



Multidisciplinary Sleep Centers: Strategies to Improve Care of Sleep Disorders Patients

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Current emphasis on patient outcomes within sleep medicine, with a particular focus on quality improvement and contained costs, calls for sleep specialists to develop innovative models for long-term care and management of sleep disorders patients. Multidisciplinary sleep centers can facilitate highest-quality care that is timely and cost-effective. Effective resource use in a multidisciplinary sleep center can help minimize fragmentation of care, reduce effort duplication, and control costs. Proposed strategies to help achieve a balance between quality of care

and cost-effectiveness include: (1) multidisciplinary specialty clinics, (2) optimized use of information technology, and (3) adoption of reliable performance measures.

Keywords: multidisciplinary, sleep disorders, cost-effectiveness, outcomes, performance measures, information technologies

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A team-based approach, relying on providers from multiple disciplines, is increasingly encouraged in health care, health research, health education, and health policy.¹ A team-structured approach to patient care is particularly useful for patients with challenging diagnostic and management issues because it harnesses expertise across a wide spectrum of providers. The label of “multidisciplinary” indicates that different disciplines work on a problem in parallel or sequentially, while remaining within their disciplinary boundaries.¹ Sleep medicine specialists commonly adopt a multidisciplinary practice model, a reflection of the evolution of sleep medicine since its establishment as a distinct discipline.

Since the discovery of REM sleep in 1953,² advances in sleep biology and biomedical innovation have catapulted sleep medicine into its existence as a rapidly growing medical subspecialty. Centers dedicated to evaluation and management of sleep disorders have developed during the past quarter-century,³ a reflection of the field's relatively recent emergence. In that brief time, the field has grown from roots planted in few medical subspecialties to one that spans numerous disciplines. Providers from family medicine, internal medicine, neurology, otolaryngology, pediatrics, or psychiatry may now apply to sleep medicine fellowship programs.⁴

A clear advantage of multidisciplinary sleep centers is the presence of a wide depth and breadth of expertise available at one institution. The balance of quality, timely access, and cost of care is especially pertinent in this era of health care reform with a growing emphasis on outcomes-based population health management. Implementation of pathways to ensure best quality, timely, cost-effective care is often an overwhelming endeavor. Potential solutions include: (1) establishment of multidisciplinary specialty clinics, (2) incorporation of

advanced technology to increase patient access to care, and (3) adoption of reliable performance measures.

MULTIDISCIPLINARY SPECIALTY CLINICS

In traditional care models, patients are referred from primary care provider to specialist or from one specialist to another, which results in numerous individual evaluations.⁵ Patients with chronic disease frequently must navigate a series of referrals and appointments. Lack of coordination amongst providers often exists, and patients may perceive the system to be overwhelming, time-consuming, and fragmented.⁶

For some patients, the need for diagnostic testing and specialty care can lead to long wait times for evaluation and treatment. Patients with obstructive sleep apnea (OSA) often experience long wait times to receive care. A survey of approximately 550 Canadian physicians involved in care of OSA patients (academic and urban family physicians, respirologists, and otolaryngologists) was done to examine patient wait times. Respondents were asked to estimate patient wait times for designated events (i.e., clinic appointments, sleep lab appointments, treatment initiation) during the evaluation and management of OSA. The results showed that patients waited a mean of 11.6 months to initiate continuous positive airway pressure and a mean of 16.2 months to initiate surgical therapy.⁷ Delayed treatment of OSA may also lead to increased cost. Studies have shown that adults with OSA have higher healthcare utilization prior to diagnosis.⁸⁻¹⁰ Increased healthcare utilization and total annual cost in years prior to diagnosis and treatment of OSA has also been shown for children.¹¹

One approach to improve this process is to establish multidisciplinary specialty clinics, which focus on multi-faceted

Table 1—Examples of specialty sleep clinics to consider in a multidisciplinary sleep center

Specialty Clinic	Potential Disciplines Involved
Refractory to CPAP	Dentistry Oral & Maxillofacial Surgery Otolaryngology Sleep Medicine
Obstructive sleep apnea and Insomnia	Behavioral Sleep Medicine Sleep Medicine
Insomnia and posttraumatic stress disorder	Behavioral Sleep Medicine Sleep Medicine Psychiatry
Obstructive sleep apnea and craniofacial anomalies	Neurology Orthodontics Otolaryngology Plastic Surgery Pulmonology Sleep Medicine
Obstructive sleep apnea and neuromuscular disease	Neurology Pulmonology Sleep medicine

evaluation and treatment of a given disease. Multidisciplinary clinics are used in the ongoing management of chronic diseases such as diabetes mellitus and heart failure.^{12,13} Multidisciplinary clinics are also commonly encountered in the medical and surgical evaluation of cancer patients. In fact, the Commission on Cancer and the American College of Surgeons require multidisciplinary cancer conferences for accreditation of health centers that provide multidisciplinary care.¹⁴

This team-oriented approach has long been considered an important component of the comprehensive care of sleep disorders patients. For example, multidisciplinary clinics can be helpful in the evaluation and management of obstructive sleep apnea patients. Continuous positive airway pressure (CPAP) is a treatment option for patients with mild OSA and is indicated for treatment of moderate to severe OSA.¹⁵ However, CPAP non-adherence, defined as a mean of ≤ 4 hours of use per night, affects 29% to 83% of patients,^{16,17} and alternative interventions requiring input from other specialists may be needed for these individuals. Practice parameters from the American Academy of Sleep Medicine identify other treatment modalities to consider for patients who are unable or unwilling to use CPAP therapy. In these patients, oral appliances are indicated for treatment of mild to moderate OSA.¹⁸ Maxillo-mandibular advancement is indicated for patients with severe OSA who are unable to unwilling to use CPAP.^{19,20} Procedures such as uvulopalatopharyngoplasty and multi-level surgery, among others, may also be considered in some patients.²⁰ Appointments with numerous specialists to discuss these options can be difficult and time-consuming. A multidisciplinary clinic, however, facilitates direct communication among specialists when considering various treatments for OSA, including weight loss and other lifestyle modification, CPAP, nasal and/or palatal surgery, mandibular advancement devices, and orthognathic surgery.²¹ Providers with expertise in each of these treatments evaluate the patient, and then convene to develop a treatment plan best

sued to the individual. As a result of discussion among specialists, patients receive a well-reasoned, collective treatment plan rather than multiple isolated opinions.²¹ Multidisciplinary clinics can include not only medical and surgical specialists, but also healthcare providers from other fields. Sharma et al. recently outlined a multidisciplinary model that allows patients with sleep related breathing disorders to receive integrated care from dental sleep medicine and sleep medicine specialists.²² In this model, patients would receive collaborative evaluation, management, and follow-up from dentists and physicians with expertise in treatment of obstructive sleep apnea.

Opportunities exist for multidisciplinary clinics to serve other cohorts of sleep disorders patients, not only adults with sleep disordered breathing. Wiggs has called for the creation of pediatric multidisciplinary sleep centers to effectively meet the needs of children with sleep disorders, particularly those with intellectual disabilities and with neurological or psychiatric conditions.²³ Adenotonsillectomy is the first-line treatment of obstructive sleep apnea in children with adenotonsillar hypertrophy.^{24,25} However, treatment can be very challenging in children with complex comorbidities such as craniofacial abnormalities, neuromuscular disease, genetic or metabolic syndromes, or cerebral palsy.²⁶ A multidisciplinary specialty clinic could facilitate the multi-faceted evaluation, treatment, and follow-up that these children require. A treatment model for multidisciplinary evaluation and management of patients with obstructive sleep apnea and comorbid insomnia has also recently been proposed.²⁷ Multidisciplinary insomnia clinics could be tailored to both adult and pediatric patients. **Table 1** outlines potential multidisciplinary specialty clinics that multidisciplinary sleep centers may consider utilizing to care for specific groups of sleep disorders patients.

Multidisciplinary specialty clinics and related conferences have the potential to impact patient care. Improved patient outcomes have been shown for patients with heart failure,²⁸ amyotrophic lateral sclerosis,²⁹ and hepatocellular carcinoma³⁰ who are treated in multidisciplinary clinics; this list grows as multidisciplinary approaches are utilized for evaluation and management of other diseases. The field of sleep medicine, at its core, is a multidisciplinary entity. Sleep medicine centers with diverse expertise should be optimally positioned to establish successful multidisciplinary specialty clinics to enhance care of sleep disorders patients.

INFORMATION TECHNOLOGY SOLUTIONS

Cloud-computing systems are controlled by a network of external servers and data stored on these servers are easily accessed through the web. Use of cloud-based systems obviates the need for an institution or practice to maintain servers or host software. Rather, data can be moved to the cloud and provided on demand, which requires less energy, physical space, and technical staff.³¹ **Figure 1** depicts how a cloud-based care management program provides another means of patient-provider communication. Cloud-based paradigms have been developed to enhance care in a variety of populations, including elderly patients in assisted living facilities³² and babies in neonatal intensive care units and special care nurseries.³³ Xia and colleagues recently proposed a cloud-based

system for real time electrocardiogram (ECG) monitoring and analysis, in which doctor and patient consoles could access the cloud system through a mobile client or a desktop/web client.³⁴

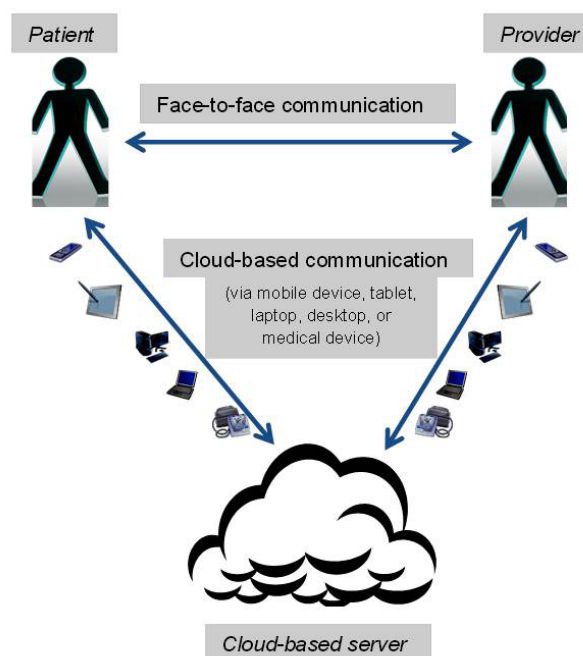
Cloud-based systems offer new possibilities for chronic disease management via enhanced patient-provider communication, easily accessible adherence data, and real-time ability to modify and optimize therapy. Most importantly, use of cloud-based systems may actually facilitate improved outcomes for patients with chronic diseases. Piette et al. used a cloud-computing system to provide self-care guidance for 85 adult diabetic patients living in an underdeveloped region of Honduras. After six weeks in the study, 98% of participants reported that due to the program they improved in aspects of diabetes management, including glycemic control (56%) or foot care (89%). In addition, mean HbA1c values reduced from 10% at baseline to 8.9% at six-week follow-up.³⁵ Use of tele-health strategies have also been shown to improve blood pressure control³⁶ and increase patient and provider satisfaction as well as to reduce costs.³⁷ Similar systems could be used by multidisciplinary sleep centers to augment care of sleep disorders patients. Cloud-computing strategies have been developed to improve access, quality, and cost-effectiveness of care in outpatient and inpatient settings.^{38,39} Use of cloud-based tele-health technologies in the practice of multidisciplinary sleep medicine may have the potential to improve care quality and outcomes for patients with sleep disorders.

Patient privacy and integrity of protected health information must be upheld with any information technology-based solution. General guidelines are already in place to delineate accountability of information security in cloud-computing systems. The cloud user is responsible for application-level security. The cloud provider, on the other hand, is responsible for physical security and likely for enforcement of external firewall policies. Security for intermediate layers of the software stack is shared between the cloud user and the cloud operator.⁴⁰ Security responsibilities are also dictated by The Health Insurance Portability and Accountability Act of 1996 (HIPAA)⁴¹ and The Health Information Technology for Economic and Clinical Health (HITECH) Act.⁴² Federal legislation requires a “Business Associate Contract” between third parties that handle protected health information and the client.⁴³ This contract must specify that the cloud provider will not engage in unauthorized use or disclosure of protected health information, will use appropriate safeguards, report illegal use of protected health information, and return or destroy the protected health information upon termination of the contract.⁴⁴ Adherence to clearly defined security requirements can facilitate successful use of cloud-based computing systems in patient care.

PERFORMANCE MEASURES

Multidisciplinary sleep centers have potential to facilitate high-quality care in the current era of health care reform. The Patient Protection and Affordable Care Act⁴⁵ calls for Accountable Care Organizations (ACOs) as the primary mechanism to achieve high-quality, cost-effective patient care. An ACO is a team of providers, tied together under a common organizational structure, that assumes responsibility for delivering and

Figure 1—Increased patient-provider communication with use of cloud-based technology.



managing the entire spectrum of care for a cohort of beneficiaries while reducing the cost of care for that same cohort.⁴⁶ Payment is associated with performance measures that emphasize quality improvement as one important means of reducing costs. Thirty-three measures fall within the four following ACO quality benchmark categories: patient/caregiver experience, care coordination/patient safety, preventative health, and at-risk population/frail elderly health.⁴⁷ Twelve of these 33 ACO metrics may easily pertain to multidisciplinary sleep centers, as these measures are directly applicable to obstructive sleep apnea patients. Some of these metrics may also apply to patients with other sleep disorders, particularly with continued development and validation of means to track therapeutic intervention and treatment response.

The Physician Quality Reporting System was enacted by the Centers for Medicare & Medicaid Services in 2007. Since 2012, the Physician Quality Reporting System (Physician Quality Reporting) Measures List⁴⁸ has included four sleep apnea measures: (1) Assessment of Sleep Symptoms; (2) Severity Assessment at Initial Diagnosis; (3) Positive Airway Pressure Therapy Prescribed; (4) Assessment of Adherence to Positive Airway Pressure Therapy. The 2013 requirement is that the sleep apnea measures be reported for 20 patients in order to receive an incentive and avoid a financial penalty. The Parkinson disease measure groups indicate that all patients with a diagnosis of Parkinson disease should be asked about sleep disturbances at least annually. The Centers for Medicare & Medicaid Services recently published a proposed rule which stipulates that all measure groups include a minimum of six measures.⁴⁹ This proposal includes a plan to increase the sleep apnea measures group, with three new measures to be added to the four measures already in place. Patient-reported outcomes should also be incorporated into quality measures.^{50,51}

The American Academy of Sleep Medicine has also developed the Innovation Care Delivery and Management Program for Patients with OSA (ICDMPPPO) with five goals: improved care coordination; increased adherence to PAP therapy; reduced comorbidities; strengthened patient satisfaction; and realized, significant cost savings for Centers for Medicare & Medicaid Services.⁵² The proposed paradigm details cost-effective methods to integrate and manage care of patients with obstructive sleep apnea across multiple providers. The program outlines enhanced information technology tools, such as a comprehensive patient-tracking and outcomes database and web-based educational modules, which would be necessary for successful implementation. This model may serve as a prototype for multidisciplinary sleep centers to develop comprehensive, cost-effective programs that improve patient-provider communication and patient outcomes.

Accountable care organizations currently highlight primary care settings and outcome measures rooted in chronic disease management, though specialists' roles in ACOs are largely undefined. This dynamic landscape offers sleep specialists the opportunity to define their role, and the importance of long-term, multidisciplinary management of sleep disorders, within the auspices of the Patient Protection and Affordable Care Act. The patient-centered aspect of multidisciplinary sleep centers may facilitate sleep medicine to be systematized into ACOs.

POTENTIAL PAYOFFS

The direct and indirect costs of untreated sleep disorders on a patient and public health level are profound. AlGhanim and colleagues examined the economic impact of untreated sleep disorders. These authors reported that in 2004 the total economic burden of sleep disorders in Australia, with a population of 20.1 million, was \$7.494 billion (reported in 2004 United States dollars). When extrapolated to the United States population, which is ten-fold greater in size, these costs were comparable to those associated with diabetes (\$132 billion in 2002). Minimal yet promising evidence exists for cost-saving within sleep medicine. Cost-effectiveness is typically expressed as incremental cost-effectiveness ratio (ICER), which is the ratio of the incremental cost and incremental change in quality adjusted life years (QALY) that stems from use of a specified treatment.⁵³ By convention an ICER/QALY value of \$50,000 is considered acceptable/beneficial, though there is evidence to suggest this limit should be higher.⁵⁴ Pietzsch and colleagues used a Markov model to perform an economic analysis of the diagnosis and treatment of moderate to severe obstructive sleep apnea based on a hypothetical average cohort of 50-year-old males. Parameter ranges were derived from the literature to conduct single-variable and multi-variable sensitivity analyses, with a specific focus on cardiovascular health. The sensitivity analyses showed that CPAP therapy compared to no treatment in patients with moderate-to-severe obstructive sleep apnea had an ICER/QALY value of \$15,915, which indicated significant cost-effectiveness of CPAP therapy in these OSA patients.⁵⁵ Sensitivity analyses also showed that full-night polysomnography and initiation of CPAP therapy compared to no diagnosis and no treatment for the diagnosis of obstructive sleep apnea in patients with 50% pretest probability of obstructive sleep apnea

had an ICER/QALY value of \$17,131. These data suggest that diagnosis and treatment of obstructive sleep apnea is a cost-effective endeavor. Treatment of other sleep disorders has been shown to be cost-effective as well.^{56,57}

CONCLUSIONS

Multidisciplinary sleep centers can improve quality and cost-effectiveness of patient care via multidisciplinary specialty clinics, thoughtful use of tele-health capabilities, and reliable performance measures. As a bona fide multidisciplinary specialty, sleep medicine provides opportunities to create and implement innovative means of improved patient care. As multidisciplinary sleep centers find new ways to coordinate care for adult and pediatric sleep disorders patients, ongoing research will help determine which strategies best allow sleep specialists to provide high quality, cost-effective, patient-centered care.

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