PAKISTAN CHEST SOCIETY

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STRIVING FOR PULMONARY CARE

Clinical Practice Guidelines

Obstructive Sleep Apnea

PAKISTAN CHEST SOCIETY-2026

Guidelines On

Obstructive Sleep Apnea

March 2026

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Preface

Obstructive Sleep Apnea (OSA) represents a significant and evolving public health concern, characterized by its high prevalence, multifactorial pathophysiology, and substantial impact on morbidity and mortality. The disorder is closely linked with cardiovascular, metabolic, and neurocognitive complications, yet remains considerably underdiagnosed, particularly in low- and middle-income countries such as Pakistan. This gap underscores the need for contextually relevant, evidence-based clinical guidance.

The present Clinical Practice Guidelines, developed under the auspices of the Pakistan Chest Society, aim to provide a structured and scientifically robust framework for the identification, evaluation, and management of OSA. These guidelines are informed by a critical appraisal of contemporary international literature, while being carefully adapted to reflect the epidemiological trends, healthcare infrastructure, and resource constraints specific to the local setting.

The central objective of this document is to facilitate uniformity in clinical practice by promoting standardized diagnostic pathways and rational therapeutic strategies. Emphasis is placed on comprehensive clinical assessment, appropriate utilization of diagnostic modalities, and individualized management approaches, including positive airway pressure therapy, behavioral interventions, and adjunctive treatments. Furthermore, the guidelines highlight the importance of multidisciplinary collaboration and patient engagement in optimizing long-term outcomes.

The development of these guidelines reflects the collective expertise and scholarly contribution of the Guideline Committee and the OSA Working Group. Their efforts have ensured that the recommendations are both methodologically sound and pragmatically applicable.

It is anticipated that this document will serve as an authoritative reference for clinicians, contribute to improved recognition and management of OSA, and support the broader advancement of sleep medicine within Pakistan.

Dr. Javed Husain
M.D., F.C.C.P
Consultant Pulmonologist & Intensivist
Diplomate American Boards of Pulmonary,
Sleep & Critical Care Medicine,
The Chest Clinic

Message by the President

Pakistan Chest Society

Obstructive sleep apnea is increasingly recognized as a contributor to cardiovascular disease, metabolic dysfunction, and impaired quality of life. These guidelines aim to improve awareness, facilitate timely diagnosis, and standardize treatment approaches, including positive airway pressure therapy. The Pakistan Chest Society emphasizes the need for integrating sleep medicine into routine respiratory practice.

Prof. Shereen Khan

President
Pakistan Chest Society

Message by the Chairman

Guideline Committee, Pakistan Chest Society

It gives me great pleasure to present the Guidelines for the Management of Obstructive Sleep Apnea (OSA) by the Pakistan Chest Society. These guidelines aim to improve early recognition and standardized care for a condition that often remains undiagnosed yet significantly affects sleep quality, daytime functioning, and overall health.

OSA is caused by repeated airway obstruction during sleep, leading to loud snoring, sleep choking episodes, poor-quality sleep, and excessive daytime sleepiness. In Pakistan, obesity, smoking, enlarged tonsils, craniofacial structure, and limited awareness contribute to its growing burden. Understanding these local factors is essential for timely and effective management.

The OSA Working Group, led by Dr. Javed Husain, has adapted international recommendations to suit Pakistan's healthcare system. These guidelines highlight key risk factors, clinical features, diagnostic evaluation including sleep studies, and appropriate management strategies.

Management must be patient-focused and systematic. Weight loss, positional therapy, treatment of nasal allergies, and lifestyle modification form the foundation of care. CPAP therapy remains the most effective treatment for moderate to severe OSA, while oral appliances and surgical interventions may benefit selected patients.

These guidelines emphasize early diagnosis, proper treatment, and patient education to reduce complications and improve quality of life. We thank all contributors for their dedication and remain committed to advancing sleep health and evidence-based respiratory care across Pakistan.

Prof. Muhammad Ashraf Jamal
Chairman Guideline Committee
Pakistan Chest Society

Pakistan Chest Society

Guideline Committee

Prof. Muhammad Ashraf Jamal

Chairman, Guidelines Committee
Pakistan Chest Society

Prof. Nisar Ahmed Rao

Professor of Pulmonology
Fazaia Ruth Pfau Medical College & Hospital, Karachi

Prof. Saadia Ashraf

Head of the Pulmonology Department
Khyber Teaching Hospital, MTI, Peshawar

Brig (R) Jamal Ahmad

Head of the Pulmonology Department
Fauji Foundation Hospital Rawalpindi

Prof. Talha Mahmood

Professor & Head of Department (Pulmonology)
Shaikh Zayed Medical Complex, Lahore

Dr. Maqbool A Langove

Associate Professor, Department of Pulmonology
Fatima Jinnah General and Chest Hospital, Quetta

Dr. Kamran Khan Sumalani

Associate Professor, Department of Pulmonology
Jinnah Postgraduate Medical Center, Karachi

Obstructive Sleep Apnea
Guideline Working Group

Dr. Javed Husain
MD, DABIM, Pulmonology, Critical Care & Sleep Medicine
Consultant Pulmonologist
The Chest Clinic, Karachi, Pakistan

Dr. Hashir Majid
MD, DABIM, Pulmonology, Critical Care & Sleep Medicine Consultant Pulmonologist
The Aga Khan University Hospital, Karachi, Pakistan

Prof. Kamran Chima
MD, DABIM, Pulmonology, Critical Care & Sleep Medicine Professor and Head of Pulmonary & Critical Care Department Doctors Hospital, Lahore, Pakistan

Prof. Dr. M Irfan Malik
MBBS, FCPS (Pulmonology), FRCP (Glasgow), FCCP, CMT (UHS)
European diplomate in Respiratory Medicine
Professor & Head of Department of Pulmonology, Critical care & Sleep Medicine
The University of Lahore, Pakistan

Chapter 01:
Introduction

Definitions and Classification

Sleep-related breathing disorders are characterized by abnormal respiration during sleep. They are divided into four major groups: Obstructive Sleep Apnea (OSA) Syndrome, Central Sleep Apnea (CSA) Syndromes, sleep-related hypoventilation disorders and sleep-related hypoxemia disorders.

The sleep apnea syndromes are characterized by intermittent episodes of reduction or complete cessation of airflow during sleep. The difference between OSA and CSA centers on the presence or absence of airway obstruction and ventilatory effort. In CSA, the airway remains patent while there is no ventilatory effort; while in OSA, both airway obstruction and respiratory effort are present.

The hallmark of sleep-related hypoventilation disorders is elevation of carbon dioxide levels for a significant duration during sleep. When there is sustained oxygen desaturation during sleep, a diagnosis of sleep-related hypoxemic disorder is used. The causes of sleep-related hypoxemia disorder include hypoventilation, ventilation-perfusion mismatching, low partial pressure of oxygen, shunt or a combination of these factors.

This guideline pertains to Obstructive Sleep Apnea Syndrome.

Epidemiology

Obstructive Sleep Apnea Syndrome is the most common sleep-related breathing disorder. It is more prevalent in males and in the obese.

It is important to confirm Obstructive Sleep Apnea Syndrome with a sleep study evaluating the number of obstructive events during sleep. A "positive" sleep study refers to any study with more than five obstructive respiratory events per hour of sleep. Although the estimated prevalence of patients with abnormal obstructive events during sleep is approximately 20 to 25 percent in males and 5 to 10 percent in females in North America (Wisconsin cohort, Pennsylvania), the actual prevalence of the OSA syndrome using in addition to the events, daytime sleepiness as a criterion is lower: between 3–7% of middle-aged men and 2–5% of women.

Pathophysiology

OSA is characterized by recurrent collapse of the pharyngeal airway during sleep despite ongoing breathing efforts. Factors which enhance collapsibility of the pharyngeal airway include conditions associated with a narrowed cross-sectional diameter of the airway (obesity, retrognathia, micrognathia, macroglossia etc.), poor muscle tone of the airway (advancing age, congenital and neurological disorders) and increased upper airway resistance as in males, predisposing individuals to develop OSA.

Other factors, including arousal threshold, upper airway anatomy, upper airway muscle drive, and stability of the respiratory control system can also affect the severity of OSA in a patient. The underlying pathogenesis may also vary by age: younger patients are more likely to have alterations in ventilatory control, whereas older patients are more likely to have predominant upper-airway collapsibility.

The airway collapse in OSA leads to intermittent reduction or complete cessation of airflow and is associated with disturbances in gas exchange (hypercapnia and hypoxemia), fragmented sleep and sympathetic nervous system activation. These in turn cause deleterious metabolic and cardiovascular consequences, such as myocardial infarction, stroke, congestive heart failure, arrhythmias and insulin resistance etc.

Risk Factors for OSA:
Table 1:

Structural risk factors	Non-structural risk factors
Innate anatomic variations (facial elongation, posterior facial compression)	Obesity
Retrognathia and micrognathia	Central fat distribution
Mandibular hypoplasia	Male sex
Brachycephalic head form (associated with an increased AHI in whites but not in African Americans)	Age
Inferior displacement of the hyoid	Postmenopausal state
Adenotonsillar hypertrophy, particularly in children and young adults	Alcohol use
Pierre Robin, Down, Marfan, and Prader-Willi Syndromes	Sedative use
High, arched palate (particularly in women)	Smoking
	Supine sleep position
	Rapid eye movement (REM) sleept

Table 1: Structural and non-structural risk factors for obstructive sleep apnea.[2]

- **Age:**
  OSA prevalence increases from young adulthood to seventh decade and then reaches a plateau.

- **Gender:**
  2-3 times more common in males than females.

- **Obesity:**
  OSA prevalence increases as the BMI and associated markers (neck circumference, waist-to-hip ratio) increase. Worsening obesity and body mass indices, particularly a BMI more than 35 kg/m,2 is increasingly associated with a risk of concomitant obesity hypoventilation syndrome (OHS). Patients with OHS have high rates of awake hypoventilation in addition to high rates of comorbid OSA.

- **Craniofacial and upper airway abnormalities:**
  These abnormalities include abnormal maxillary or short mandibular size, wide craniofacial base, tonsillar hypertrophy and adenoid hypertrophy. These factors are best recognized in Asian patients.

- **Other risk factors:**
  Nasal congestion confers a two-fold increased risk of OSA. Smoking also increases the risk of OSA as current smokers are 3 times more likely to have OSA than past or never smokers. Menopausal women have increased risk of OSA. Patients of OSA also report having family history of snoring or OSA. Genetic basis accounts for about one fourth of OSA prevalence.

- **Medical conditions:**
  Certain medical conditions increase the risk of OSA. These include pregnancy, end-stage renal disease, congestive heart failure, chronic lung disease, post- traumatic stress disorder, CVA (cerebrovascular accident), acromegaly, hypothyroidism and polycystic ovarian syndrome (PCOS).

Clinical Features:
A constellation of signs and symptoms can be suggestive of OSA; however, it should be noted that there is no specific clinical feature that is pathognomonic for the disease.

Symptoms:
Common symptoms exhibited by OSA patients are listed in table 2 below.

Table 2:

During sleep	While awake
Loud snoring / snorting	Daytime sleepiness
Witnessed apneas by bed partner	Non-restorative sleep
Awakening with choking	Lack of concentration
Nocturnal restlessness	Cognitive deficits
Vivid, strange or threatening dreams	Changes in mood
Gastro-esophageal reflux	Morning headaches
Insomnia with frequent awakening	Dry mouth
Nocturia	Impotence or decreased libido
Hyper-salivation	
Teeth-grinding	
Diaphoresis	

Table 2: Symptoms of obstructive sleep apnea syndrome. Adapted from Riha, 2010, with permission from the publisher

The classical presentation described for patients with OSA is one of snoring, witnessed apneas and daytime somnolence. While this is common in the obese, middle-aged male, it is important to remember that women may present with more subtle mood disturbances and that their snoring or apneas may have been missed by less vigilant male partners.

Certain conditions are associated with a higher incidence of obstructive sleep apnea (table 4). Their presence should alert the clinician to assess for the possibility of undiagnosed OSA, including post-menopausal state in women, history of refractory hypertension or asthma, lone atrial fibrillation, hypothyroidism, acromegaly, polycystic ovarian syndrome, cigarette-smoking and chronic nasal congestion.

Signs:
When evaluating OSA, the clinician should be alert to the presence of certain physical characteristics that are associated with an increased risk of the disease (table 3). These include:

- **Obesity:**
  Body mass index (BMI) more than 30 kg/m2. The correlation with OSA is stronger with central obesity, indicated by a waist circumference of 40 inches for men and 38 inches for women, and a waist-hip ratio of 0.595 and 0.575 respectively.

- **Crowded airway:**
  Craniofacial features that predispose to narrowing of the upper airway and OSA include retrognathia, micrognathia, malocclusion, high and arched hard palate, macroglossia, elongated and low-lying uvula, enlarged tonsils and adenoids, lateral peritonsillar narrowing, reduced nasal valve patency due to nasal septal deviation and/or nasal polyps, hypertrophied nasal turbinates. A modified Mallampati class III or IV airway is considered a risk factor for OSA.

- **Large neck circumference:**
  Collar sizes of above 17 inches for men and 16 inches for women are associated with a higher incidence of OSA.

Table3:

Signs to Look for on Examination	
• Obesity BMI more than 30 kg/m²	• Retrognathia (backset jaw)
• Large neck circumference more than 40 cm	• Enlarged tonsils
• Reduced nasal patency	• Adenoid hypertrophy
• Small mandible, small maxilla	• Elongated or low-lying uvula
• Dental malocclusion	• High or narrow hard palate
• Macroglossia	• Crowded airway

Table 3: Clinical features of obstructive sleep apnea syndrome. BMI: body mass index. Adopted from RIHA, 2010, with permission from the publisher.

Patients at high risk of OSA
Table 4:

Patients at high risk of OSA	
• Obesity	• Cerebrovascular accidents
• Congestive heart failure	• Type 2 diabetes
• Atrial fibrillation	• Bariatric surgery candidates
• Nocturnal arrhythmias	• Commercial pilots and truck-drivers
• Pulmonary hypertension	
• Treatment refractory systemic hypertension	

Consequences

The association with cardiovascular, cerebrovascular and metabolic disorders implies that OSAS contributes to increased morbidity and mortality in the general population. Undiagnosed OSAS results in higher medical costs; even a single roadside accident due to sleepiness caused by OSAS can incur considerable health costs; Other consequences include:

- Untreated OSA is associated with considerable morbidity and mortality.
- Cardiovascular morbidity:
  OSA, especially moderate-to-severe OSA, is associated with systemic hypertension, pulmonary hypertension, coronary artery disease, cardiac arrhythmias, heart failure, sudden cardiac death, venous thromboembolism and stroke. Use of PAP therapy diminishes these risks, particularly in those under the age of 65 years.

- Impaired daily function:
  OSA is associated with excessive daytime sleepiness, inattention and fatigue which may impair daily function.

- Impaired cognition and psychiatric disturbances:
  OSA may induce cognitive deficits. These patients also have a two-fold higher risk of depression and sexual dysfunction.

- Drowsy driving and motor vehicle crashes:
  Motor vehicle crashes are two to three times more common among patients with OSA than without OSA. OSAS is associated with a large increase in the risk of motor vehicle accidents, with a relative risk of 3.7. These patients should be counseled to avoid activities that require vigilance and alertness until their sleep disordered breathing and daytime sleepiness resolves with therapy for OSA. Successful OSA treatment improves stimulator performance and decreases motor vehicle crashes.

- Metabolic syndrome and type 2 diabetes:
  In patients with metabolic syndrome, OSA has been independently associated with increased glucose and triglyceride levels, insulin resistance and type 2 diabetes as well as markers of inflammation. The proposed mechanism for this includes oxidative stress caused by intermittent hypoxemia and sympathetic activation.

- Nonalcoholic fatty liver disease:
  Patients with OSA have an increased prevalence (two to three-fold) of NAFLD, particularly those with severe OSA.

- Perioperative complications:
  Patients with OSA may be at greater risk for perioperative complications such as postoperative acute respiratory failure, cardiac events and intensive care unit transfers.

- Mortality:
  Patients with untreated severe OSA (AHI more than 30 events/ hour) have a two-to-three-fold increased risk of all-cause mortality compared with individuals without OSA, independent of other risk factors.

Diagnostic Testing for Adult Sleep Apnea Patient Clinical Practice Guideline

OSA is a chronic disease that rarely resolves except with substantial weight loss or successful corrective surgery. As with other chronic diseases, periodic follow-up by a qualified clinician (e.g physician or advanced practice provider) is necessary to confirm adequate treatment, assess symptom resolution, and promote continued adherence to treatment.

Patients with untreated OSA may be at increased risk of developing cardiovascular disease, including difficult-to control blood pressure, coronary artery disease, congestive heart failure, arrhythmias and stroke. OSA is also associated with metabolic dysregulation, affecting glucose control and risk for diabetes. Undiagnosed and untreated OSA is a significant burden on the healthcare system, with increased healthcare utilization seen in those with untreated OSA, highlighting the importance of early and accurate diagnosis of this common disorder.

Recognizing and treating OSA is important for a number of reasons. The treatment of OSA has been shown to improve QOL, lower the rates of motor vehicle accidents, and reduce the risk of the chronic health consequences of untreated OSA mentioned above. There is also data supporting a decrease in healthcare utilization and cost following the diagnosis and treatment of OSA. However, there are challenges and uncertainties in making the diagnosis and a number of questions remain unanswered. Therefore, when OSA is suspected, a comprehensive sleep evaluation is important to ensure appropriate diagnostic testing is performed to address OSA, as well as other comorbid sleep complaints. The diagnosis of OSA involves measuring breathing during sleep.

The third edition of the International Classification of Sleep Disorders, Text revision (ICSD-3 TR) defines OSA as a PSG or HSAT (Home sleep apnea testing) determined obstructive apnea and hypopnea index (AHI) ≥ 5 events/h associated with the typical symptoms of OSA (Sleepiness, fatigue, insomnia or other symptoms leading to impaired sleep-related quality of life), or PSG or HSAT determined obstructive apnea and hypopnea index AHI ≥ 15 events/h that are not explained by another disorder.

The scoring of respiratory events is defined in The AASM Manual for the Scoring of Sleep and Associated Events: Rules, Terminology and Technical Specifications, Version 3 (AASM Scoring Manual). However, it should be noted that there is variability in the definition of a hypopnea event. The AASM Scoring Manual recommended definition requires that changes in flow be associated with a 3% oxygen desaturation or a cortical arousal but allows an alternative definition that requires association with a 4% oxygen desaturation without consideration of cortical arousals. Depending on which definition is used, the AHI may be considerably different in a given individual.

Due to the high prevalence of OSA, there is significant cost associated with evaluating all patients suspected of having OSA with PSG (currently considered the gold standard diagnostic test). Further, there also may be limited access to In-laboratory testing in some areas. HSAT, which has limitations, is an alternative method to diagnose OSA in adults, and may be less costly and more efficient in some populations.

There are four levels of sleep studies as shown in table 5.

Table 5:

Level of study	Characteristics	Comments
Level 1	**Attended in-laboratory full polysomnography** (typically consists of EEG, EOG, chin EMG, airflow, respiratory effort, Sao_2, EKG, leg EMG, and body position)	Gold standard for the diagnosis of OSA
Level 2 (comprehensive portable polysomnography)	**Unattended full polysomnography** (monitors same parameters as Level 1 study including EEG, EOG, chin EMG, airflow, respiratory effort, SaO2, EKG, leg EMG, and body position)	Validity of results may be limited by insufficient sleep time, absence of REM sleep, or absence of sleep in the supine position.
Level 3 (cardiorespiratory sleep studies, or modified portable sleep-apnea testing)	**Cardiopulmonary studies consisting of 4 or more parameters** (eg, airflow, Sao_2, respiratory effort, EKG, or body position)	Useful when there is a high pretest likelihood of OSA, Levels 1 or 2 studies are not readily available, and delay in testing is unacceptable. Might be useful for follow-up evaluation following therapy of patients previously diagnosed with OSA
Level 4 (continuous single or dual bioparameter recording)	**Monitoring using only one or two parameters** (eg, Sao_2, airflow or snoring)	Poor specificity, and sensitivity Not recommended for diagnosis of OSA

EEG: electroencephalography, **EOG:** electrooculography, **EMG:** electromyography, **SaO2:** oxygen saturation of arterial blood, **EKG:** electrocardiogram, **OSA=** obstructive sleep apnea, **REM=** rapid eye movement)

Chapter 02:
Clinical Practice Recommendations

Diagnostic testing for OSA should be performed in conjunction with a comprehensive sleep evaluation and adequate follow-up:
OSA is one of many medical conditions that may be the cause of sleep complaints and other symptoms. Therefore, diagnostic testing for OSA is best carried out after a comprehensive sleep evaluation. The clinical evaluation for OSA should include a thorough sleep history and a physical examination that includes the respiratory, cardiovascular, and neurologic systems. The examiner should pay particular attention to observations regarding snoring, witnessed apneas, nocturnal choking or gasping, restlessness, and excessive sleepiness. It is also important that other aspects of sleep history be collected, as many patients suffer from more than one sleep disorder or are present with atypical sleep apnea symptoms. In addition, medical conditions associated with increased risk for OSA, such as obesity, hypertension, stroke, and congestive heart failure should be identified. The general evaluation should serve to establish a differential diagnosis, which can then be used to select the appropriate test(s). Follow-up, under the supervision of a sleep medicine physician, ensures that study findings and recommendations are relayed appropriately; and that appropriate expertise in prescribing and administering therapy is available to the patient.

This pathway should include the following elements: a focused evaluation of sleep apnea performed by a clinical provider, and use of tools or questionnaires that capture clinically important information that is reviewed by a sleep medicine physician prior to testing. Following testing, a comprehensive sleep evaluation and follow up under the supervision of a sleep medicine physician should be completed.

Polysomnography is the standard diagnostic test for the diagnosis of OSA in adult patients in whom there is a concern for OSA based on a comprehensive sleep evaluation.

Misdiagnosing patients can lead to significant harm due to lost benefits of therapy in those with OSA, and the prescription of inappropriate therapy in those without OSA. As discussed in the recommendations below, sleep apnea-focused questionnaires and clinical prediction rules lack sufficient diagnostic accuracy, and therefore direct measurement of SDB is necessary to establish a diagnosis of OSA. PSG is widely accepted as the gold standard test for diagnosis of OSA. Further, this test has traditionally been used as the gold standard for comparison to other diagnostic tests, including HSAT (Home Sleep Apnea Testing). Besides the diagnosis of OSA, PSG can identify co- existing sleep disorders, including other forms of sleep-disordered breathing. In some cases, and within the appropriate context, the use of HSAT as the initial sleep study may be acceptable, as discussed in the recommendations below. However, PSG should be used when HSAT results do not provide satisfactory post-test probability of confirming or ruling out OSA.

Recommendation 1: We recommend that clinical tools, questionnaires and prediction algorithms not be used to diagnose OSA in adults, in the absence of polysomnography or

home sleep apnea testing. (STRONG)

Clinical prediction algorithms may be used in sleep clinic patients with suspected OSA but are not necessary to establish the need for PSG or HSAT and further are not sufficient to substitute for PSG or HSAT. In non-sleep clinic settings, these tools may be more helpful to identify patients who are at increased risk for OSA, but this was beyond the scope of this guideline.

Evaluation with a clinical tool, questionnaire or prediction algorithm may be less burdensome to patients and clinicians than HSAT or PSG; however, their low levels of accuracy make them poor diagnostic tools.

Berlin Questionnaire:
The Berlin Questionnaire consists of eleven questions divided into three categories to classify the patient as high or low risk for OSA
Overall, the Berlin Questionnaire produced a large number of false negative results, thereby limiting its utility as an instrument to diagnose patients with OSA. Specifically, when assessing the performance of the Berlin Questionnaire in identification of subjects with an AHI cutoff of ≥ 5, the pooled sensitivity was 0.76 (95% CI: 0.72 to 0.80), while the pooled specificity was 0.45
(95% CI: 0.34 to 0.56).

Furthermore, the questionnaire had suboptimal accuracy, ranging from 56% to 70%; accuracy became progressively more compromised with consideration of higher OSA severity thresholds
The quality of evidence for the use of the Berlin Questionnaire was low after being downgraded due to either heterogeneity, indirectness, or imprecision

Epworth Sleepiness Scale:
The Epworth Sleepiness Scale (ESS) is a self-reported questionnaire involving eight questions to assess the propensity for daytime sleepiness or dozing.
The overall results indicate that the ESS had a large number of false negative results limiting its utility for the diagnosis of OSA. When considering an AHI of ≥ 5, the ESS revealed a range of sensitivity of 0.27–0.72 and specificity of 0.50–0.76. The ESS demonstrated an accuracy ranging from 51% to 59% for the AHI ≥ 5 cutoff. Therefore, the ESS had a high number of false negative results (range of 244 to 635 per 1,000 patients; assuming a prevalence of 87%).

STOP-BANG Questionnaire:
The STOP-BANG questionnaire is an OSA screening tool consisting of four yes/no questions and four clinical attributes

The overall findings reveal that the STOP-BANG questionnaire had high sensitivity, but low specificity for the detection of OSA. These findings became more pronounced when higher levels of OSA category cutoffs were considered.

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Home sleep apnea testing for the diagnosis of obstructive sleep apnea in adults:

Recommendation 2: We recommend that polysomnography, or home sleep apnea testing with a technically adequate device, be used for the diagnosis of OSA in uncomplicated adult patients presenting with signs and symptoms that indicate an increased risk of moderate to severe OSA. (STRONG)

Recommendation 3: We recommend that if a single home sleep apnea test is negative, inconclusive or technically inadequate, polysomnography be performed for the diagnosis of OSA. (STRONG)

An uncomplicated patient is defined by the absence of:
1. Conditions that place the patient at increased risk of non-obstructive sleep-disordered breathing (e.g., central sleep apnea, hypoventilation and sleep-related hypoxemia). Examples of these conditions include significant cardiopulmonary disease, potential respiratory muscle weakness due to neuromuscular conditions, history of stroke and chronic opiate medication use.
2. Concern for significant non-respiratory sleep disorder(s) that require evaluation (e.g., disorders of central hypersomnolence, parasomnias, sleep-related movement disorders) or interfere with accuracy of HSAT (e.g., severe insomnia).
3. Environmental or personal factors that preclude the adequate acquisition and interpretation of data from HSAT.

An increased risk of moderate to severe OSA is indicated by the presence of excessive daytime sleepiness and at least two of the Sleep Medicine; Volume 13, issue 10, page 1205-1207) following three criteria: habitual loud snoring, witnessed apnea or gasping or choking, or diagnosed hypertension.

HSAT is to be administered under the supervision of a sleep medicine physician. A single HSAT recording is conducted over at least one night. "The raw data from HSAT device must be reviewed and interpreted by a physician who is either board certified in sleep medicine or overseen by a board-certified physician". (Clinical use of a Home Sleep apnea test: An American Academy of Sleep Medicine Position Statement. Journal of Clinical Sleep Medicine; volume 13, issue 10, page 1205-1207)

A technically adequate HSAT device incorporates a minimum of the following sensors: nasal pressure, chest and abdominal respiratory inductance plethysmography, and oximetry; or else PAT (peripheral arterial tonometry) with oximetry and actigraphy. For additional information regarding HSAT sensor requirements, refer to The AASM Manual for the Scoring of Sleep and Associated Events. A technically adequate diagnostic test includes a minimum of 4 hours of technically adequate oximetry and flow data obtained during a recording attempt that encompasses the habitual sleep period.

Finally, use of HSAT to diagnose OSA has been shown to provide adequate clinical outcomes and efficiency of care when performed with adequate clinical and technical expertise, using specific types of HSAT devices, in an appropriate patient population, and within an appropriate management pathway. Use of HSAT in other contexts may not provide similar benefit, and therefore the recommendations for the use of HSAT are limited. On the other hand, unstudied or understudied contexts could exist in which HSAT may provide benefit to a patient.

Benefits Versus Harms:
Use of HSAT may provide potential benefits to patients with suspected OSA. Such benefits could include convenience, comfort, increased access to testing, and decreased cost. HSAT can be performed in the home environment with fewer attached sensors during sleep. The availability of HSAT for diagnosis may improve access to diagnostic testing in resource-limited settings, or when the patient is unable to leave the home or healthcare setting for testing. In addition, HSAT may be less costly when used appropriately. These benefits must be weighed against the potential for harm. Harms could result from the need for additional diagnostic testing among patients with technically inadequate or inconclusive HSAT findings, or from misdiagnosis and subsequent inappropriate therapy or lack of therapy.

A single HSAT recording encompassing multiple nights may have potential advantages or drawbacks relative to only a single night of recording. For example, if multiple-night HSAT improved accuracy or resulted in fewer inconclusive or inadequate studies, patient outcomes or costs might improve. On the other hand, the potential for multiple-night recordings to increase cost and patient inconvenience must be considered. Insufficient evidence exists to support routine performance of more than a single night's recording for HSAT.

Diagnosis of obstructive sleep apnea in adults with comorbid conditions:

Recommendation 4: We recommend that polysomnography, rather than home sleep apnea testing, be used for the diagnosis of OSA in patients with significant cardiorespiratory disease, potential respiratory muscle weakness due to neuromuscular condition, awake hypoventilation or suspicion of sleep-related hypoventilation, chronic opioid medication use, history of stroke or severe insomnia.

Summary
This recommendation is based on the limited data available regarding the validity of HSAT

in patients with significant cardiorespiratory disease, neuromuscular disease with respiratory impairment, suspicion of hypoventilation, opioid medication use, history of stroke, or severe insomnia. The overall quality of evidence was very low due to imprecision, indirectness, and risk of bias.

PSG is the gold standard method for the diagnosis of OSA and other forms of sleep-disordered breathing. HSAT has not been adequately validated or demonstrated to provide favorable clinical outcomes and efficient care in the above patient populations and may result in harm through inaccurate assessment of sleep-disordered breathing.

Benefits Versus Harms:
Certain patient populations are at increased risk of having forms of SDB other than OSA (e.g., CSA, hypoventilation, and hypoxemia). These forms of SDB can cause significant morbidity and mortality if left untreated. HSAT has not been validated to diagnose some of these types of SDB (CSA, hypoventilation); therefore, the use of HSAT in populations at increased risk for SDB other than OSA increases the likelihood of not detecting these breathing disorders, which could lead to inadequate treatments, increased long-term healthcare costs, morbidity and mortality. In addition, the accuracy of HSAT has not been validated in patients with severe insomnia where it may be compromised leading to similar outcomes. Though the cost of diagnostic PSG is higher than HSAT, the benefits of increased accuracy, use of appropriate therapy, and improved clinical outcomes outweigh this factor. There are, however, instances where PSG cannot be performed for practical reasons (hospitalization, inability of patient to leave home setting or participate in PSG), and use of HSAT may be reasonable, as the alternative is to not address SDB at all.

Diagnosis of obstructive sleep apnea in adults using a split-night versus a full-night polysomnography protocol:

Recommendation 5: We suggest that, if clinically appropriate, a split-night diagnostic protocol, rather than a full-night diagnostic protocol for polysomnography, be used in the diagnosis of OSA. (WEAK)

This recommendation is based on a split-night protocol that initiates CPAP titration only when the following criteria are met:
1. Amoderate to severe degree of OSA is observed during a minimum of 2 hours of recording time on the diagnostic PSG, AND
2. At least 3 hours are available for CPAP titration.

A split-night study may be preferred relative to full-night PSG and PAP titration studies due to the convenience and cost savings of completing a diagnostic and titration study during one rather than two separate PSG studies. However, this needs to be balanced with the consequences of potentially inconclusive diagnostic or titration portions of the sleep study. If the diagnostic portion is inconclusive, a second PSG is needed. If the titration portion is inconclusive, a second PAP titration study, or the use of auto adjusting PAP may be needed. Based on clinical judgment, the majority of well-informed patients would choose the split-night protocol over a full-night protocol, when clinically appropriate andt

feasible, and that the benefits of a split-night diagnostic protocol in such circumstances outweigh the potential harms.

Benefits Versus Harms:
The split-night protocol, in comparison to a full-night baseline assessment followed by a separate PAP titration, has the potential to provide the needed diagnostic information and effective CPAP settings within the same recording. Potential disadvantages of the split-night study include insufficient diagnostic sampling (e.g., limited REM sleep time and limited supine time in those with difficulty initiating sleep), and insufficient time to ascertain appropriate CPAP treatment settings. Based on clinical judgment, the TF determined that there is low certainty that the benefits of a split-night study in comparison to full-night studies exceed the harms.

Patients' Values and Preferences:
When comparing the split-night study to the full-night study, existing data are consistent and demonstrate a high level of reproducibility of the standard AHI metric and effective identification of the optimal CPAP pressure. These data also suggest that the two approaches lead to similar follow-up CPAP adherence.

Repeat polysomnography for the diagnosis of obstructive sleep apnea in adults:

Recommendation 6: We suggest that when the initial polysomnogram is negative and there is still clinical suspicion for OSA, a second polysomnogram be considered for the diagnosis of OSA. (weak)

Summary
There was limited evidence from which to assess the efficacy of performing a repeat PSG when the initial PSG is negative. The recommendation is based on evidence from comparisons of a single-night PSG to two-nights of PSG for the diagnosis of OSA. These studies found no consistent differences overall in AHI scores, but potentially significant minorities of patients had results that were different in clinically meaningful ways on the two nights. The certainty in the evidence regarding night-to-night variability of AHI from the meta-analysis started as high, but there was limited evidence from which to assess the efficacy of single-night PSG versus two-night PSG in terms of diagnostic accuracy and clinical outcomes.
Benefits Versus Harms: A second night of PSG in symptomatic patients allows for the diagnosis of OSA in 8% to 25% of patients with initial false negative studies. Establishing a diagnosis of OSA in these patients allows for treatment that leads to improved symptom control (e.g., less daytime sleepiness), better QOL, and potentially decreased cardiovascular morbidity over time. However, routinely repeating PSG in patients with an initial negative PSG has potential downsides. There is a risk that repeat testing could lead to false positive cases being identified and unnecessarily treated. In addition, the routine use of a 2-night study protocol would cause inconvenience to the patient, increased utilization of resources and healthcare costs, and perhaps even delays in the care of other patients awaiting PSG. However, due to the increased likelihood of diagnosing symptomatic patients, and based on their clinical judgment, the TF determined that the benefits of a second PSG outweigh the harm; though the certainty that the benefits outweigh the harm is low.

Chapter 03:
Management of OSA

Obstructive sleep apnea should be managed with a multi-faceted approach, focusing on
1. Patient education
2. Adjunctive measures including weight management, behavioral changes and
3. Specific treatment for the disease

1. Patient Education

Patient education should be an integral component of OSA management.
The sleep specialist should have a detailed discussion on the risk factors, pathophysiology, natural course, clinical consequences and treatment options of OSA with all patients. The discussion should be tailored to the individual, focusing on patient related factors such as weight, co-morbid conditions, expectations, and should be based on the severity of their OSA as quantified by objective, accurate sleep testing. Patient education is associated with better compliance with OSA treatment with positive airway pressure, decreased disturbance related to PAP therapy and improved overall quality of life in OSA patients on PAP. Hence, a multi-disciplinary approach for education, involving the sleep specialist, primary care physician and ancillary health staff, should be actively pursued

2. General Adjunctive Measures

Weight and behavior management should be part of the general management of OSA patients.

Weight Management:

Weight loss should be part of the management of overweight patients with OSA:

OSA patients who are overweight or obese (BMI equal or greater than 25 kg/m^2, or even above 23.5kg/m2 in our Pakistani population) should be encouraged to lose weight. About 70% of OSA patients are obese and OSA prevalence in obese men and women is around 40%, with a higher BMI being linked to higher prevalence of OSA. A 10% increase in body weight is associated with a 30% increase in the severity of OSA.

Weight loss, via "medical" (lifestyle changes with dietary intervention, coupled with exercise and GLP-1 medications) or surgical means, can lead to a diminution in the severity of OSA, with improvement in Apnea Hypopnea Index and oxygen desaturation. In addition, weight loss has significant further health benefits in overweight individuals, related to the association between cardiovascular, metabolic and malignant diseases and obesity.
Conversely, weight gain is associated with a worsening of the severity of sleep disordered breathing. OSA patients who are within their acceptable weight range should be commended and encouraged to maintain their weight.

Weight loss should not be used as the primary treatment for significant OSA:
The complete cure rate of OSA with dietary intervention and weight loss alone is low. A significant proportion of OSA patients continue to have residual obstructive respiratory events despite losing weight. Hence, weight loss alone cannot be recommended as the primary therapy for OSA. However, weight loss does have an impact on AHI reduction: A 1% reduction in weight is associated with 3% change in AHI; A 10% weight loss leads to a 26% reduction in AHI, especially in patients with a BMI > 35 kg/m^2.

A repeat titration study may be considered in OSA patients with significant weight change:
PAP requirements can change with a significant alteration in a patient's weight. This may lead to a different PAP requirement for the patient. When auto-titrating PAP (APAP) therapy is being used for treatment, the machine will automatically adjust delivered PAP to meet the new requirements (unless the required PAP falls out of the machine's set limits); however, for patients on fixed CPAP, a repeat titration study (or switch over to an APAP) may be needed, to ascertain ideal PAP for treatment. Generally, a 10% change in weight is considered significant enough to consider a repeat titration study.

Behavior Management:
Sedatives, hypnotics, alcohol use and smoking may worsen upper airway dysfunction and should be avoided in OSA patients.

Patients should not drive or operate heavy machinery when sleepy or tired:
OSA should be treated to decrease the risk of these accidents. Patients should be advised against driving or operating heavy vehicles, especially if they are tired or sleepy.

Side sleeping and head of bed elevation can be considered as adjunctive therapy for OSA in certain situations. Sleep position can affect airway size and patency with a decrease in the area of the upper airway, particularly in the lateral dimension, while in the supine position. Positional therapy, consisting of a method that keeps the patient in a non-supine position, is an effective secondary therapy or can be a supplement to primary therapies for OSA in patients who have a low AHI in the non-supine versus that in the supine position (positional OSA). Side sleeping and sleeping with elevation of head and trunk to 30-60 degrees can improve respiratory disturbances. However, the reduction in obstructive events with postural therapy is variable, and, hence, is generally not recommended as sole treatment for significant OSA.

3. Airway-Specific Treatment Measures
Indications for treatment:

Moderate to severe OSA should be treated:
OSA, especially untreated moderate and severe sleep apnea (an apnea-hypopnea or respiratory disturbance index of 15/hour or more), is a significant risk factor for cardiovascular morbidity and mortality. A consistent association between moderate-to-severe OSA and cardiovascular diseases, such as systemic arterial hypertension, coronary artery disease, heart failure, arrhythmia and strokes, has been observed across multiple studies.

Treatment of OSA in this population is hence strongly recommended. Treatment of mild OSA should be considered if associated with functional impairment or co-morbid cardiovascular or mood disorders:

PAP therapy brings about improvement in excessive sleepiness and sleep-related quality of life. Impairment in sleep and daytime functioning linked with snoring, nocturnal choking, sleep disturbances, nocturia, morning headaches, daytime fatigue and lost productivity are alleviated with PAP treatment. Other than cardiovascular disease, OSA has also been linked with metabolic disorders, depression, and impairment of cognition and functioning. Treatment of OSA, even when mild, should be considered when accompanied by these comorbid conditions or symptoms

Positive Airway Pressure Therapy for OSA:

PAP should be considered first-line therapy for OSA in most patients:
Positive airway pressure is effective in treating OSA. It is superior to oral appliances in treating moderate to severe OSA and is associated with less morbidity when compared to the surgeries that are most successful for OSA treatment. As such, it should be considered as first-line therapy for most OSA patients.

However, there is a significant proportion of patients who are unwilling to use or unable to tolerate PAP therapy. In these situations, alternative treatment - such as oral appliances, especially for mild OSA; surgery and hypoglossal nerve stimulation device where available for more severe disease - should be used.

CPAP or auto PAP are recommended over BPAP in the initial routine treatment of OSA:

Bilevel positive airway pressure (BPAP) is perceived to be more comfortable than CPAP because it lowers pressures during expiration, making it easier for patients to exhale. However, this has not been objectively demonstrated, with similar adherence rates to CPAP when compared to BPAP for OSA. Moreover, CPAP was found to be equivalent to BPAP in improving quality of sleep, sleep-related quality of life, excessive sleepiness and lowering of AHI.
Newer CPAP devices, with their modified pressure profile technology which lowers positive airway pressure during exhalation, mostly nullify the advantage of BPAP over CPAP; in addition, they are less costly than BPAP. However, in situations where higher PAP are needed (typically above 20 cm H_2O), which are beyond the capability of most CPAP or APAP machines to generate, BPAP is needed for therapy. BPAP may also have a role in patients who are unable to adhere to CPAP or APAP therapy.

APAP and CPAP have been found to have similar efficacy and clinical outcomes in treating OSA. Either can be used when initiating treatment for OSA. CPAP is generally cheaper than APAP, whereas APAP is advantageous in situations where there might be a change in pressure requirement for OSA treatment, e.g. weight change, alcohol consumption, different body positioning, nasal blockage.

PAP therapy can be initiated at home with an auto PAP or with CPAP after an in-lab PAP titration. It should be noted that this recommendation does not apply to patients with certain coexisting medical problems (e.g. heart failure, COPD, BMI > 40): in-lab PAP titration is suggested in these scenarios prior to starting home PAP.

Factors that cause patient discomfort with PAP therapy should be addressed:
Nasal blockage or dryness, poor mask fit and air leak related to use of PAP interface can lead to patient discomfort and potentially affect adherence. These factors should be inquired about and addressed if present during follow-up visits.

The use of a heated humidifier with PAP has been shown to improve nasopharyngeal symptoms and improve patient comfort. These symptoms include oropharyngeal and nasal dryness, nasal congestion and discharge, epistaxis, xerostomia, sinus pain or headaches, sore throat and dysphonia. Use of heated humidifier (HH) should be considered in patients reporting such complaints. A trial of nasal steroids can also be considered in patients exhibiting these symptoms. It should be noted, however, that HH use has not been associated with better adherence to PAP therapy.

Mask selection is important in ensuring a good fit and seal, minimizing discomfort and air leak. Use of nasal PAP interface may improve patient comfort and, potentially, adherence rates when compared to Oro-nasal masks.

Oral Appliances for OSA:

Oral appliances can be used for treatment of mild to moderate OSA:
Oral appliances (OAs) increase the cross-sectional diameter of the upper airway and improve its patency by either advancing the jaw (mandibular repositioning device) or preventing posterior collapse of the tongue (tongue retaining device).

These devices also improve the muscle tone of the upper airway, thereby decreasing collapsibility. OAs are not as effective in treating OSA as PAP therapy. They decrease obstructive respiratory events to a lesser extent than PAP; however, this diminution is generally sufficient for successful treatment of mild to moderate OSA. OAs can hence be used as primary therapy in this population of OSA patients, especially if patients are intolerant to PAP or prefer alternate treatment. Generally, adherence to OAs is better than that for PAP therapy.

Oral appliances for OSA patients should be custom-made by a qualified dentist:
OAs should be customized, and preferably, titratable. Patients should be evaluated by a dental professional who is qualified to assess and treat patients with OSA. Patients need to be evaluated whether they will benefit from OA (a thorough examination of oral structures, temporo- mandibular joints and surrounding tissue needs to be undertaken by the dentist to determine candidacy) prior to the manufacture of customized OAs.

Adequacy of treatment by oral appliances should be ascertained by follow-up sleep testing and periodic follow-up:
A follow-up sleep test (in-lab or at home) should be performed with the OA in place once the device has been titrated to its final, optimal fit. This is to ensure that the OA is achieving its desired therapeutic effect. Patients should also be followed periodically by the sleep specialist and dental professional to ensure that the device fits well and for adequacy of treatment and resolution of symptoms.

Surgery for OSA:

Airway surgery can be considered for OSA patients intolerant of other modalities:
More than twenty-five surgical modalities have been utilized for OSA treatment. Results are quite variable for different procedures. Only tracheostomies and maxilla-mandibular advancement have shown consistently successful results. Due to the associated morbidity and small risk of mortality with these procedures, they are generally reserved for patients with severe OSA who have failed or cannot tolerate PAP or other modalities. Multi-level surgery, radiofrequency ablation and palatal implants have variable success rates and can be tried in milder OSA. As surgery is associated with potentially higher rates of morbidity and mortality, it is considered as second line therapy behind PAP and oral appliances.

Patients undergoing airway surgery for OSA should have a follow up sleep study:
Due to the variable success rates and cases of relapse after surgery, follow-up objective testing, to ascertain cure, is recommended after a reasonable period to allow healing. Typically, testing is performed a few weeks after the procedure. Patients should also be monitored clinically for recurrence of symptoms.

Hypoglossal Nerve Stimulation for OSA:

Hypoglossal nerve stimulator device can be used in a selected group of patients:
Patients with moderate-to-severe OSA who are intolerant to PAP therapy can be treated with an implantable hypoglossal nerve stimulator (HNS) device. Patients most likely to benefit from HNS are those with a BMI < 35 kg/m2, an AHI between 20-50 events/hour (with a non-supine AHI > 10 events/hour), and non-concentric retro-palatal airway collapse on drug-induced sleep endoscopy. Obstructive respiratory and oxygen desaturation events decrease by about two-third with HNS use, with an average decrease in AHI by 21 events/hour of sleep. HNS should be placed by an operator experienced in performing this procedure.

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