

## Curriculum and Competency Assessment Tools for Sleep Disorders in Pulmonary Fellowship Training Programs

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### INTRODUCTION

Syndromes of respiratory disorders of sleep as well as nonpulmonary disorders of sleep are common and amenable to treatment (1). Obstructive sleep apnea hypopnea syndrome is the most common diagnosis found in the laboratory assessment of patients with sleep-related complaints (2). Anecdotal reports suggest that between 10 and 40% of a community outpatient practice of pulmonary medicine involves assessment for and management of sleep-disordered breathing. In addition, nonpulmonary disorders of sleep often present as comorbid conditions in patients with pulmonary disorders. In the many areas where access to expertise in sleep medicine is limited, the pulmonary physician with actual or perceived expertise in sleep-disordered breathing usually is the principal resource to whom patients and other physicians turn for advice or consultation on patients with sleep problems. Because there is considerable overlap of the cardinal signs and symptoms across a wide range of sleep disorders, including sleep apnea, the pulmonary specialist may be asked to appropriately identify, manage, or refer patients with nonpulmonary problems of sleep.

Knowledge of sleep disorders and circadian rhythm is not only relevant to clinical practice but also is a seminal element of the pulmonary fellowship experience (3, 4). In addition, for all physicians, adequate sleep and recovery sleep are important for professionalism, learning, and personal relationships (5, 6). Some education in sleep medicine and chronobiology occurs in undergraduate medical education (7, 8), and additional curricular efforts to expand this exposure are underway at these levels of training (9). Hence, the pulmonary trainee of the future will likely have experienced such basic instruction.

Competency domains related to sleep and chronobiology have been partially articulated for undergraduate medical education (10) and to some degree for residency training (8). Competencies in these areas have been suggested (10–12), but have not been systematically incorporated within pulmonary fellowship training and do not incorporate viewpoints from directors of

accredited pulmonary training programs, or from specialties like neurology or psychiatry in which sleep expertise is also used.

Although the content of expected instruction in fellowships is updated every 5 years by the Accreditation Council of Graduate Medical Education (ACGME), standards are not very detailed (10, 12). For continued accreditation, each institutional program is visited regularly, and assessed regarding plans for instruction. Over the past 10 years, pulmonary training programs have needed to incorporate training in evolving areas, such as transplantation medicine, AIDS, trauma management, and interventional pulmonology, as well as sleep. ACGME visits assess resource availability in terms of expertise from other specialties (e.g., surgery, infectious disease, and cardiology) and of programs, such as lung transplantation. Not all required expertise in sleep medicine must reside within the faculty of the pulmonary division running the program, but formal and semiformal arrangements among specialties are expected to provide trainees with sufficient experiences and education within the relevant domains that are important for the practice of pulmonary medicine.

The process of fellowship and individual accreditation in sleep medicine is changing, as the field will be recognized by ACGME. Beginning by 2007, the American Board of Internal Medicine (ABIM) in collaboration with other boards will administer an officially recognized Added Qualification in Sleep Medicine examination; ACGME postgraduate training program requirements for sleep medicine also are being created. These changes have created a need to define in greater detail the curriculum for sleep medicine expected for pulmonary trainees. Because the ACGME requirements usually are approved 1 to 2 years before they go into effect and last for 5 years, it is appropriate that the ACGME Residency Review Committee (RRC) requirements are general and that subspecialty professional societies and training directors develop a more detailed curriculum as in training standards. This also allows alteration in the curriculum or the assessment tools more often than on a 5-year cycle. A brief, general outline of the major sleep-related domains was included in the 1988 ACGME guidelines for pulmonary medicine. In 2002, the American Thoracic Society (ATS) board was petitioned by the Assembly on Respiratory Neurobiology and Sleep (RNS) to develop a process to identify the scope and manner of postdoctoral clinical fellowship training in programs for pulmonary and critical care medicine. A committee was charged to address the following issues and goals:

1. Estimate current knowledge and skills relevant for and possibly required in the management of sleep disorders in a general pulmonary practice. It was believed that understanding the knowledge needed for a pulmonary practitioner rather than for an academic general pulmonary faculty member would be generally applicable to all pulmonary training programs.
2. Propose a curriculum, objectives, and methods to establish minimum levels of competence relevant to pulmonary fellowship training, independent of the additional training that would be required to be eligible for certification examinations in sleep medicine. Competence in a discipline or

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skill can be attained through a variety of methods and starts with specification of learning objectives (13). These objectives could be applicable to the wide spectrum of current accredited programs. Because there was no precedent or data, objectives were to be derived from expert opinion. The objectives developed through these discussions were not to be requirements, but suggestions for individual training program directors to potentially implement. The directors now are required to articulate competencies for all aspects of training for ACGME accreditation of their pulmonary and critical care medicine programs. The methods developed also were not intended to serve as a requirement for all pulmonary trainees to complete but rather as predefined, optional methods for assessment of competence in specific domains.

3. Suggest ways to implement this curriculum and to assess trainees for competency, consistent with the ACGME toolbox approach (14).

The scope of this project specifically did not address pediatric training fellowship programs, because the prevalence, differential diagnosis, and diagnostic criteria of sleep conditions are quite different between adult and pediatric populations and because different residency review committees, training programs, and ABIM testing are involved. Thus, the content and conclusions of this report are mainly applicable to adult pulmonary fellowship training.

## METHODS

The RNS assembly and ATS training committee received ATS funding to support this cooperative project. The project committee membership intentionally was composed of sleep experts, including individuals with nonpulmonary backgrounds and recognized roles in national sleep associations, and of two individuals with extensive involvement in pulmonary fellow training (past presidents of the Association of Pulmonary and Critical Care Medicine Program Directors [APCCMPD]). The committee derived educational competency criteria for sleep-related domains using existing methodology (13, 15). The committee initially collected data on existing sleep curricula and commentary (9, 10, 12), drawing on information from the ATS training committee, the APCCMPD, and the ATS Respiratory Neurobiology and Sleep (RNS) and Clinical Problems assemblies. The group met in 2003 to synthesize the information, identify those skills currently encountered and potentially required in general pulmonary practice, and create the set of learning objectives and goals. Over 40 ATS members attended an open lunchtime presentation and discussion of the topic at the ATS 2003 International Conference meeting. The committee's draft document then was disseminated for comment through the relevant ATS assemblies and leadership and at the annual 2003 meetings of the APCCMPD and American College of Chest Physicians. A series of iterative interactions by the committee chair with individuals who also serve as board members of the American Academy of Sleep Medicine, ABIM, and the American Board of Sleep Medicine also occurred. These efforts identified five core areas in which competency should be obtained during pulmonary fellowship.

The committee developed Appendix material consisting of suggested learning formats and model assessments for many of the core competencies. In February 2004, a second draft document and the Appendix material were released from the committee, and circulated among the ATS assemblies of Clinical Problems, Structure, and Function, and RNS, as well as the training committee. The resulting final document was presented to the ATS board for review, revisions, and approval.

## RESULTS

The committee compiled current knowledge and skills used in the management of sleep disorders in a general pulmonary practice based on review of existing ACGME guidelines for pulmonary programs and the experiences of program directors, collective personal experiences of experts, and discussions with trainees in outpatient clinics and community practitioners. The initial goal was to assemble all content that might have some relevance to the practice of pulmonary medicine. The committee intentionally did not categorize these items using the somewhat vague terms found in the 1992–2004 ACGME guidelines for pulmonary medicine (skills in the interpretation of “sleep studies” and the knowledge area of “sleep disorders”). Table 1 presents the broad range of components of sleep medicine that have some relevance to pulmonary medicine, dividing them into three categories: basic science, procedures, and clinical management. Table 1 identifies the very broad scope of sleep medicine's interface with pulmonary medicine. It is not intended that all practicing pulmonary physicians or trainees currently have knowledge or training in all these areas, nor are all routinely used in the practice of pulmonary medicine. There are no data to inform which are the most used or useful knowledge or skills.

In constructing Table 1, committee members were surprised at the range of information; however, by analogy, pulmonary physicians use a broad range of knowledge in the assessment of patients with symptoms (like cough) or signs (like an abnormal chest radiograph). Second, Table 1 also helped the committee define the components within the broad range that are appropriate for the core education about sleep disorders for “basal” training in general pulmonary medicine.

The committee distilled from Table 1 five “core proficiencies” and associated learning objectives believed to be important domains for all pulmonary medicine trainees (Table 2). Thus, the core components in Table 2 are much less broad than the wide range of areas included in Table 1. The committee recognized that completing a standard pulmonary fellowship training program and meeting competence in these five areas do not in themselves necessarily guarantee sufficient knowledge, experience, or skill to direct and manage a sleep disorders of breathing laboratory as currently defined by the American Academy of Sleep Medicine. Additional training and/or experience, including acquisition of skills in laboratory testing and management, may be needed to accomplish this goal.

The first two proficiencies in Table 2 are knowledge domains for the respiratory control mechanisms in sleep and the pathophysiology of obstructive sleep apnea. These areas often are taught through lectures or reading assignments, and assessed using a written examination about the content area. The knowledge areas are akin to current ACGME guidelines that list “sleep disorders” as a required topic area in pulmonary fellowships.

The committee defined three additional diagnostic and management skill domains related to “sleep studies.” The third of the five proficiencies requires the trainee to demonstrate skills of acquiring appropriate information from the history and physical examination and creating a differential diagnosis in the evaluation of a patient with a sleep complaint as a presenting or comorbid condition.

A fourth skill is the understanding and interpretation of the polysomnography report. This includes the ability to recognize simple and straightforward sleep-tracing abnormalities, such as central or obstructive apneas, Cheyne-Stokes' respiration, and periodic limb movements, which are often present in patients with sleep-disordered breathing. This competency also includes the ability to understand and interpret for use in clinical practice the data components and detailed reports that come from sleep

**TABLE 1. RANGE OF SLEEP CONTENT USED IN THE PRACTICE OF PULMONARY MEDICINE**

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- I. Scientific basis of pulmonary medicine
    - A. Physiology
      - 1. Nature of sleep and of cardiopulmonary control
      - 2. Examples of effects of sleep on cardiopulmonary function
        - a. Effects of sleep deprivation
        - b. Circadian rhythm
        - c. Altitude and environmental effects
      - 3. Neuroanatomy of the upper airway and chest wall
      - 4. Arousal mechanisms from sleep relating to cough, apnea, paroxysmal nocturnal dyspnea, and chemosensation (hypoxemia, hypercapnia)
      - 5. Development and aging
    - B. Pathophysiologic mechanisms and consequences
      - 1. Obstructive sleep apnea
      - 2. Central sleep apnea and Cheyne-Stokes' respiration
      - 3. Nocturnal hypoventilation in other diseases (COPD, restrictive diseases, asthma)
    - C. Population and clinical epidemiology of sleep-disordered breathing
  - II. Diagnostic methods and procedures
    - A. Sleep-related history and physical examination
      - 1. History, including the use of patient-based tools such as the Epworth sleepiness scale or other instruments
      - 2. Medication-related effects on sleep
      - 3. Directed examination of the patient (airway/chest wall/BMI)
      - 4. Differential diagnosis and pretest probability of sleep-disordered breathing as well as of other sleep disorders
      - 5. Comorbidity (CHF, GERD, panic attacks)
    - B. Testing, its indications, and clinical utility
      - 1. Cardiorespiratory monitoring over time (portable monitoring)
        - a. Airflow and respiratory effort measurements
        - b. Continuous oximetry and end-tidal CO<sub>2</sub> measurements
      - 2. Polysomnography
        - a. Indications for testing
        - b. Distribution of sleep stages
        - c. Important elements in polysomnography report that influence management
        - d. Recognize awake and sleep (non-REM/REM) states
        - e. Recognize hypopneas and apneas (obstructive, central, mixed)
        - f. Recognize classic examples of other specific conditions (PLMs)
        - g. Recognize respiratory effort-related arousals
      - 3. Patient-based collection of sleep-wake behavior ("sleep log" or "sleep diary")
      - 4. Understand indications and utility of ancillary tests for sleepiness
        - a. Multiple Sleep Latency Test
        - b. Maintenance of Wakefulness Test
  - III. Broad clinical management
    - A. Obstructive sleep apnea
      - 1. Natural history
      - 2. Treatment
        - a. Ventilatory support (CPAP, bilevel treatment, oxygen)
        - b. Surgical management, including UPPP and bariatric surgery
        - c. Behavioral and pharmacologic options
      - 3. Definitions of outcome
    - B. Central sleep apnea (Cheyne-Stokes' respiration) and its management
    - C. Other sleep disorders (understand first-line therapy)
      - 1. Periodic limb movement
      - 2. Insomnia and sleep hygiene
      - 3. Narcolepsy
    - D. Sleep issues in other disorders
      - 1. Pulmonary diseases (respiratory failure, COPD, restrictive lung disease, asthma)
      - 2. Cardiac disease (CHF, angina, hypertension)
      - 3. Neuromuscular diseases
      - 4. Obesity
      - 5. GERD
    - E. Assessments of the hospitalized patient
      - 1. Perioperative screening and management
      - 2. Management of previously unrecognized sleep-disordered breathing
  - IV. Administrative and professional issues
    - A. State and federal reporting requirements
    - B. Reimbursement guidelines
    - C. Patient and public health advocacy
    - D. Accreditation and certification requirements for sleep laboratories and individuals
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*Definition of abbreviations:* BMI = body mass index; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; CPAP = continuous positive airway pressure; GERD = gastroesophageal reflux disease; PLMs = periodic leg movements; UPPP = uvulopalatoplasty.

**TABLE 2. SLEEP MEDICINE CORE KNOWLEDGE DOMAINS AND COMPETENCY ASSESSMENT METHODS FOR PULMONARY FELLOWSHIP TRAINEES**

After Completion of an Accredited Training Program in Pulmonary and Pulmonary and Critical Care Medicine, the Physician Will:	Suggested Instructional Methods	Recommended Assessment Methods
Explain the effects of sleep on respiratory control mechanisms	Reading assignments or lecture-based presentation	Standardized written and/or oral exam
Describe the pathophysiology and consequences of obstructive sleep apnea hypopnea syndrome; central sleep apnea; Cheyne-Stokes' respiration; obesity hypoventilation syndrome; and nocturnal respiratory dysfunction in other pulmonary, cardiac, and neurologic disorders	Problem-based cases, lecture series, or reading assignments	Standardized written and/or oral exam
Formulate an appropriate differential diagnosis from the sleep history and physical examination	Clinic-based experiences, preceptor teaching	Behavioral checklists, global rating scales using standardized patients and real patients
Comprehend all elements of a comprehensive PSG report, and identify common normal and abnormal tracings from a PSG record (obstructive and central apneas, PLMs, Cheyne-Stokes' respiration)	Examples and case management	Checklist evaluation for encounters, standardized cases and PSG tracings
Demonstrate management skills for sleep apnea and other common sleep disorders of breathing, including appropriate referral for diagnoses other than or in addition to sleep-disordered breathing	Multiple patient encounters and simulated case management	Standardized case management problems and/or clinical simulation

*Definition of abbreviations:* PLMs = periodic leg movements; PSG = polysomnography.

centers, including the scoring of sleep state, cardiopulmonary monitoring, and ancillary measures, with or without a subsequent objective assessment of sleepiness. A pulmonary physician should understand the primary data extraction, and the strengths and limitations of the measures, rather than relying solely on the final diagnosis and recommendation(s) contained as a summary interpretation. Meeting competency in this domain does not assume or guarantee that trainees are ready to independently interpret full polysomnography studies in a sleep center. It also is not sufficient to guarantee the quality of an individual trainee's interpretation of polysomnographic studies in a sleep disorders of breathing laboratory.

The fifth skill is the management of patients with sleep-disordered breathing, particularly sleep apnea. The ACGME first stated this skill as management of "sleep disorders" in the requirements for pulmonary fellowship accreditation in 1988, and this language continued up until recent times. The understanding of pretest probability, patient outcome, and knowledge of equipment, social aspects of care, and other tools used in follow-up of patients with sleep-disordered breathing should be a part of fellowship training. Training would incorporate knowledge and skills with new technology for diagnosis, treatment, and/or follow-up. An essential component in this domain is recognizing when a patient likely has diagnoses instead of or in addition to sleep apnea, and the criteria for referral to a comprehensive sleep center and specialist. Patients with nonclassic conditions or lack of response to standard therapy should be appropriately referred to comprehensive sleep centers and/or sleep-certified specialists. Given the broad range of clinical decisions and patient-based outcomes encountered in pulmonary practice, knowledge is needed in the economic, legal, and social aspects of sleep-disordered breathing. Assessment of competency in this domain could involve multiple approaches.

The committee believes that competency in each of these domains can be acquired and refined within the setting of a standard pulmonary fellowship program. The committee also believes that using competency assessment skills, rather than a time-based exposure, is more reliable and also allows training programs and trainees greater flexibility. Many of the necessary skills are most often assessed during patient care using both formal and informal assessment of trainee proficiency. Objective structured clinical examinations offer a standardized approach to assessment of both knowledge and application of knowledge to patient care. An individual fellowship training program could

choose or modify one or more of these competency-based assessments or create new ones directed at a particular domain in pulmonary sleep medicine. As training programs develop specific competency assessment tools in each of the five domains, they should be shared between programs through the ATS, APCCMPD, or other professional societies. Alternatively, programs could opt to assess sleep medicine training of their fellows using a completely different approach.

## CURRICULAR RESOURCES

Knowledge and acquisition of skills can be accomplished using a number of models and modes of instruction (13). The manner of instruction will vary according to local resources, based on the size and scope of particular pulmonary training programs. Furthermore, to accommodate different types of learners, varying formats are useful and may include lectures, case-based instruction modules, projects, interactive instructional programs or models, and one-on-one instruction. Table 3 lists titles of currently used instruction or lectures that were identified during committee discussions or in review of this document by other organizations and individuals. A limited number of detailed examples are provided in the online supplement to this document. The committee encourages training programs that develop techniques, materials, or other innovative learning tools about sleep and sleep disorders to share them with other programs through the RNS or ATS training committee websites and through the APCCMPD.

Current sources for content include the major pulmonary textbooks in the field; however, immediately useful instructional material in a variety of formats is now present in textbooks of sleep medicine and practice parameters (*see* the online supplement for an annotated bibliography as of 2004). Internet resources also could be modified or adapted by training programs to enhance learning (Table 4).

The American Academy of Sleep Medicine in collaboration with the Sleep Academic Awardees have created a website (16) as a repository for model slide sets relevant to basic and clinical training in sleep medicine. The site includes content case summaries and other material that can be used directly or modified for instruction, assessment, or self-study. In many cases, this material must be modified to an appropriate level of complexity for the specific purpose, such as continuing medical education programs or case-based assessment.

**TABLE 3. EXAMPLES OF PRESENTATIONS TO ACHIEVE COMPETENCY OBJECTIVES**


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<p>Sleep and pulmonary practice</p> <ul style="list-style-type: none"> <li>Describe the indications for polysomnography</li> <li>Compare and contrast the symptoms of and causes for sleepiness, inattention, and fatigue</li> <li>Recall the behavioral and cardiovascular correlates of unrecognized sleep apnea</li> <li>Compare and contrast treatment options for patients with sleep apnea</li> <li>Describe a recognition and management strategy for Cheyne-Stokes' breathing</li> <li>Name three endocrinologic disorders associated with sleep-disordered breathing</li> <li>Describe how the efficacy of cancer, asthma, and COPD treatments are affected by the timing of medications</li> <li>Prescribe safe and effective countermeasures to sleepiness for residents rotating through the MICU</li> <li>Prescribe safe and effective measures for patients with sleep-disordered breathing</li> <li>Distinguish by history nocturnal leg cramps, restless leg syndrome, peripheral vascular disease, and peripheral neuropathy</li> <li>Compare and contrast the causes of sleep apnea in children and adults</li> <li>Demonstrate CPAP and bilevel treatment, masks, and maintenance</li> <li>List legal and ethical implications of untreated sleep disorders and societal sleepiness</li> </ul> <p>Impact of sleep in intensive care and consultative practice</p> <ul style="list-style-type: none"> <li>List the management issues raised by sleep apnea in the pre- and postoperative care of the surgical patient</li> <li>Describe the features of the MICU environment that enhance or inhibit the restorative effects of sleep and circadian rhythm</li> <li>Describe the impact of 1-night total sleep loss, chronic partial sleep loss, and sleep inertia on respiratory control</li> <li>List the role of snoring and sleep apnea in the pathophysiology of preeclampsia</li> <li>Identify the role of sleep disruption in presentations of confusion, stupor, and coma</li> </ul> <p>General knowledge and clinical management</p> <ul style="list-style-type: none"> <li>Provide behavioral therapy to improve sleep patterns in adolescents and young adults</li> <li>Demonstrate the use of a sleep history for assessment</li> <li>List indications, efficacy, and risk/benefit of prescription hypnotics and of over-the-counter medications/alternative treatments to promote sleep</li> <li>Explain the four criteria for a diagnosis of narcolepsy</li> <li>Compare methods to evaluate subjective and objective sleepiness</li> <li>Discuss the purposes for a Multiple Sleep Latency Test</li> </ul>
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*Definition of abbreviations:* COPD = chronic obstructive pulmonary disease; CPAP = continuous positive airway pressure; MICU = medical intensive care unit.

**TABLE 4. WEB-BASED RESOURCES (ACTIVE AS OF FEBRUARY 8, 2004)**

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- American Thoracic Society  
This web-based resource holds relevant statements on sleepiness and sleep apnea and the utility of cardiopulmonary monitoring.  
<http://www.thoracic.org/statements/>  
<http://www.thoracic.org/assemblies/rms/default.asp>
  - American Academy of Sleep Medicine  
MEDSleep. A program developed by the National Center on Sleep Disorders Research NHLBI's Sleep Academic Award Program. The MEDSleep website provides a comprehensive library of more than 100 web-based sleep curricular-based materials, which can be downloaded free of charge on most curricular elements for sleep medicine and neurobiology of sleep.  
[www.aasmnet.org/MEDSleepprogram.htm](http://www.aasmnet.org/MEDSleepprogram.htm)
  - European Respiratory Society's Web-based Learning Programme in Sleep Medicine  
This program is currently in development.  
[www.ersnet.org/sleep\\_medicine/home/](http://www.ersnet.org/sleep_medicine/home/)
  - Australasian Sleep Society  
The website hosted has many portals to the sleep web world.  
<http://www.sleephomepages.org/>
  - National Center on Sleep Disorders Research  
The NCSDR of the NHLBI has web-based educational materials on its website designed for health professionals, including information on sleep apnea and restless legs syndrome.  
[www.nhlbi.nih.gov/health/prof/sleep/index.htm](http://www.nhlbi.nih.gov/health/prof/sleep/index.htm)
  - Sleep Home Pages  
This site is operated by Web Science International with support provided in part from the National Institute of Mental Health. The site provides the Sleep Syllabus, which was originally developed by members of the Sleep Research Society. Other useful information is also provided on this website.  
[www.sleephomepages.org/sleepsyllabus](http://www.sleephomepages.org/sleepsyllabus)
  - National Sleep Foundation's Sleep Medicine Alert  
These web-based alerts provide reviews on sleep topics, including circadian rhythms and sleep-related breathing disorders.  
[www.sleepfoundation.org/publications.cfm](http://www.sleepfoundation.org/publications.cfm)
  - American Sleep Apnea Association  
This association has web-based materials tailored for patients and health care professionals concerning sleep apnea and treatment options.  
<http://www.sleepapnea.org/>
  - Sleep Medicine Home Page  
This web-based resource provides many resources including topics covering sleep physiology and clinical sleep medicine, and also lists sleep-related professional associations and foundations with their websites.  
[www.users.cloud9.net/~thorpy/](http://www.users.cloud9.net/~thorpy/)
  - Restless Legs Foundation  
The Restless Legs Foundation provides a medical bulletin written for health professionals, which is updated yearly, and which clearly outlines the diagnosis, pathophysiology, and treatment of restless legs syndrome and periodic limb movement disorder.  
[www.rls.org/frames/home\\_frame.htm](http://www.rls.org/frames/home_frame.htm)
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**TABLE 5. EXAMPLES OF TOPICS FOR IN-DEPTH STUDY OR RESEARCH**


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Fundamentals of Clinical Management
Expression of circadian rhythm and sleep in common respiratory illnesses
Interactions among sleep habits and adherence to therapy
Clinical decision making in the management of sleep apnea
Sleep and sleep behavior in children with respiratory illnesses
Correlate the physical examination of the upper airway with perioperative anesthetic risk
Art and Science of Pulmonary Medicine
Implementation strategies for teaching sleep history in pulmonary training
Discrimination of sleepiness, fatigue, and inattention in COPD, asthma, and other intrinsic lung diseases
Strategy for managing sleep problems induced by treatment (e.g., steroid use, cancer chemotherapy)
Other Areas
Systems management of sleepiness in MICU rotations
Sleep apnea and public policy
Medical economics of sleep apnea, sleepiness, and circadian rhythm

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*Definition of abbreviations:* COPD = chronic obstructive pulmonary disease; MICU = medical intensive care unit.

## RELATIONSHIP TO NATIONAL TESTING

Questions about sleep and chronobiology appear in standardized tests at many levels. The U.S. Medical Licensing Examination (USMLE) Step 1 now includes the ontogeny of sleep, circadian rhythm, and the impact of sleepiness on human behavior. USMLE Step 2 now explicitly includes sleep apnea, narcolepsy, and idiopathic hypersomnolence, insomnia, and other sleep disturbances under the content area of “paroxysmal disorders.” USMLE Step 3 explicitly identifies sleep disorders in the context of the nervous system disease/disorders, as well as the traditional topics on patient presentations and clinical assessments (14). Therefore, fellowship trainees in the near future already will have encountered the concepts of sleep and chronobiology at multiple levels of prior training. The goal therefore is to focus the education within fellowship training programs on the sleep components important in pulmonary medicine.

Approximately 5% of the questions in the ABIM pulmonary disease certification examination are primarily in the sleep content area, similar to the question profiles for other common illnesses, like pneumonia. Questions have included fragments from a polysomnography record requiring knowledge of how to interpret tracings besides those of cardiopulmonary monitoring, such as relatively straightforward examples of periodic leg movements or sleep apnea and questions concerning recognition and initial therapy of narcolepsy, sleep cycle disorders, and insomnia. Therefore, the science and art behind the clinical problems of sleep-disordered breathing are recognized as essential knowledge domains for independent assessment for accreditations and competency in pulmonary medicine.

## ADVANCED ACTIVITIES AND RESEARCH OPPORTUNITIES

There is broad recognition by ATS and other groups that more researchers are needed in sleep medicine and that this is a rapidly growing multidisciplinary field. Research in sleep disorders and the related topic of chronobiology is expected by the ACGME to be conducted within most fellowship programs. Examples of important research areas defined by the committee are listed in Table 5. These examples also are applicable for those in Ph.D. or master's-level programs. One innovative program, based within a National Institutes of Health-sponsored general clinical research center, provides organized training courses and programs for fellows to do research in sleep disorders (Catesby Ware, M.D., personal communication). Each fellowship program should identify local physician-scientists who conduct research in sleep and chronobiology and use them as mentors and advisors to research programs in pulmonary medicine.

## ASSESSMENT TOOLS

Knowledge is generally tested by written examination, but there is increasing interest in complementary assessments, such as observed patient interactions, simulated patients, structured clinical encounters, or chart review, as outcomes for assessment during training (14). An array of assessment tools is available (16–18) or new tools can be constructed from the competency objectives. The online supplement provides examples of assessments.

## SITES FOR INSTRUCTION WITHIN A PULMONARY TRAINING PROGRAM

The most efficient venue for instruction is a clinical rotation or experience in a sleep laboratory and a curriculum organized by a sleep medicine expert within the division. In such an environment, trainees should obtain and intensively practice their skills in clinical assessment and differential diagnosis. The committee cannot require dedicated sleep medicine block time, but endorses this as one component of pulmonary fellowship training. It is recognized that not all pulmonary training programs administer a sleep laboratory or have sleep-certified providers in their faculty. However, even without these resources within the program, competency still can be acquired and assessed through other means, including formal interactions with other sleep programs within or outside the home institution. The committee recommends that all pulmonary trainees have exposure to sleep medicine, including time spent in a sleep diagnostic laboratory or sleep center with accredited sleep medicine specialists.

In the near future, there will be educational opportunities for the pulmonary trainees to interact with individuals directing a sleep medicine fellowship program. Pulmonary trainees should interact with other sleep-related ACGME clinical trainees from disciplines such as neurology, pediatrics, psychiatry, and otolaryngology. With a defined curriculum and available competency-assessment tools, a pulmonary program could serve as a major resource for sleep education in an academic medical center.

## IMPLEMENTATION STRATEGIES

Implementation of this curriculum will present some challenges for program directors. Successful implementation will be enhanced if the competencies are seamlessly integrated into existing training methods and experience. This integration is particularly important because education and competency assessment in many other areas also must be accomplished. Furthermore, integration of sleep training should be accomplished without significantly reducing time for research or other elective clinical activities.

In most programs, small group sessions are an integral part of pulmonary/critical care training, and many case-based discussions can be adapted to include sleep-disordered breathing, other sleep disorders, the effect of sleep on respiratory control and gas exchange, and the sleep and chronobiological aspects of therapy. Because sleep apnea is the most common respiratory disorder cared for by primary care practitioners (19, 20), and the most common sleep disorder managed in tertiary sleep centers (2), the pulmonary service can be a resource for inpatient consultations. Collaboration between pulmonary training programs and existing sleep medicine programs will provide access to additional expertise, exposure to a broad array of patients with sleep complaints, and opportunity to develop joint training electives and assessments. Attendance at sleep medicine conferences could provide educational opportunities without the need for pulmonary medicine program directors to develop entirely new goals, objectives, or educational programs.

This document and its supplementary material will be disseminated through both print and digital formats to serve as a resource for training in sleep disorders for pulmonary and pulmonary/critical care training programs in the United States. The supplemental material should evolve and be expanded as programs that use the current material refine or develop new approaches. Furthermore, competency evaluation methods should be reevaluated periodically to assess their performance and to ensure relevance to patient needs.

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THIS STATEMENT WAS PREPARED BY AN AD HOC SUBCOMMITTEE OF THE ASSEMBLY ON RESPIRATORY NEUROBIOLOGY AND SLEEP WITH THE ATS TRAINING COMMITTEE. MEMBERS OF THE SUBCOMMITTEE ARE AS FOLLOWS:

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