

# A Sleep Medicine Curriculum for Pulmonary and Pulmonary/Critical Care Fellowship Programs

## A Multisociety Expert Panel Report



David A. Schulman, MD, MPH, FCCP; Craig A. Piquette, MD, FCCP; Mir M. Alikhan, MD; Neil Freedman, MD, FCCP; Sunita Kumar, MD, FCCP; Jennifer McCallister, MD, FCCP; Babak Mokhlesi, MD; Jean Santamauro, MD, FCCP; Effie Singas, MD, FCCP; Eric Stern, MD; Kingman P. Strohl, MD; and Kenneth R. Casey, MD, MPH, FCCP

**BACKGROUND:** Pulmonary medicine specialists find themselves responsible for the diagnosis and management of patients with sleep disorders. Despite the increasing prevalence of many of these conditions, many sleep medicine fellowship training slots go unfilled, leading to a growing gap between the volume of patients seeking care for sleep abnormalities and the number of physicians formally trained to manage them. To address this need, we convened a multisociety panel to develop a list of curricular recommendations related to sleep medicine for pulmonary fellowship training programs.

**METHODS:** Surveys of pulmonary and pulmonary/critical care fellowship program directors and recent graduates of these programs were performed to assess the current state of sleep medicine education in pulmonary training, as well as the current scope of practice of pulmonary specialists. These data were used to inform a modified Delphi process focused on developing curricular recommendations relevant to sleep medicine.

**RESULTS:** Surveys confirmed that pulmonary medicine specialists are often responsible for the diagnosis and treatment of a number of sleep conditions, including several that are not traditionally considered related to respiratory medicine. Through five rounds of voting, the panel crafted a list of 52 curricular competencies relevant to sleep medicine for recommended inclusion in pulmonary training programs.

**CONCLUSIONS:** Practicing pulmonary specialists require a broad knowledge of sleep medicine to provide appropriate care to patients they will be expected to manage. Training program directors may use the list of competencies as a framework to ensure adequate mastery of important content by graduating fellows.

CHEST 2019; 155(3):554-564

**KEY WORDS:** curriculum development; education; sleep medicine

FOR EDITORIAL COMMENT, SEE PAGE 460

**ABBREVIATIONS:** CSA = central sleep apnea; HSAT = home sleep apnea testing; PAP = positive airway pressure; PCCM = pulmonary and critical care medicine; PLMD = periodic limb movement disorder; PSG = polysomnography; RLS/WED = restless legs syndrome/Willis-Ekbom disease; SDB = sleep-disordered breathing

**AFFILIATIONS:** From the Division of Pulmonary, Allergy, Critical Care and Sleep Medicine (Dr Schulman), Emory University School of Medicine, Atlanta, GA; Division of Pulmonary, Critical Care, Sleep and Allergy (Dr Piquette), University of Nebraska School of Medicine, Omaha, NE; Department of Pulmonary and Critical Care Medicine

(Dr Alikhan), Houston Methodist West Hospital, Houston, TX; Department of Medicine (Dr Freedman), Northshore University Health System, Evanston, IL; Department of Medicine (Dr Kumar), Loyola University Stritch School of Medicine, Maywood, IL; Division of Pulmonary, Critical Care, and Sleep Medicine (Dr McCallister), The Ohio State University Wexner Medical Center, Columbus, OH; Department of Medicine (Dr Mokhlesi), the University of Chicago Pritzker School of Medicine, Chicago, IL; Pulmonary Service (Dr Santamauro), Memorial Sloan Kettering Cancer Center, Weill Cornell Medicine, New York, NY; Division of Pulmonary, Critical Care and

## Introduction

In 2014, a joint task force composed of representatives from the American College of Chest Physicians, the American Thoracic Society, the Association of Pulmonary and Critical Care Medicine Program Directors, and the Society for Critical Care Medicine published a recommended list of entrustable professional activities for fellows completing training in pulmonary, critical care medicine or combined pulmonary and critical care medicine (PCCM) programs.<sup>1</sup> This document, crafted in response to a paradigm shift occurring in many areas of medical education to focus on competency-based developmental outcomes, recommended that graduating fellows be able to diagnose and treat patients with both respiratory and nonrespiratory sleep disorders, including insomnia, narcolepsy, and restless legs syndrome. This is congruent with the content currently covered on the American Board of Internal Medicine's certification examination in pulmonary medicine, of which sleep represents ten percent.<sup>2</sup>

PCCM specialists have always had an important role in the recognition, management, and research in regard to sleep-related breathing disorders, and its impact on pulmonary hypertension, hypoventilation, and cardiovascular consequences. In 2005, the American Thoracic Society convened a task force to identify some of the competencies in sleep one might need for PCCM fellowship programs. This work was also prompted by a survey that the PCCM specialist in some, particularly rural communities was often seen as knowledgeable in "sleep" and referred patients in which the sleep complaints were undifferentiated. The document suggested areas that might be a focus for instruction, and a roadmap for research topics.

---

Sleep Medicine (Dr Singas), Donald and Barbara Zucker School of Medicine at Hofstra/Northwell, New Hyde Park, NY; Community Medical Center (Dr Stern), Missoula, MT; Department of Medicine (Dr Strohl), Case Western Reserve University, Cleveland, OH; and Division of Pulmonary, Critical Care, and Allergy (Dr Casey), University of Wisconsin School of Medicine and Public Health, William S. Middleton Memorial Veterans Hospital, Madison, WI.

**DISCLAIMER:** American College of Chest Physician guidelines are intended for general information only, are not medical advice, and do not replace professional medical care and physician advice, which always should be sought for any medical condition. The complete disclaimer for this guideline can be accessed at <http://www.chestnet.org/Guidelines-and-Resources/Guidelines-and-Consensus-Statements/CHEST-Guidelines>.

**CORRESPONDENCE TO:** David Schulman, MD, MPH, FCCP, 615 Michael St, Ste 205-J, Atlanta, GA 30329; e-mail: [daschul@emory.edu](mailto:daschul@emory.edu)  
Copyright © 2018 American College of Chest Physicians. Published by Elsevier Inc. All rights reserved.

**DOI:** <https://doi.org/10.1016/j.j.chest.2018.10.024>

In 2007, the ABIM offered its first certification examination in Sleep Medicine, and the largest percentage of first-time test takers, many of whom were offered seating on the basis of experience, were those with pulmonary training.<sup>3</sup> This pathway to the certificate examination closed in 2013, when it became an examination one could take following a 1-year ACGME-accredited sleep medicine fellowship. One may enter this fellowship from a number of primary and specialty training programs other than PCCM.

These sleep medicine specialists are now trained to manage a broad range of disorders, and develop knowledge of basic science and clinical management practices that are, like critical care medicine, spread among several different medical disciplines. This intensive training is designed for high level expertise to treat both very common (insomnia,<sup>4</sup> restless legs syndrome<sup>5</sup>) and rare (narcolepsy<sup>6</sup>) conditions, as well as OSA.<sup>7-10</sup> The field recognizes that subspecialty training offers crucial expertise to complex patients, and that co-management of patients may be necessary to provide care for those who have sleep complaints or disorders.

The development of sleep medicine as a separate ABIM specialty is now 10 years old. Data suggest that the prevalence of sleep-disordered breathing (SDB) is increasing compared with previous reports.<sup>11,12</sup> At the same time, the number of individuals pursuing formal training in sleep medicine is limited (averaging 106 over the last 5 years), with > 20% of sleep medicine fellowship training slots going unfilled.<sup>13</sup> In addition, those certified in 2007 are now retiring at a greater rate than those actively graduating from training programs. This gap between disease prevalence and the number of formally trained, dedicated sleep medicine providers highlights the need to more clearly define the role of and training for pulmonary specialists in the recognition and management of patients with sleep pathology, and to assess symptoms relating to disorders of sleep-wake states. To achieve this goal, a multisociety committee was convened, with the goals of gauging the current state of sleep medicine education during pulmonary fellowship training and producing curricular competencies for sleep medicine topics applicable to pulmonary and PCCM fellowships. Committee members included sleep specialists (N. F., B. M., K. P. S., and K. R. C.), program directors of PCCM training (J. M., C. A. P., E. S., and J. S.), individuals who met both of these criteria (D. A. S. and S. K.), and recent graduates of PCCM programs who were working outside academia

(M. M. A. and E. S.). All members of the committee were trained in Pulmonary Medicine.

The committee felt strongly that these recommendations should not be read as mandates, especially given the ever-broadening scope and depth of pulmonary and critical care medicine leading to an increasing body of

knowledge for training programs to consider for inclusion in their curricula. The goal herein is to advise both program directors and governing bodies what considerations should be given in the education and assessment of trainees in pulmonary medicine, based upon the scope of practice that will be expected of them upon completing their training.

---

## Methods

The committee distributed two different surveys to better inform its work. The first was distributed to all active program directors of pulmonary or PCCM training programs. Data regarding the duration of sleep-related clinical experiences, the total number of hours per year of sleep-related didactics, and the ability of graduating fellows to diagnose and treat common sleep disorders (OSA, central sleep apnea [CSA], sleep-related hypoventilation, restless legs syndrome/Willis-Ekbom disease [RLS/WED]/periodic limb movement disorder [PLMD], narcolepsy, idiopathic hypersomnia, insomnia and circadian rhythm disorders) were collected. Program directors also provided information regarding their expectation that graduates be able to interpret the primary data from polysomnography (PSG) and home sleep apnea testing (HSAT).

The second survey was distributed to graduates of pulmonary and PCCM training programs; those who subsequently became board certified in sleep medicine were excluded from the survey. To maintain the privacy of fellowship graduates, survey links were distributed by program directors to their own graduates; as a result, the total number of distributed surveys is not known. Data were collected regarding the type of practice in which the individual was involved (academic vs nonacademic, the presence of a board-certified sleep specialist within the practice) and whether those surveyed personally billed for the interpretation of PSG or HSAT. Additionally, respondents were asked whether they were expected to diagnose and/or treat each of nine categories of sleep disorders (OSA, CSA, sleep-related hypoventilation, RLS/PLMD, narcolepsy, idiopathic hypersomnia, insomnia, circadian rhythm disorders, and parasomnias).

---

## Survey Results

Forty-three pulmonary or PCCM program directors responded to our survey, representing a 27% response rate. Programs of all sizes were represented (from fewer than three fellows per year up to more than eight). More than 90% of responses were from combined PCCM programs; this is consistent with the relative paucity of pure pulmonary fellowships around the country. Approximately one-half of programs had an affiliated sleep medicine fellowship at the same institution; results from these programs did not significantly differ from those of the other fellowships. The majority of programs (67%) required between 1 and 2 months of clinical sleep experience; 49% provided < 5 h of sleep-related didactics to their fellows each year.

The next phase of the committee's work began with the assumption that pulmonary trainees would be responsible for only a subset of the medical knowledge required by graduates of sleep medicine fellowships. Requirements for education in sleep fellowships was derived from the ACGME Program Requirements for Graduate Medical Education in Sleep Medicine.<sup>14</sup> Expectations related to the competencies of professionalism, systems-based practice, practice-based learning, and interpersonal skills were excluded from further discussion, as they were universally covered by the existing competencies for pulmonary and PCCM programs. From this document, 69 potential curricular competencies relevant to medical knowledge and patient care were identified and voted on using a formal Delphi process.

This project was a stakeholder-based consensus process since a nonsystematic review of the literature determined that it was not feasible to perform an evidence-based analysis. Consensus was determined according to a predefined policy of the CHEST Guideline Oversight Committee.<sup>15</sup> This is a rigorous and explicit consensus achievement process based on the Delphi technique.<sup>16</sup> Each item considered for clinical competency was subject to an anonymous voting procedure which was performed on-line. Consensus required a response rate of 75% for each of the statements and was defined as 80% of the respondents voting *agree* or *strongly agree* based on a five-point scale. If consensus was not achieved, the statement was modified based on feedback from the group and voted upon again. Up to three rounds of voting were permitted. If consensus was not achieved after the third round, the item was rejected. One of the authors (K. R. C.) served as a methodologist for this process. All authors were permitted to utilize data obtained from the program director and graduate surveys during both the voting and modification processes.

More than one-half of program directors reported that graduating fellows were able to perform primary interpretation of PSG, while less than one-quarter reported the same expectations of HSAT.

Unsurprisingly, an overwhelming majority of program directors expected graduates to be able to diagnose and treat OSA. While a similar percentage expected their fellows to diagnose CSA and sleep-related hypoventilation, the expectations regarding treatment of those disorders was significantly lower.

One hundred fifty-nine graduates of pulmonary and PCCM programs responded to our survey request; of these respondents, 22 reported board certification in sleep medicine and were excluded from further data

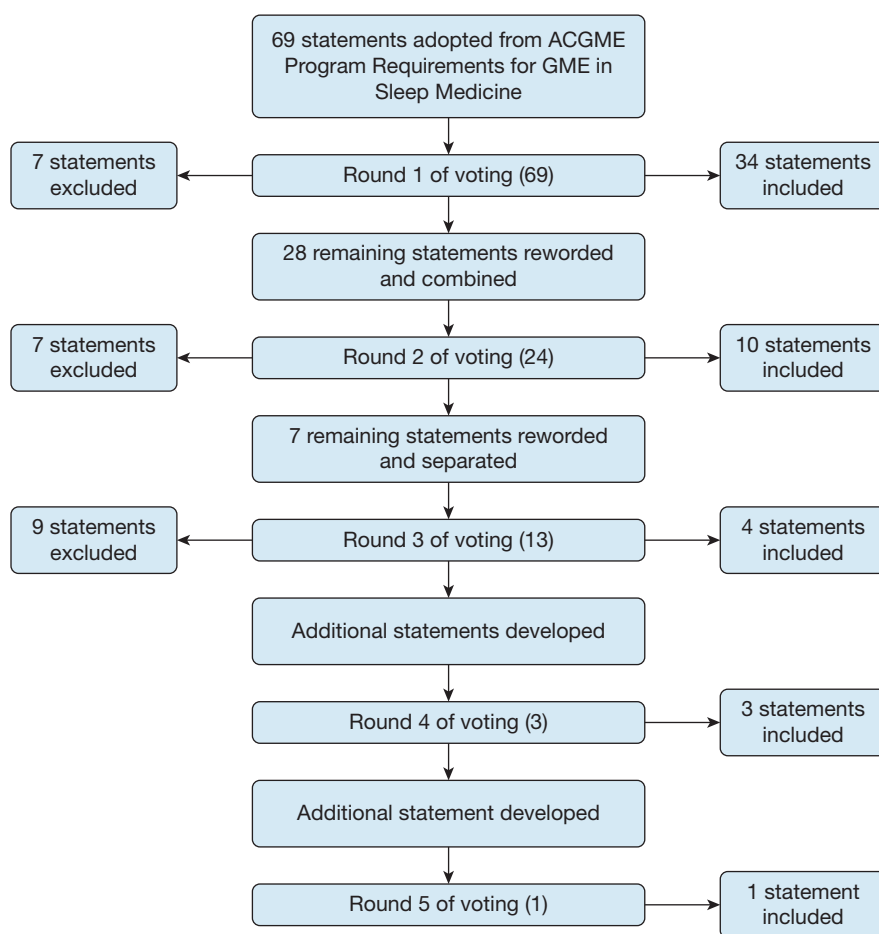


Figure 1 – Diagram of the Delphi voting process. Not all active statements were addressed during every round. ACGME = Accreditation Council for Graduate Medical Education; GME = Graduate Medical Education.

collection. The majority reported that they were expected to diagnose and manage both OSA and sleep-related hypoventilation; similar to the program director survey, the majority also reported a need to diagnose, but not manage, CSA. The data regarding the need for graduates to diagnose each of the other listed sleep pathologies were remarkably similar to the data garnered when program directors were asked whether their graduates would be able to diagnose them. In contrast, graduates reliably indicated they were expected to treat these disorders to a greater extent than their program directors expected. Less than one-quarter of respondents reported that they personally interpreted and billed for PSG; a similar number indicated that they interpreted and billed for HSAT.

Complete results of both of these surveys are available in [e-Appendix 1](#); [e-Figures 1-14](#).

## Consensus Results

Consensus on all potential curricular competencies was achieved within five sessions of Delphi voting, as shown

in [Figure 1](#). Not all active statements were addressed during each conference call session. Because voting was performed in an anonymous manner online, different statements were at various points of completion during each session. The final proposed sleep-related curricular competencies for pulmonary and PCCM fellowship programs that were approved by the committee are summarized in [Table 1](#). A verbatim list of individual statements as voted on the committee, and the consensus reasoning behind their approval, follows. Of note, these recommendations were also approved by the Boards of Directors of both the American Thoracic Society and the Association of Pulmonary and Critical Care Medicine Program Directors. As per CHEST policy, the items will be presented as suggestions, since they are consensus-based.

## Curriculum Components

The Committee strongly suggests that fellows completing pulmonary training be able to do each of the following:

**TABLE 1 ] Recommended Sleep Medicine Curriculum Components for Pulmonary and Pulmonary/Critical Care Medicine Fellowships**

Fellows should demonstrate knowledge of:
Respiratory physiology and pathophysiology related to sleep and sleep disorders.
Upper airway anatomy, normal and abnormal across the adult life span.
The physiologic effect of sleep on upper airway anatomy and physiology.
The effects of sleep on pulmonary anatomy and physiology.
The effects of sleep on the physiology of respiratory control.
The clinical manifestations of insomnia, including difficulty with initiating and maintaining sleep.
The ability to identify symptomatic patients with chronic insomnia who would benefit from cognitive behavioral therapy.
The clinical effects of light-dark cycles, jet lag, and melatonin on the circadian rhythm.
The changes in sleep across the adult life span.
The effects of sleep on cardiovascular anatomy and physiology.
Cardiovascular pathophysiology related to sleep and sleep disorders.
The effects of sleep and sleep disorders on gastroesophageal reflux.
The effects of medications on sleep and sleep disorders.
The relationship between medical, neurologic, and psychiatric disorders, and sleep disorders (eg, the relationship between hypertension and sleep apnea).
The nosology for common respiratory sleep disorders as described in the current edition of The International Classification of Sleep Disorders.
The diagnostic strategies used to assess for sleep disorders.
The clinical manifestations of sleep-related breathing disorders in adults.
The indications/contraindications, proper patient preparation, and potential shortcomings of polysomnography and portable sleep monitoring.
Secondary interpretation of polysomnographic data (reading and understanding the report) and portable sleep monitoring (reading and understanding the report).
Management of ambulatory sleep monitoring equipment, including respiratory plethysmography, oximetry, airflow monitors, and position sensors.
Appropriate use of nasal continuous positive airway pressure, bilevel pressure, and other modes of positive airway pressure therapy for OSA.
Appropriate use of oral appliances, maxillofacial, and upper airway surgery for obstructive sleep apnea.
Appropriate use of positional therapy for OSA, central sleep apnea, and hypoventilation.
Appropriate treatment of sleep-related breathing disorders in adults with congestive heart failure, COPD, and/or neuromuscular disease.
Methods to improve adherence to positive airway pressure modalities after implementation.
The history and physical examination needed to identify patients who require formal evaluation for circadian rhythm disorders, abnormal nocturnal behaviors, narcolepsy, and idiopathic hypersomnia.
The clinical manifestations of restless leg syndrome and periodic limb movement disorder.
The legal aspects of sleep medicine, including regulations regarding driving risks and reporting.
Fellows should demonstrate clinical competence in
Advising patients regarding healthy sleep habits, sleep hygiene, common nonpharmacologic treatments for sleepiness, and the advantages and disadvantages of the different pharmacotherapies available for managing insomnia.
Performing physical, neurologic, and mental status examinations relevant to the practice of sleep medicine.
Interpreting sleep diaries, and standardized scales of sleepiness.
The recognition of hypoxemia, obstructive apnea, central apnea, Cheyne-Stokes respiration, and hypoventilation on diagnostic testing.
Interpreting downloads from positive pressure devices.
Interpreting a report containing multiple sleep latency test results and maintenance of wakefulness test results (secondary interpretation).

**1.1 Demonstrate knowledge of respiratory physiology and pathophysiology related to sleep and sleep disorders.**

**1.2 Demonstrate knowledge of upper airway anatomy, normal and abnormal across the adult life span.**

**1.3 Demonstrate knowledge of the physiologic effect of sleep on upper airway anatomy and physiology.**

**1.4 Demonstrate knowledge of the effects of sleep on pulmonary anatomy and physiology.**

**1.5 Demonstrate knowledge of the effects of sleep on the physiology of respiratory control.**

*Remarks: The committee felt that these areas are already components of pulmonary training; although not explicitly stated in the current competencies for pulmonary fellowship, knowledge of these domains is relevant to both sleep medicine and pulmonary medicine.*

**2.1 Demonstrate clinical competence in advising patients regarding healthy sleep habits and sleep hygiene.**

**2.2 Demonstrate clinical competence in advising patients about common nonpharmacologic treatments for sleepiness.**

**2.3 Demonstrate knowledge of the clinical manifestations of insomnia, including difficulty with initiating and maintaining sleep.**

**2.4 Demonstrate clinical competence in advising patients regarding the advantages and disadvantages of the different pharmacotherapies available for managing insomnia.**

**2.5 Demonstrate knowledge of the ability to identify symptomatic patients with chronic insomnia who would benefit from cognitive behavioral therapy.**

*Remarks: The committee felt that these content domains are components of well-rounded internal medicine training but could be reinforced during pulmonary training. Many patients referred for sleep apnea evaluation present with complaints of inability to maintain sleep and excessive daytime somnolence; knowledge of proper sleep hygiene and an understanding of managing symptoms of both sleepiness and insomnia may obviate the need for unnecessary diagnostic evaluation.*

**3.1 Demonstrate knowledge of the clinical effects of light-dark cycles, jet lag, and melatonin on the circadian rhythm.**

**3.2 Demonstrate knowledge of the changes in sleep across the adult life span.**

*Remarks: While these areas do not specifically assist with the diagnosis and management of sleep disorders, the committee felt that a general understanding of normal sleep physiology, including the effects of both age and environmental contributors, would help trainees distinguish normal from abnormal findings that would require further evaluation. A discussion regarding knowledge of neuroanatomy and the roles of different neurotransmitters also occurred, but neither of these domains was considered sufficiently critical to warrant inclusion in the pulmonary curriculum.*

**4.1 Demonstrate knowledge of the effects of sleep on cardiovascular anatomy and physiology.**

**4.2 Demonstrate knowledge of cardiovascular pathophysiology related to sleep and sleep disorders.**

*Remarks: The committee felt that understanding the relationship between sleep and cardiovascular physiology was critical to understanding the relationship between sleep pathology and its cardiovascular impact. Because cardiovascular morbidity and mortality have been strongly associated with SDB, we felt that an understanding of this association and its pathophysiology was an important aspect of pulmonary training.*

**5.1 Demonstrate knowledge of the effects of sleep and sleep disorders on gastroesophageal reflux.**

*Remarks: Sleep fellowship curricular competencies include a broader focus on the relationship between sleep and gastrointestinal physiology, but the committee chose to limit this to gastroesophageal reflux based upon its strong association with SDB.*

**6.1 Demonstrate knowledge of the effects of medications on sleep and sleep disorders.**

**6.2 Demonstrate knowledge of the relationship between medical, neurologic, and psychiatric disorders, and sleep disorders (eg, the relationship between hypertension and sleep apnea).**

*Remarks: Generating a differential diagnosis for common sleep complaints requires providers to understand the effects of common diseases and frequently prescribed medications on sleep; identifying a sleep complaint secondary to another disorder can avoid unnecessary diagnostic and therapeutic interventions. In addition, having a solid grasp of risk factors for SDB can help a provider to better characterize a patient's pretest*



probability for pathology and assist with appropriate triage of further testing.

**7.1 Demonstrate knowledge of the nosology for common respiratory sleep disorders as described in the current edition of The International Classification of Sleep Disorders.**

**7.2 Demonstrate knowledge of the diagnostic strategies used to assess for sleep disorders.**

*Remarks: Because many different sleep disorders can present with symptoms of sleepiness and sleep disruption, the committee felt that an understanding of the breadth of sleep pathology would be critical for pulmonary trainees to develop an appropriate diagnostic plan even if the details of the plan are implemented by a sleep specialist.*

**8.1 Demonstrate clinical competence in performing physical, neurologic, and mental status examinations relevant to the practice of sleep medicine.**

**8.2 Demonstrate clinical competence in interpreting sleep diaries.**

**8.3 Demonstrate clinical competence in interpreting standardized scales of sleepiness.**

*Remarks: As easy-to-obtain, low-cost, and reliable tests, physical examination, sleepiness and other psychometric scales, and sleep diaries are standard components of the evaluation of both insomnia and excessive daytime sleepiness; because the decision to treat SDB often depends upon the degree of sleepiness, the committee chose to make this latter suggestion stronger than the others within this category. The committee did not think that there was sufficient evidence for the use of one scale over another.*

**9.1 Demonstrate knowledge of the clinical manifestations of sleep-related breathing disorders in adults.**

*Remarks: With the increasing prevalence of SDB and the relative shortfall in board-certified sleep medicine providers, an increasing number of patients with sleep apnea will be diagnosed and managed by pulmonary specialists. To this end, such providers need to be well-versed in identifying such patients, including those with OSA, CSA, Cheyne-Stokes respiration, and hypoventilation.*

**10.1 Demonstrate knowledge of the indications/contraindications, proper patient preparation, and potential shortcomings of PSG.**

**10.2 Demonstrate knowledge of the indications/contraindications, proper patient preparation, and potential shortcomings of portable sleep monitoring.**

*Remarks: While the committee did not believe that pulmonary specialists need to be able to perform either PSG or HSAT on their own, we felt that they did need the skills required to identify which modality of testing would be preferable for a given patient, based upon a combination of pretest probabilities and other patient factors.*

**11.1 Demonstrate knowledge of secondary interpretation of polysomnographic data (reading and understanding the report).**

**11.2 Demonstrate knowledge of secondary interpretation of portable sleep monitoring (reading and understanding the report).**

*Remarks: The committee felt that primary interpretation of the entirety of data gleaned from either PSG or HSAT was not a skill required for pulmonary fellowship graduates, but did find that understanding of all data included on the report, including sleep staging and arousal frequency, as well as respiratory statistic, was critical to assisting patients with their therapeutic decision-making.*

**12.1 Demonstrate clinical competence in the recognition of hypoxemia on diagnostic testing.**

**12.2 Demonstrate clinical competence in the recognition of obstructive apnea on diagnostic testing.**

**12.3 Demonstrate clinical competence in the recognition of central apnea on diagnostic testing.**

**12.4 Demonstrate clinical competence in the recognition of Cheyne-Stokes respiration on diagnostic testing.**

**12.5 Demonstrate clinical competence in the recognition of hypoventilation on diagnostic testing.**

*Remarks: Because the treatment of different subtypes of SDB can differ significantly, distinguishing between these different subtypes is critical to appropriately inform treatment decisions. The committee also felt it reasonable to expect pulmonary trainees to be able to review the airflow, respiratory effort, and oximetry tracings within the primary data of either PSG or HSAT to make these distinctions, if necessary.*

**13.1 Demonstrate knowledge of the management of ambulatory sleep monitoring equipment, including**

**respiratory plethysmography, oximetry, airflow monitors, and position sensors.**

*Remarks: With the move away from PSG for the diagnosis of OSA in appropriate patients, it is increasingly common for outpatient practices to distribute HSAT devices directly from their offices. The committee felt it appropriate to prepare pulmonary graduates for this growing trend by providing them the skills needed to direct the technical aspects of testing (in much the same way they are taught to direct pulmonary function laboratories).*

**14.1 Demonstrate knowledge of the appropriate use of nasal CPAP, bilevel pressure, and other modes of positive airway pressure (PAP) therapy for OSA.**

**14.2 Demonstrate knowledge of the appropriate use of oral appliances for OSA.**

**14.3 Demonstrate knowledge of the appropriate use of maxillofacial and upper airway surgery for OSA.**

**14.4 Demonstrate knowledge of the appropriate use of positional therapy for OSA.**

*Remarks: Educating OSA patients about the different treatment options available and assisting them in making an appropriate, individualized decision requires pulmonary physicians to understand the risks and benefits of each, and to be able to explain each option in depth to their patients.*

**15.1 Demonstrate knowledge of the appropriate use of positional therapy for CSA.**

**15.2 Demonstrate knowledge of the appropriate use of positional therapy for hypoventilation.**

*Remarks: There is a growing body of data supporting the use of positional therapy for treatment of non-OSA forms of SDB. We felt it appropriate for pulmonary trainees to be aware of these data.*

**16.1 Demonstrate knowledge of the appropriate treatment of sleep-related breathing disorders in adults with congestive heart failure.**

**16.2 Demonstrate knowledge of the appropriate treatment of sleep-related breathing disorders in adults with COPD.**

**16.3 Demonstrate knowledge of the appropriate treatment of sleep-related breathing disorders in adults with neuromuscular disease.**

*Remarks: The treatment of SDB in the context of significant cardiovascular, pulmonary, or neurologic comorbidity can represent a particular challenge. Because*

*of the frequency of these complicating factors and the degree to which they can affect the choice of treatment, the committee advised that curricular space be dedicated to understanding how their presence affects both the diagnosis and therapy of sleep-related breathing disorders.*

**17.1 Demonstrate clinical competence in interpreting downloads from positive pressure devices.**

*Remarks: Management of patients on PAP therapy for SDB is facilitated by objective measurement of patient adherence, mask leak, and residual disease burden. Review of such data can provide critical insight into barriers to, and methods of improvement in, PAP adherence.*

**18.1 Demonstrate knowledge of methods to improve adherence to PAP modalities after implementation.**

*Remarks: Adherence to PAP therapy is a significant challenge for patients with SDB; physicians who manage the care of these patients must be aware of common ways to improve device use, including the strategic use of humidification, pressure ramping, and different types of facial interfaces.*

**19.1 Demonstrate knowledge of the history and physical examination needed to identify patients who require formal evaluation for circadian rhythm disorders.**

**19.2 Demonstrate knowledge of the history and physical examination needed to identify patients who require formal evaluation for abnormal nocturnal behaviors.**

**19.3 Demonstrate knowledge of the history and physical examination needed to identify patients who require formal evaluation for narcolepsy and idiopathic hypersomnia.**

*Remarks: As previously noted, patients referred for evaluation for SDB are often found to have other, nonrespiratory sleep disorders. While the committee did not feel that pulmonary specialists should be required to diagnose and treat most of these disorders, we believe that they be aware of these disorders and be able to refer appropriately to more focused specialists as needed.*

**20.1 Demonstrate knowledge of the clinical manifestations of restless leg syndrome.**

**20.2 Demonstrate knowledge of the clinical manifestations of PLMD.**



*Remarks: While these disorders do not fall within the domain of respiratory sleep pathology, the committee felt that their high prevalence warranted their inclusion in the curriculum for pulmonary specialists. RLS/WED and PLMD are very common conditions that are often detected during routine evaluation for sleep pathology. Committee members felt that pulmonologists should be able to identify and treat patients suffering from insomnia due to RLS/WED, while also being able to recognize the findings of PLMD on history and PSG.*

### **21.1 Demonstrate knowledge of the ability to read and interpret a report containing multiple sleep latency test results (secondary interpretation).**

*Remarks: Hypersomnia syndromes, including narcolepsy and idiopathic hypersomnia, are frequently overdiagnosed in patients with inadequately treated SDB. The committee's decision to include these curricular items stemmed predominantly on the frequency with which patients are incorrectly diagnosed with these pathologies; pulmonary specialists need to be sufficiently familiar with interpretation of multiple sleep latency testing to determine whether patients may have a comorbid circadian rhythm or neurologic sleep disorder that requires further evaluation.*

### **22.1 Demonstrate knowledge of the ability to read and interpret a report containing maintenance of wakefulness test results (secondary interpretation).**

*Remarks: While maintenance of wakefulness testing is of uncertain clinical value, it is still used in some parts of occupational medicine as a measure of the ability to perform job-related duties. Until this practice abates, the committee felt that pulmonologists should have familiarity with the interpretation of this test, including its distinct role from multiple sleep latency testing and its debatable role in patient management.*

### **23.1 Demonstrate knowledge of the legal aspects of sleep medicine, including regulations regarding driving risks and reporting.**

*Remarks: SDB is clearly associated with a markedly increased risk of motor vehicle accidents. While reporting laws throughout the United States generally favor the protection of patient privacy, pulmonologists should be educated about the counseling of affected patients regarding the accident risk and ensuring documentation of that discussion.*

## **Discussion**

The growing number of patients with SDB, in conjunction with the shrinking number of dedicated practicing sleep medicine specialists, will require pulmonologists to see more patients with sleep pathology than ever before. Our committee used a formal Delphi process to compile 52 curricular competencies relevant to sleep medicine for inclusion in pulmonary training programs. This document has several essential applications. Physicians pursuing training in pulmonary medicine require a set of expectations for their practice following completion of fellowship. Training program directors may choose to utilize these as a framework to craft teaching experiences to ensure adequate mastery of important content.

Committee members are sensitive to the fact that adding these additional educational requirements to training programs will not be a simple process for most programs. We are aware of pulmonary fellowship programs that do not have affiliated board-certified sleep specialists. These programs could develop both on-site and perhaps off-site content to achieve some of the more esoteric competencies. The finite duration of pulmonary training is also a zero-sum game, meaning that developing curricular space for this content must necessarily come at some expense of other currently taught material. It is likely that a combination of formal didactics, independent reading, and novel clinical experiences will be required to ensure that graduating trainees have sufficient mastery of these new competencies to enter the world of independent practice. Off-the-shelf products covering this content may not yet exist for institutions to implement, so we will need to partner with our national societies to assist in the development of assessment tools for local use, and to ensure that the certification examination reflects the appropriate scope of practice for pulmonary providers. Some programs may choose to prioritize these curricular components, selectively implementing those that are more directly related to sleep-related breathing disorders. This document is not intended as advocacy for mandatory implementation of the curriculum covered herein; these suggestions were not meant to serve as a template for quality or performance assessment of training programs. Nevertheless, the committee strongly believes that, in the interest of patient safety and quality of care, each item contained in this document is valuable and should be considered in

the process of developing a comprehensive sleep curriculum for fellows in pulmonary disease.

Of note, we have not addressed the question of when referral to a sleep specialist, neurologist, psychiatrist, or any other specialist should occur. The threshold of indications for referral is highly variable among practitioners and may vary in different practice settings as well. Clearly, when any practitioner is making decisions that are not supported by his or her knowledge base, referral is appropriate, but the degree to which any individual practitioner has mastery of any specific area of content will vary among these topics. Just as some pulmonary specialists may choose to manage patients with pulmonary hypertension, interstitial lung disease, or cystic fibrosis on their own, while others would be more inclined to refer such patients to more dedicated subspecialists, the same will be true of nocturnal hypoventilation, restless legs syndrome, and narcolepsy.

We suspect that some readers will opine that the curricular competencies include content that is beyond the scope of what practicing pulmonologists need to know, while others will propose missing domains that they feel should have been included. Besides an imperative for the PCCM graduate to be familiar enough with this material to pass a Board examination, there needs to be a practical benefit by gaining expertise and reimbursable skills in the management of respiratory disorders of sleep and wakefulness. Cooperation among nonpulmonary sleep medicine specialists will always be important to manage in a care system, but the current parsing of test interpretation for studies to identify sleep-related respiratory disorders to only sleep medicine providers cannot be sustained if the epidemic in sleep apnea is to be addressed. Specifically, when sleep monitoring is not a part of the recording, cardiopulmonary variables collected over time are within the domain of PCCM practice, as has been articulated in ACGME PCCM program guidelines since 1986. Daytime hypoventilation syndromes when treated need monitoring during sleep, and the implementation of ventilator support requires verification and/or adjustments that are more commonly encountered by PCCM than by nonpulmonary Sleep Medicine providers. The PCCM professional societies can create didactic programs with certificates, set standards for interpretations, and drive outcomes research with this technology or other approaches to determine their place in practicing evidence-based, cost-effective medicine for sleep apnea and hypoventilation.

Although the process that we used to determine the final list of competencies was objective, determined a priori, and included a broad spectrum of individuals involved in the training and practice of pulmonary medicine, we recognize that other reasonable individuals could have voted differently. That noted, we believe that this document contains recommendations that are both implementable and relevant to the care of our patients. Because we recognize that the scope of practice of any profession varies over time, we would encourage a revisiting of these competencies after several years to ensure that they remain pertinent and accurately represent the required skill set.

## Acknowledgments

**Financial/nonfinancial disclosures:** None declared.

**Endorsements:** This guideline has been endorsed by the American College of Chest Physicians, the American Thoracic Society and the Association of Pulmonary and Critical Care Medicine Program Directors.

**Role of sponsors:** CHEST was the sole supporter of these guidelines, this article, and the innovations addressed within.

**Other contributions:** The authors thank Beth Corey, BA, and Joyce Reitzner, MIPH, for their efforts in crafting this document.

**Additional information:** The e-Appendix and e-Figures can be found in the Supplemental Materials section of the online article.

## References

1. Fessler HE, Addrizzo-Harris D, Beck JM, et al. Entrustable professional activities and curricular milestones for fellowship training in pulmonary and critical care medicine: executive summary from the Multi-Society Working Group. *Crit Care Med*. 2014;42(10):2290-2291.
2. American Board of Internal Medicine. Pulmonary Disease Certification Examination Blueprint. <http://www.abim.org/~media/ABIM%20Public/Files/pdf/exam-blueprints/certification/pulmonary-disease.pdf>. Accessed March 12, 2017.
3. Strohl KP. Sleep medicine training across the spectrum. *Chest*. 2011;139(5):1221-1231.
4. Roth T, Coulouvrat C, Hajak G, et al. Prevalence and perceived health associated with insomnia based on DSM-IV-TR; International Statistical Classification of Diseases and Related Health Problems, Tenth Revision; and Research Diagnostic Criteria/International Classification of Sleep Disorders, Second Edition criteria: results from the America Insomnia Survey. *Biol Psychiatry*. 2011;69(6):592-600.
5. Phillips B, Young T, Finn L, Asher K, Hening WA, Purvis C. Epidemiology of restless legs symptoms in adults. *Arch Intern Med*. 2000;160(14):2137-2141.
6. Black J, Reaven NL, Funk SE, et al. The Burden of Narcolepsy Disease (BOND) study: health-care utilization and cost findings. *Sleep Med*. 2014;15(5):522-529.
7. Kendzerska T, Gershon AS, Hawker G, Tomlinson G, Leung RS. Obstructive sleep apnea and incident diabetes. A historical cohort study. *Am J Respir Crit Care Med*. 2014;190(2):218-225.
8. Marshall NS, Wong KKH, Liu PY, Cullen SRJ, Knuiman MW, Grunstein RR. Sleep apnea as an independent risk factor for all-cause mortality: the Busselton Health Study. *Sleep*. 2008;31(8):1079-1085.
9. Gottlieb DJ, Yenokyan G, Newman AB, et al. Prospective study of obstructive sleep apnea and incident coronary heart disease and heart failure: the Sleep Heart Health Study. *Circulation*. 2010;122(4):352-360.

10. Redline S, Yenokyan G, Gottlieb DJ, et al. Obstructive sleep apnea-hypopnea and incident stroke: the Sleep Heart Health Study. *Am J Respir Crit Care Med*. 2010;182(2):269-277.
11. Peppard PE, Young T, Barnett JH, Palta M, Hla KM. Increased prevalence of sleep-disordered breathing in adults. *Am J Epidemiol*. 2013;177(9):1006-1014.
12. Heinzer R, Vat S, Marques-Vidal P, et al. Prevalence of sleep-disordered breathing in the general population: the HypnoLaus study. *Lancet Respir Med*. 2015;3(4):310-338.
13. National Resident Matching Program. Results and Data: Specialties Matching Service 2017 Appointment Year. <http://www.nrmp.org/wp-content/uploads/2017/02/Results-and-Data-SMS-2017.pdf>. Accessed March 12, 2017.
14. Accreditation Council for Graduate Medical Education. ACGME Program Requirements for Graduate Medical Education in Sleep Medicine. [http://www.acgme.org/Portals/0/PFAssets/ProgramRequirements/520\\_sleep\\_medicine\\_2016\\_1-YR.pdf](http://www.acgme.org/Portals/0/PFAssets/ProgramRequirements/520_sleep_medicine_2016_1-YR.pdf). Accessed March 12, 2017.
15. Lewis SZ, Diekemper R, Ornelas J, Casey KR. Methodologies for the development of CHEST guidelines and expert panel reports. *Chest*. 2014;146(1):182-192.
16. Jones J, Hunter D. Consensus methods for medical and health services research. *BMJ*. 1995;311(7001):376-380.