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SPECIAL ARTICLES

The Past Is Prologue: The Future of Sleep Medicine

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The field of sleep medicine has gone through tremendous growth and development over a short period of time, culminating in recognition of the field as an independent medical subspecialty by the Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties (ABMS). However, the fellowship training requirement that is now mandatory for sleep medicine board certification eligibility has had the unintended consequence of restricting the influx of young physicians to the field. In response to the potential workforce shortage confronting the field of sleep medicine, the American Academy of Sleep Medicine (AASM) board of directors has developed a comprehensive plan to strengthen the field by growing sleep fellowship programs, exploring novel sleep medicine training opportunities, creating and fostering the sleep team (with special emphasis on engagement of primary care providers), embracing the role of consumer sleep technologies, and expanding the reach of sleep specialists through telemedicine. The AASM plans summarized in this special article represent efforts to confront serious workforce challenges and turn them into opportunities that will improve the health of both our patients and our field.

Keywords: sleep medicine, growth, development, workforce, fellowship programs

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INTRODUCTION

"And by that destiny to perform an act
Whereof what's past is prologue, what to come
In yours and my discharge."
—William Shakespeare. The Tempest. Act 2, Scene 1:288-90.

To understand the future of sleep medicine, we must first consider that the past is our prologue. The field of sleep medicine has gone through tremendous evolution since the discovery of REM sleep in 1953.[1] Clinical and basic research demonstrated the necessity and importance of sleep to human health,[2–8] polysomnography moved from the laboratory to the clinic,[9,10] and epidemiological studies showed that sleep disorders were some of the most prevalent diseases known to mankind.[11–13] These advances fostered creation and development of organizations focused on clinical sleep medicine such as the American Academy of Sleep Medicine (AASM) and the American Board of Sleep Medicine (ABSM). These organizations appreciated the need for specialized training and certification to ensure physician competency in caring for patients with sleep disorders. The AASM focused on professional education, accreditation, and the development of practice standards, whereas the ABSM implemented a standardized process and examination for the certification of sleep specialists.

In 1988 the AASM founded the Sleep Medicine Fellowship Training Committee (SMFTC) to develop guidelines and accredit fellowship training programs that would ensure comprehensive training in clinical, technical, and research aspects of sleep medicine.[1] Initially this training occurred by adding sleep medicine content to existing clinical neurophysiology and pulmonary fellowship training programs, and candidates could become eligible for the ABSM examination through a combination of training and clinical experience. Over time, more comprehensive sleep medicine fellowship training programs were established, and by 2005 the ABSM began to require a full year of sleep medicine training to sit for the board examination. At the same time, efforts to hand off sleep fellowship program accreditation from the AASM to the Accreditation Council for Graduate Medical Education (ACGME) were successful, with the ACGME formally recognizing sleep medicine as an independent subspecialty in 2003 and approving the program requirements for sleep medicine training in 2004. In less than two decades, sleep medicine training programs evolved from supplemental sleep medicine education added to existing clinical neurophysiology and pulmonary training programs to ACGME-approved, one-year, dedicated sleep fellowship programs.

Board eligibility and certification evolved in parallel with these training advancements. The AASM offered an examination in clinical polysomnography from 1978 until 1991, when the ABSM was established as an independent examination board. From 1991 until 2006 the ABSM administered a certifying examination in sleep medicine, with a total of 3,445 physicians and PhDs achieving the designation of Diplomate, ABSM. The ABSM ceased offering this examination when the American Board of Internal Medicine (ABIM), American Board of Psychiatry and Neurology (ABPN), and four other member boards of the American Board of Medical Specialties (ABMS) began offering a biennial sleep medicine examination

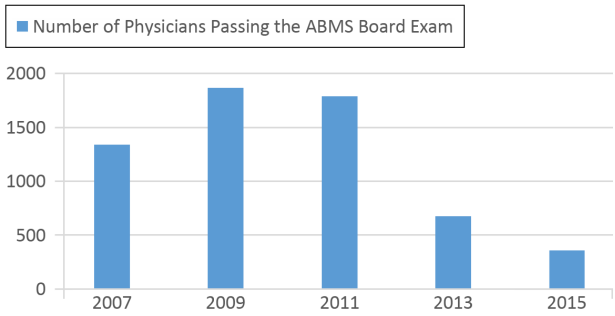
in 2007. During the first three ABMS examination cycles from 2007 through 2011, individuals who had not completed 12 months of formal sleep medicine training could qualify to take the examination through a "practice pathway" if they met specific requirements related to their clinical experience. In addition, those previously certified by the ABSM were also allowed to sit for the examination without having to prove prior training.[8–11] After the 2011 examination, these practice pathways were abolished, and the board began to require a physician to complete at least 12 months of an ACGME-approved sleep medicine fellowship to become board-eligible.[8–11]

This represented a defining moment in the growth and development of the field of sleep medicine for two divergent reasons. First, ACGME fellowship accreditation and ABMS certification definitively cemented sleep medicine as an independent medical specialty. Second, the more stringent requirements for board eligibility resulted in fewer physicians sitting for the sleep medicine board examination beyond 2011 (**Figure 1**). The sleep medicine community believed that the ongoing development of sleep medicine fellowship training programs, through growth in both the number of programs and trainees per program, would address this shortcoming. Unfortunately, although fellowship programs and the number of fellows have increased through the years (**Table 1**), they have fallen far short of the numbers needed to address the high prevalence of sleep disorders in the growing population. Indeed, the field has plateaued and is likely to contract, with the number of retiring sleep specialists expected to outpace the number of new board-certified sleep medicine physicians in the years ahead, representing a quandary for our field. This is happening at a time of increasing demand for our services.

For example, one of the primary concerns of the Federal Motor Carrier Safety Administration (FMCSA), as it plans rules to address obstructive sleep apnea (OSA) in safety sensitive positions, is the limited availability of sleep medicine physicians to diagnose and treat all affected commercial motor vehicle operators should formal rules be imposed. This is only one instance among many that demonstrate the dependence of the future of sleep medicine on a sufficient workforce that can address the massive sleep disease burden in the general population.

Understanding the gravity of this challenge, the AASM board of directors hosted the Future Models of Care conference at the Hyatt Regency in downtown Chicago, IL, November 16–17, 2013. This gathering of more than 50 sleep medicine thought leaders and stakeholders focused on a number of strategies for addressing the impending sleep physician shortage, including how to engage primary care in sleep medicine, build multilayered sleep teams, and leverage telemedicine to expand patient access to sleep specialists. These fruitful discussions led the AASM board of directors to develop a comprehensive plan to grow the field of sleep medicine. The remainder of this article describes the key elements of this plan, including its rationale.

Figure 1—American Board of Medical Specialties (ABMS) board certification.



GROWING SLEEP FELLOWSHIP PROGRAMS

The first priority of the AASM is to foster the continued growth and development of ACGME-approved, one-year sleep fellowship programs and increase the number of board-certified sleep medicine physicians (BCSMPs). The aspirational goal is to maximize the supply of BCSMPs to ensure the availability of quality care for all patients who have a sleep-wake disorder. Opportunities to do so still exist. Recently, the AASM surveyed the University of Michigan's first- and second-year medical students regarding their understanding of the potential for a career in sleep medicine. More than half were unaware that sleep medicine is an independent ABMS medical specialty. Currently there are 83 ACGME-approved sleep medicine fellowship programs, allowing for more than 200 training slots annually in the United States. However, more than 40% of the 147 accredited medical schools in the United States do not have

Table 1—Sleep medicine fellowship program development, 2012 to 2017.

Fellowship Appointment Year	# of ACGME Programs	Total Slots Filled	Programs in NRMP Match	Slots in NRMP Match	Applicants in NRMP Match	Slots Filled in NRMP Match
2017	83	*	80	166	143	130
2016	83	166	72	142	127	112
2015	83	165	70	130	102	94
2014	83	153	69	133	105	97
2013	79	154	64	129	112	98
2012	74	154	53	99	103	87

*The number of total slots filled for the 2017 appointment year was unavailable at the time of publication. ACGME = Accreditation Council for Graduate Medical Education, NRMP = National Resident Matching Program.

programs. Thus, potential exists for both increased awareness of a sleep medicine career, and development and growth of new fellowship training programs. Therefore, the AASM has taken a number of practical steps to attract young physicians to our exciting and fulfilling profession, with the goal of filling all sleep medicine fellowship training slots annually with the strongest possible applicants. Initial results are encouraging, as the number of applicants participating in the sleep medicine match coordinated by the Specialties Matching Service, which is administered by the National Resident Matching Program (NRMP), increased by 24.5% from 2015 to 2016 and by 12.6% from 2016 to 2017 (**Table 1**).

One of the challenges for young physicians who consider a career in sleep medicine is a lack of understanding of what the career entails and what types of practice models exist. This uncertainty may deter them from choosing a sleep medicine career. To address this issue the AASM developed the website www.choosesleep.org, which offers a broad overview of a sleep medicine career, including the diverse pathophysiology of sleep disorders, an explanation of various career types, a discussion of emerging sleep technologies, and details on how to become board certified. In addition, a resource containing all identifiable practice types, including research, is under development to help young physicians and scientists better map out their future in sleep medicine. The Twitter hashtag #ChooseSleep is being used as part of a social media strategy to generate a conversation about sleep medicine career opportunities and the importance of sleep to health and well-being.

Specialty-specific interest groups at medical schools across the nation provide a forum for like-minded medical students to meet and explore professional interests and career opportunities. These interest groups educate students on how to pursue specific careers in medicine and explain the nuts and bolts of what these careers entail. Such groups could provide an opportunity to recruit young physicians into the field of sleep medicine. Last year the AASM piloted sleep medicine interest groups (SMIGs) at six medical schools across the country, and this year the number of medical schools with a SMIG quickly grew to 18. The goals of these groups are to cultivate medical student interest in sleep medicine clinical care and research, offer structured opportunities for mentorship and networking with sleep medicine faculty and fellows, and provide community outreach that promotes healthy sleep awareness. SMIG leaders also will connect with leaders of internal medicine interest groups (IMIGs) and special interest groups of the neurology section (SIGNS) to collaborate and share information regarding sleep career opportunities. Because of the success of this program, the plan is to expand SMIGs to additional medical schools across the nation, with the necessary materials for founding a SMIG available at ChooseSleep.org.

The ultimate goal of fellowship training is achievement of board certification. To highlight the value of this credential, the AASM created the logo in **Figure 2** and the associated tagline, "The Most Qualified Physicians to Care for Sleep Disorders." This logo will be made available as an online badge that may be used by AASM members who are BCSMPs to represent their proven high level of expertise in diagnosing and treating sleep disorders.

Figure 2—Logo for AASM members who are board-certified in sleep medicine.

To further quantify the value of board certification, the AASM has provided the American Sleep Medicine Foundation (ASMF) with earmarked funding for awards or contract projects to investigate the value of all the training that underlies board certification. By showing the importance of this credential to clinical care outcomes, the field can provide a strong value proposition to young physicians for fellowship training in sleep medicine. Amplification of this message will occur through a series of advertisements in primary care and specialty journals highlighting board certification and encouraging referrals to these highly trained sleep specialists.

The AASM is also implementing a number of initiatives focused on physicians in ABMS residency programs that lead to fellowship eligibility in sleep medicine. The AASM Sleep Medicine Fellowship Directors Council is developing an electronic publication to address issues and challenges that face these young physicians as they pursue a career in medicine, and it will help them determine whether sleep medicine is a good match for their personal and professional goals. All residency programs accredited by the ACGME are required to have regular lectures on fatigue management to maintain accreditation. The AASM Sleep, Alertness and Fatigue Education in Residency (SAFER) slides, which were previously created for this purpose, will be supplemented with additional content about a career in sleep medicine and how to become a sleep specialist. To address the lack of knowledge regarding the possibility of a career in sleep medicine, the AASM will send letters to all ABMS sleep-medicine-eligible specialty program directors, residents, and fellows at institutions that offer a sleep medicine fellowship program, encouraging them to consider a career in sleep medicine. The AASM also sent letters to all second- and third-year medical students across the country, encouraging them to explore the career opportunities that sleep medicine offers.

The AASM is also taking a practical approach to grow the profession. To increase exposure to sleep medicine, AASM courses have been discounted for residents from ABMS sleep-medicine-eligible specialties at institutions that have current sleep medicine fellowship training programs. Complimentary registration for the SLEEP meeting is offered to graduating sleep medicine fellows and residents from ABMS sleep-medicine-eligible specialties at these same institutions. At SLEEP

2016 in Denver, 118 residents and fellows took advantage of this free offer. The AASM hosted a gathering of these attendees, introducing them to the AASM and the field of sleep medicine. SLEEP 2016 in Denver was the first year of this program, and it received positive reviews from the residents and fellows who attended. To further help them on their way, the AASM is developing programs to assist entering fellows as they relocate from their residency program to their sleep medicine fellowship, while also offering help to graduating fellows in their sleep medicine career job search. As they start their careers, their AASM membership dues will be cut in half in their first postfellowship year.

The American College of Physicians (ACP) provides opportunities to engage with a large group of physicians who have the potential to pursue a career in sleep medicine. Thus, the AASM will attend several ACP state chapter meetings to promote sleep medicine fellowships, provide the ACP with information about sleep medicine to include in its career counseling program, and promote the field of sleep medicine in various ACP journals via advertisements and content contributions. Similar submissions also are planned for journals most relevant to second -and third-year internal medicine and neurology residents, pulmonary fellows, and the hospital systems linked to large internal medicine and neurology residencies and pulmonary fellowships. This includes providing information about sleep medicine in resident lounges, and contributing sleep medicine content to the top blogs, podcasts, and program events that are followed by internal medicine and neurology residents and pulmonary fellows. Last, the AASM is considering the development of an educational resource on wellness and sleep for medical schools to fit within their curriculum.

Supporting and developing our current fellowship programs is crucial, but growing the number of fellowships is every bit as important. Thus, the AASM is planning a grant program to provide staff assistance to residency departments for the purpose of developing an application for an ACGME-approved sleep medicine fellowship training program. The target is to expand the number of programs from 83 to 130 in the years ahead. This initiative would involve contacting all of the medical schools that currently lack a fellowship training program in sleep medicine to encourage them to start one. It would be necessary to identify a leader at these institutions in appropriate departments or divisions to champion this effort.

EXPLORING NOVEL SLEEP MEDICINE TRAINING OPPORTUNITIES

Numerous factors are converging simultaneously to warrant serious consideration of novel pathways to board eligibility. As previously mentioned, the primary objective is the growth and development of existing ACGME-approved sleep fellowship programs. However, stopping there would miss the opportunity to engage physicians looking for a mid-career change in specialty, or younger physicians who cannot afford to put their careers on hold for yet another year of training. Novel training opportunities also could provide a backup plan should graduate medical education (GME) funding for sleep fellowships ever be cut or eliminated. To grow the specialty to the numbers needed to meet the increasing demand for sleep medicine services, we must be creative and develop legitimate options outside our traditional training opportunities.

The Department of Health and Human Services (HHS), through the Centers for Medicare and Medicaid Services (CMS), is the single largest funder of GME in the United States, with Veterans Affairs and state governments also contributing. In fiscal year 2012, the last year of data available for all federal sources of GME payments, GME consumed an estimated $15 billion in public funding, which was the largest federal investment in the health care workforce.[14] Currently the United States federal government is more than $19.5 trillion in debt, and most state governments are struggling to balance their budgets. Budget pressures have forced the Obama administration and members of Congress to consider introducing budgets and legislation that reduce GME funding. For example, in 2010 the Simpson-Bowles National Commission on Fiscal Responsibility and Reform recommended changes that would have reduced Medicare medical education payments by an estimated $60 billion through 2020.[15] In 2014 the Institute of Medicine issued a report entitled, "Graduate Medical Education That Meets the Nation's Health Needs."[16] This report advocates for increased transparency and accountability in the GME financing system to produce adequate numbers of physicians who are prepared to work in needed specialties or geographic areas, specifically commenting on the mismatch between the health needs of the population and specialty makeup of the physician workforce. This report represents growing sentiment that GME funds should be targeted to expand the primary care workforce and indicates that fund allocation decisions could make specialty fellowship training programs selectively susceptible to imposed cuts.

In light of these developments, the AASM has crafted a forward-thinking action plan. The AASM is tracking all legislation to identify any funding bill that contains action related to GME funding, and our political action committee is prepared to engage a coalition of legislators and groups representing other medical specialties with ACGME-approved training programs in opposition to any proposed cuts to GME funding. Because Medicaid programs in most states help offset a portion of GME costs incurred by teaching hospitals and other entities, the AASM also will encourage our members to get involved at the state level and will work with all state sleep societies to ensure that state funding for GME continues.

To best prepare sleep medicine for the negative ramifications of any GME funding cuts, novel avenues to board certification must be explored. These avenues would have the same rigor and expectations as our current ACGME-approved sleep fellowships, but they would leverage advances in information technology to bring the training to the people who want it. These programs may be similar in nature to existing Executive MBA Programs, meaning a shift from full-time to part-time programs. Thus, the AASM has appointed a committee to begin to outline the elements of a two-year, part-time training program that would meet all ACGME requirements and augment existing fellowship training programs. If the ACGME proves interested in piloting innovative training programs to

assess feasibility, the AASM could collaborate to develop test case programs, including detailed analysis of the effect on clinical competency and cost. In parallel, the AASM would conduct focus groups of BCSMPs and internal medicine and neurology residents to gauge their interest in this proposal.

CREATING AND FOSTERING THE SLEEP TEAM

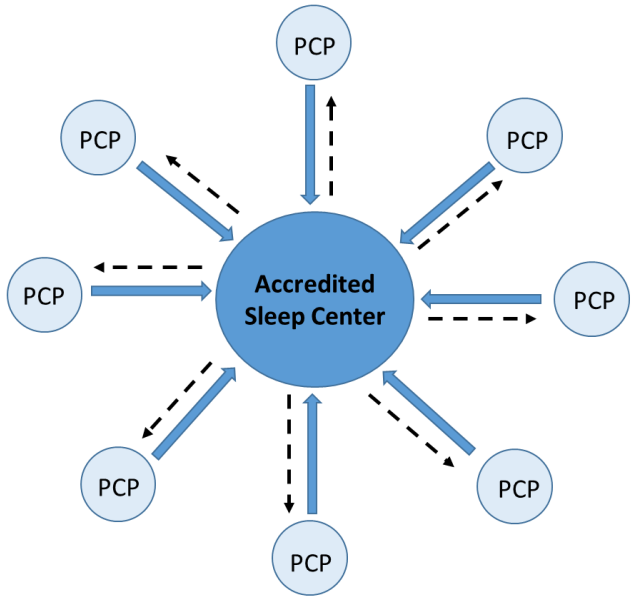
Multidisciplinary collaboration is embedded in the very DNA of sleep medicine. Physicians from no fewer than seven specialties, from psychiatry to otolaryngology, can enter a sleep medicine fellowship program. In many practices, board-certified sleep medicine physicians work closely with advanced practice registered nurses, physician assistants, and sleep technologists to provide care for our patients. Thus, it is not surprising that fostering and developing a team-based approach to the future of sleep medicine is natural for the field. In a recent patient survey conducted by Frost and Sullivan, 30% of patients reported their risk of sleep apnea was first identified by a primary care physician, with 10% receiving their diagnosis from these providers.[17] Are these physicians well trained in sleep medicine, or are they filling a void in the absence of sufficient sleep medicine physicians? Considering the workforce challenges facing our specialty, coupled with the lack of sleep medicine education across the continuum of undergraduate to graduate medical education, it seems the latter is more likely. The challenge facing the sleep medicine community is to create educational pathways and criteria to ensure the former is also true. Not every patient with diabetes is managed by an endocrinologist, and not every patient with a sprained ankle sees an orthopedic surgeon. To reach the estimated 23 million adults in the United States with undiagnosed sleep-disordered breathing,[18] a model of care that embraces a role for primary care providers (PCP) makes sense. The challenge for the sleep medicine community is how to integrate primary care with the sleep center in a manner that is effective, safe, and productive.

A "hub and spoke" model (**Figure 3**) provides a useful metaphor for how this can be accomplished and is consistent with the Patient-Centered Medical Home, a care delivery model in which timely, coordinated care is directed through primary care and communicated effectively to patients.[19,20] The hub and spoke, at its very essence, represents a collaborative care model between PCPs and board-certified sleep medicine physicians and accredited sleep centers. The "spokes" denote affiliated primary care practices and providers with heightened awareness of the effect of sleep disorders on their patient populations. The "hubs" denote accredited sleep centers housing BCSMPs and their sleep teams. Fostering and developing these collaborative care relationships requires training and educational standards for PCPs, clear delineation of responsibilities, and ongoing communication between the involved parties.

The AASM board of directors is considering a proactive approach to help build this collaborative care model. Proposed accreditation standards are being drafted to encourage BCSMPs to work with PCPs to develop affiliated practices, with telemedicine potentially playing a key role in fostering the necessary communication between the accredited sleep center and affiliated practices. As Patient-Centered Medical Home based practice models result in high patient satisfaction and improved outcomes,[21] the AASM can offer marketing services to help sleep centers that have developed this model to attract new patients. The AASM also can help build the model by identifying and cultivating affiliated practice referral sites. To assess the efficacy of this model on sleep medicine patient care and outcomes, award mechanisms through the ASMF could be proposed.

The creation and development of this practice model represents a bold challenge for our field. If the goal is to bring sleep medicine to all who need it, then this is an important path forward. This inclusiveness will further grow and establish the field of sleep medicine, and it will advance the Institute for Healthcare Improvement's Triple Aim of better care for individuals, better health for populations, and lower per capita costs.[22] However, many details are left to be considered. Primary care providers in affiliated clinics will need to meet as-yet undetermined educational criteria to serve in these roles. Furthermore, two separate roles are envisioned for the affiliated PCP. In the first role, the PCP performs the initial sleep history and physical examination, orders the appropriate sleep test to be interpreted by the BCSMP residing at the hub, and then releases the patient to the same BCSMP to receive follow-up and treatment. Home sleep apnea testing (HSAT) could be performed at the spoke or the hub, depending on the specific practice arrangement, but it always would be interpreted by

Figure 3—Hub and spoke model for integrating primary care providers (PCP) into established sleep centers.



With appropriate training, procedures, and oversight, the initial patient evaluation and home sleep apnea testing (HSAT) might be accomplished in the PCP office and interpreted by board-certified sleep medicine physicians in the sleep center hub. More complex patients, and those with indeterminate HSATs, would be referred to the sleep center, represented by the blue arrows. Patients would be referred back to the PCP for long-term management once their complex issues are addressed and treatment is stable, represented by the dashed arrows.

the BCSMP at the sleep center hub. Once the patient is treated and stable, further follow-up could occur at the sleep center hub or affiliated practice spoke. The second potential role for an affiliated PCP is similar to the first, with the difference being that all patient care and follow-up occurs at the affiliated practice spoke under the care of the PCP. Tiered educational requirements and potential certification levels developed for each of these roles are currently under consideration. Importantly, regardless of the role of the affiliated PCP, patients with complicated sleep disorders would be referred directly to the BCSMP at the sleep center hub prior to any decisions involving diagnostic testing.

PCPs in this model could include internists, family practice physicians, pediatricians, psychologists, advanced practice registered nurses (APRNs), and physician assistants (PAs). The AASM already offers a full array of educational opportunities for these clinicians, from the annual SLEEP and Sleep Medicine Trends meetings, to online and print resources including books, manuals, slide decks, and webinars. Recently, special attention has been focused on the needs of APRNs and PAs, as evidenced by the work of the AASM's APRN/PA task force and the regular gatherings of PAs and APRNs at the SLEEP meeting. This work has resulted in publication of materials delineating the special challenges facing these clinicians as they embark on sleep medicine-focused careers.[23] In an effort to define and facilitate the training necessary to bring APRNs and PAs into accredited sleep center practices, the AASM is developing its first online educational modules for this purpose.

No discussion of the sleep team would be complete without mention of the important role of sleep technologists. To ensure the health and vitality of this career, the AASM supports a training and certification pathway that can develop an interested individual into a vital member of the sleep team. The Accredited Sleep Technologist Education Program (A-STEP), now in its 10th year, includes 80 hours of a live introductory course followed by 23 online, self-study modules. Completion of this program fulfills eligibility requirements to take the ABSM registered sleep technologist (RST) examination. As the hub and spoke sleep practice model develops, the role of these individuals could evolve beyond performance of sleep diagnostic tests to include adherence data download and management, troubleshooting positive airway pressure (PAP) interface issues via telemedicine, and PAP machine adjustment under the direction of the BCSMP.[24]

EMBRACING THE ROLE OF CONSUMER SLEEP TECHNOLOGIES

Sleep medicine, by its very nature, is a technology-driven medical specialty. From polysomnography and HSAT to PAP machines and hypoglossal nerve stimulators, sleep specialists have implemented innovative technology to treat sleep illness. Moreover, consumer sleep technologies now are transforming the way populations consider their sleep health.[25] The field of sleep medicine can debate the pros and cons of this emerging phenomenon and its collective effect on sleep, but this paradigm shift affords an opportunity to consider how the practice of sleep medicine may evolve in coming years. In particular, it is important to contemplate how these changes may increase the efficiency of sleep providers, improve access to sleep services, and reduce the cost of providing sleep care.

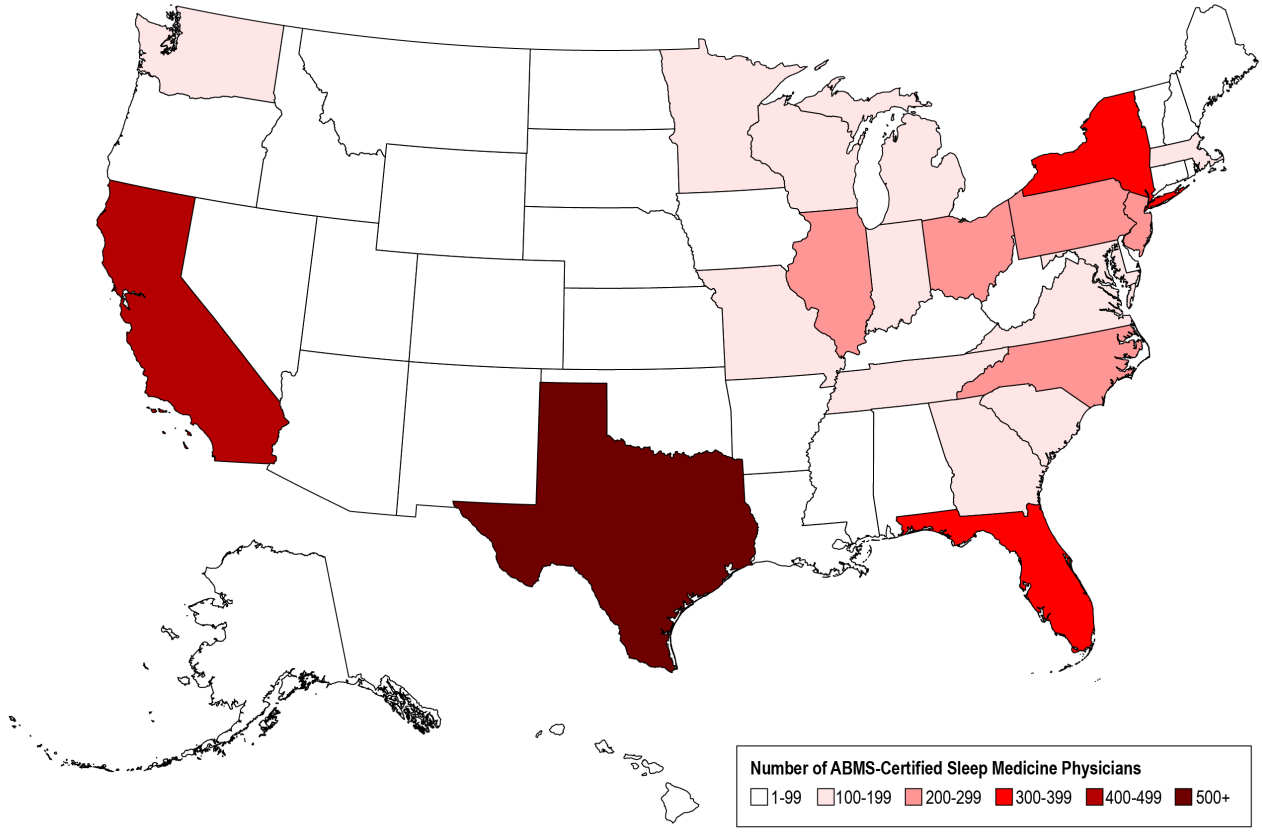
Emerging technologies that allow clinicians to screen for, and potentially diagnose, sleep apnea via contactless monitoring on smartphone applications could obviate the need to mail and retrieve home sleep apnea tests or have the patient come into the sleep laboratory for testing.[26,27] A comprehensive telemedicine pathway could exist for sleep-disordered breathing. The initial visit and follow-ups could be completed by simultaneous video-based telemedicine with either the sleep specialist or a member of the sleep team; the diagnosis would be accomplished through physician supervision of contactless monitoring of breathing patterns in the patient's own home over multiple nights; and PAP compliance and adjustment would be assessed and facilitated by industry-provided cloud computing solutions and simultaneous telemedicine visits. This paradigm extends beyond sleep apnea. The diagnosis and treatment of insomnia and sleep-related movement disorders such as restless legs syndrome also could unfold in a similar manner, albeit without need for a consumer-based diagnostic test. Although simultaneous telemedicine visits could be used to diagnose insomnia and implement cognitive behavioral therapy for insomnia (CBT-I), Internet-based CBT-I programs dramatically extend access to this proven insomnia treatment modality.[28]

The reduction in cost, and the increase in access to care, could have substantial financial implications for providers, patients, payers and employers. Indeed, a recent economic analysis by Frost and Sullivan, which was commissioned by the AASM, used sophisticated economic modeling to show the United States economy could save more than $100 billion annually if every patient with sleep apnea were diagnosed and treated.[29] As this economic modeling used current diagnostic pathways, billions more could be saved through implementation of "contactless" diagnostic solutions. Ultimately, the rise in consumer sleep technologies will drive more patients into sleep centers as the general population gains better insight into their sleep problems and seeks to optimize their sleep health. Thus, technology may both exacerbate the sleep specialist shortage problem through increasing referrals, and ameliorate the problem by providing simple, cost-effective pathways for patients to move quickly and efficiently through diagnosis and treatment pipelines. Where the end game lies could depend on how quickly these technologies achieve clinical validation, as well as how adeptly the sleep community embraces and integrates them.

EXPANDING THE REACH OF SLEEP SPECIALISTS THROUGH TELEMEDICINE

Two major drivers of telemedicine development are a high volume of demand for a particular clinical service, and a highly critical need for clinical expertise to deliver the service.[30] These drivers are directly relevant to the field of sleep medicine today. The current population of the United States is estimated by the United States Census Bureau to be approximately 325

Figure 4—Heat map of the geographic distribution of American Board of Medical Specialties (ABMS) board-certified sleep medicine physicians (BCSMPs) across the United States.



million people, and presently there are approximately 7,500 board-certified sleep specialists. This means that the ratio of people to sleep specialists in the United States is more than 43,000:1. In comparison, an area that has a ratio of people to psychiatrists greater than or equal to 30,000:1 could be eligible for designation by the United States Health Resources and Services Administration as a mental health shortage area.[31] In addition, there are geographic barriers to high-quality sleep care, with board-certified sleep physicians and accredited sleep centers clustering in more urban, highly populated areas (**Figure 4**). Building and filling sleep medicine fellowship programs, creating novel educational pathways to board eligibility, and fostering the development of sleep teams all are effective strategies to address this problem. None of these solutions has more immediate potential to overcome these challenges than telemedicine, which can dramatically increase sleep medicine accessibility and clinical efficacy. Therefore, in January 2016, the AASM officially launched a state-of-the-art telemedicine platform that was designed specifically for the sleep field and subsequently began developing multiple resources and educational opportunities to equip sleep specialists to implement a telemedicine program.[32]

For years sleep specialists, perhaps without conscious awareness, have embraced "store and forward" telemedicine through HSAT and PAP adherence monitoring. Bringing telemedicine into the sleep clinic is the natural next step, with numerous studies suggesting benefits to all parties involved.[33] A recent analysis of all telemedicine visits at one Veterans Affairs (VA) hospital over an eight-year period included 5,695 clinical encounters and found that telemedicine resulted in an average travel savings of 145 miles and 142 minutes per visit.[34] These factors, along with reduced time lost from work and fewer inappropriate emergency room visits, result in reduced costs for patients leading to high levels of patient satisfaction.[35] Telemedicine benefits providers as well, as long as it is supported by state legislation and insurer policies. Implementation of a comprehensive sleep telemedicine protocol can increase the total number of sleep consultations and sleep studies performed, while simultaneously reducing the time between sleep consultation and PAP prescription by nearly two months.[36]

The convenience of telemedicine is especially salient to the long-term management of chronic diseases, such as OSA, insomnia, and narcolepsy. A recent prospective, parallel-group randomized pilot study demonstrated that a telemedicine-based OSA diagnosis and treatment paradigm was non-inferior to traditional face-to-face care in regard to functional outcomes.[37] Similarly, a meta-analysis concluded that Internet-delivered CBT is effective in improving sleep in adults with insomnia.[28] Adherence to PAP therapy is crucial to achieving optimal treatment outcomes. Unfortunately, many patients reject, discontinue, or suboptimally use PAP therapy. The rate of CPAP discontinuation in the first 3 years of prescription

ranges from 12% to 25%.[38] When patients do not use CPAP sufficiently, clinical outcomes are compromised,[39,40] showing that maximal adherence is an important aspect of patient management. Telemedicine can reduce the timing and increase the regularity of clinical follow-up and allow continuous monitoring and motivational interviewing of the patient.[41] For these reasons telemedicine increases PAP treatment adherence with benefits to patient outcomes.[42–44] This is particularly important considering that the Centers for Medicare and Medicaid Services is shifting from a fee-for-service payment model toward a performance payment model as stipulated in the Medicare Access and CHIP Reauthorization Act of 2015 (MACRA), which established the Merit-Based Incentive Payment System (MIPS) and Advanced Alternative Payment Models (APMs). Although important questions regarding the long-term effect of telemedicine remain,[45] by improving patient access and convenience, and increasing practice efficacy, telemedicine can help address the sleep specialist workforce shortage and promote positive health outcomes by expanding the reach of sleep medicine practices.

CONCLUSIONS

Ultimately, the future of sleep medicine lies in its ability to provide the workforce to care for sleep disorders across the population, from the cradle to the grave. We must face the reality that our field is contracting due to a combination of market forces and an unintended consequence of recognition by ACGME and ABMS. We must embrace the bold and innovative approaches necessary to ensure the long-term vitality of our field. Attracting young physicians to our specialty, growing fellowship programs in numbers and slots, and creating unique training opportunities will increase the number of BCSMPs in coming years. Leveraging technology such as telemedicine and simple smartphone application-based monitors will afford increases in practice efficiency and patient satisfaction, and reduce the cost of sleep care. Building and nurturing the sleep team, with special emphasis on engagement of primary care providers, will bring sleep health into the forefront of consciousness of these front-line providers and increase access for patients. The AASM plans summarized in this special article represent efforts to confront serious workforce challenges and turn them into opportunities that will improve the health of both our patients and our field. If "what's past is prologue," then our stage is set for what is to come; the future is "in yours and my discharge." Let's write this future together.

ABBREVIATIONS

AASM, American Academy of Sleep Medicine
ABIM, American Board of Internal Medicine
ABMS, American Board of Medical Specialties
ABPN, American Board of Psychiatry and Neurology
ABSM, American Board of Sleep Medicine
ACGME, Accreditation Council for Graduate Medical Education
ACP, American College of Physicians
APM, Advanced Alternative Payment Model
APRN, advanced practice registered nurse
ASMF, American Sleep Medicine Foundation
A-STEP, Accredited Sleep Technologist Education Program
BCSMP, board-certified sleep medicine physician
CBT-I, cognitive behavioral therapy for insomnia
CMS, Centers for Medicare and Medicaid Services
FMCSA, Federal Motor Carrier Safety Administration
GME, graduate medical education
HHS, Department of Health and Human Services
HSAT, home sleep apnea testing
IMIG, internal medicine interest group
MACRA, Medicare Access and CHIP Reauthorization Act of 2015
MBA, master of business administration
MIPS, Merit-Based Incentive Payment System
NRMP, National Resident Matching Program
OSA, obstructive sleep apnea
PA, physician assistant
PAP, positive airway pressure
PCP, primary care provider
RST, registered sleep technologist
SAFER, Sleep, Alertness and Fatigue Education in Residency
SIGNS, special interest group of the neurology section
SMFTC, Sleep Medicine Fellowship Training Committee
SMIG, sleep medicine interest group
VA, Veterans Affairs

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