING GUIDELINES

To report provider services, use appropriate CPT* codes, Alpha Numeric (HCPCS level 2) codes, Revenue codes, and/or ICD diagnosis codes.

- 95800 Sleep study, unattended, simultaneous recording; heart rate, oxygen saturation, respiratory analysis (e.g., by airflow or peripheral arterial tone), and sleep time
- 95801 Sleep study, unattended, simultaneous recording; minimum of heart rate, oxygen saturation, and respiratory analysis (e.g., by airflow or peripheral arterial tone)
- 95806 Sleep study, unattended, simultaneous recording of, heart rate, oxygen saturation, respiratory airflow, and respiratory effort (e.g., thoracoabdominal movement)
- G0398 Home sleep study test (HST) with type II portable monitor, unattended; minimum of 7 channels: EEG, EOG, EMG, ECG/heart rate, airflow, respiratory effort and oxygen saturation
- G0399 Home sleep test (HST) with type III portable monitor, unattended; minimum of 4 channels: 2 respiratory movement/airflow, 1 ECG/heart rate and 1 oxygen saturation
- G0400 Home sleep test (HST) with type IV portable monitor, unattended; minimum of 3 channels

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POLICY HISTORY

Date	Reason	Action
April 2022	Annual Review	Policy Renewed
April 2021	Annual Review	Policy Revised
April 2020	Annual Review	Policy Renewed
April 2019	Annual Review	Policy Renewed
April 2018		New Medical Policy Created

New information or technology that would be relevant for Wellmark to consider when this policy is next reviewed may be submitted to:

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