Trends in Sleep Medicine:  
How to Adjust with Changing Technology

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Objectives:  
• Identify ways to expand clinical expertise to enhance clinical  
sleep abilities
• Discuss the rapidly changing face of sleep medicine
Benjamin Fox, M.D.

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Neuro-Interventional Medical Director: Dixie Regional Medical Center
Neurosurgical uses of EEG
Disclosures

• Employee of Intermountain Healthcare / Intermountain Medical Group

• No financial relationships with any other medical/surgical/endovascular companies

• I am a neurosurgeon & a neurointerventionalist

• I am not a neurologist (I do not read or perform EEGs)
Patient 1

• 59 yo male “worst headache of my life”
• Photophobia
• Neckpain

• To ER
Hanging dead Chicken sign
Types of Strokes

**Ischemic Stroke**
- Area deprived of blood
- Obstruction blocks blood flow to part of the brain

**Hemorrhagic Stroke**
- Area of bleeding
- Weakened vessel wall ruptures, causing bleeding in the brain

- Blood in subarachnoid space
- Aneurysm
- Hematoma
- Infarct
- Intracerebral hemorrhage
- Hypertension
Intracranial Aneurysms

- Weak spot in a vessel -> dilatation or ballooning of an intracranial arterial wall
Craniotomy & Clip Ligation/Obliteration


http://www.mayfieldclinic.com/PE-Clipping.htm
Coil Embolization

Aspect Ratio. The length of the dome (D) divided by the length of the neck (N) is the dome:neck ratio. (A) A favorable dome:neck ratio is 2 or greater. (B) A smaller dome:neck ratio may require adjunctive techniques like balloon or stent assistance for best results.
Temporary Vessel Occlusion

• **Pros**
  • Decreases blood flow to aneurysm
    • Softer, visualization
    • Easier to place final clip

• **Cons**
  • No blood flow to the brain in blood vessel distribution during temporary vessel occlusion
• Decrease metabolism of brain cells
  • Barbiturates/
    Etomidate/Propofol
• Burst Suppression
  • Intraoperative continuous EEG
  • Adjust medication doses/bolus based on this
• <15 min of temporary clip time
• EEG/SSEP (multimodal neuromonitoring)
Video
Patient 2

• 69 yo male with facial droop, facial numbness, and dysarthria

• MRI shows scattered foci of DWI signal
  • Small acute embolic strokes bilaterally

• Carotid ultrasound with high grade Internal Carotid artery stenosis
Carotid Stenosis

• > 70% stenosis- treatment recommended

• Treatment options
  • Carotid endarterectomy (CEA)
    • surgery
  • Carotid stent angioplasty with distal protection device
    • Cath lab
• We place a clamp on the carotid artery....

• How do we know that we are not affecting the brain- hypoperfusion/strokes?
• Continuous EEG
• Somatosensory Evoked Potentials

• Monitor for decreases: Hypoperfusion of the hemisphere

• Shunt
Patient 3

• 57 yo male s/p fall from scaffolding with traumatic brain injury

• GCS 9, dysphasia, combative and not following commands

• Intubated for workup and safety
  • Keppra IV
  • Propofol for sedation

• Cerebral Edema -> ICP pressure monitoring
• 3 days
  • Try to hold sedation, ICP raises, sedation restarted

• 5 days
  • Hold sedation- no change in exam
  • EEG ordered- status- nonconvulsive

• Loaded on 2 AEDs
• Continuous EEG in ICU
  • Status broken
Intracranial EEG
Intracranial EEG

- Intermountain Medical Center
  - Drs. Constantino, McDonald, Maughan
- Medically intractable epilepsy
- Map with intent to treat surgically
- Subdural grid electrodes
  - Placed directly on brain
- Intracerebral depth electrodes
• 24/7 Video EEG
• Map seizure focus
• Resect seizure focus
WWW.healthcaresolutionsplus.org
Conclusion

• Multiple EEG opportunities in the neurosurgical world (intraoperative and ICU)

• Any Questions?
Trends in Sleep Medicine
Where have we been? Where are we headed?
How do we survive in the new paradigm?

Kirk Watkins, M.D., D.ABSM
Medical Director
Intermountain Dixie Regional Sleep Disorders Center
Local Coverage Determination (LCD): Outpatient Sleep Studies (L27530)
Effective date 07/11/2008

Out of Center Sleep Testing (OCST) - prior terms include Home Sleep Testing (HST), Portable Monitoring (PM) or Out of the Facility (OOF) Testing

A Final Decision Memo (FDM) was issued by CMS on March 13, 2009 concerning Home Sleep Testing (HST) acceptance for coverage to determining need for CPAP. Several issues were unanswered by this FDM. This LCD shall attempt to clarify under what circumstances this OCST will be considered reasonable and necessary and therefore payable. The accuracy of diagnostic sleep studies depends on the knowledge, skill, and experience of the technologist and interpreter and does not matter if Type I, II, III, or IV or where the test is performed. Consequently, the providers of interpretations must be capable of demonstrating documented training and experience and maintain documentation for post-payment audit. (See "Documentation Requirements" section of this policy for certification/ accreditation requirements.) Because patients referred for sleep studies must be evaluated thoroughly, the participation of a physician in the program is required. After evaluation, diagnosis, and the development of a treatment plan, patients are usually returned to their referring physicians, some patients will elect at least some treatment and follow-up with the sleep disorders program staff, particularly for prescription refills, the follow-up of nasal CPAP, etc. It is expected that ongoing education of the patient is an integral part of the treatment.
Home sleep testing for the diagnosis of obstructive sleep apnea: indications and limitations.

Abstract

The increasing prevalence and recognition of obstructive sleep apnea (OSA) coupled with an awareness of its detrimental health consequences has resulted in the need for timely and cost efficient access to diagnostic sleep testing and treatment. As a result, increased emphasis is being placed on simplified ambulatory models for the diagnosis and treatment of OSA using home sleep testing (HST). An ambulatory sleep program requires the combination of clinical assessment for identifying patients at high risk for OSA, HST for the diagnosis of OSA, and home auto-titrating positive airway pressure units for treatment. Randomized control trials evaluating the efficacy of this ambulatory approach to diagnose and treat OSA in high-risk patients without significant medical comorbidities reveal the potential for equivalent patient outcomes when compared with the use of polysomnography and in-laboratory continuous positive airway pressure titration.

Cruz et al Semin Respir Crit Care Med 2014 Oct;35(5):552-9
An Economic Evaluation of Home Versus Laboratory-Based Diagnosis of Obstructive Sleep Apnea.

**DESIGN:**
A cost-minimization analysis from the payer and provider perspectives was performed, given that 3-mo clinical outcomes were equivalent.

**SETTING:**
Seven academic sleep centers.

**PARTICIPANTS:**
There were 373 subjects at high risk for moderate to severe OSA.

**INTERVENTIONS:**
Subjects were randomized to either home-based limited channel portable monitoring followed by unattended autotitration with continuous positive airway pressure (CPAP), versus a traditional pathway of in-laboratory sleep study and CPAP titration.

**CONCLUSIONS:**
For payers, a home-based diagnostic pathway for obstructive sleep apnea with robust patient support incurs fewer costs than a laboratory-based pathway. For providers, costs are comparable if not higher, resulting in a negative operating margin.

All 19 Sleep HealthCenters clinics close abruptly

Sleep HealthCenters, a for-profit chain of sleep clinics mostly in New England, abruptly closed this week, leaving some patients who showed up for appointments facing locked doors and a closure notice citing “circumstances beyond our control.”

The Boston-based company has been struggling financially, in large part because more of the diagnostic services once provided at a sleep center are being conducted in patients’ homes, Richard Mikels, the company’s attorney, said Friday night. As a result, all 19 locations, including 11 in Massachusetts, have been closed.

“This change from the pervasive use of sleep centers to the pervasive use of home testing, which is less lucrative for the provider, is actually at the core of the problem,” Mikels said.
AASM response to closing of Sleep HealthCenters facilities in New England and Arizona

Sunday, January 27, 2013

DARIEN, IL – The American Academy of Sleep Medicine encourages patients who have been affected by the closing of multiple Sleep HealthCenters facilities in New England and Arizona to contact a local AASM accredited sleep disorders center to make arrangements for the immediate transition of their medical care.

Founded in 1997 in Brighton, Mass., Sleep HealthCenters was a leading sleep medicine provider with numerous offices in the Boston area and throughout Massachusetts, as well as additional satellite facilities in Connecticut, Rhode Island and Arizona. On Thursday, Jan. 24, the company announced on its website and via signs posted at its facilities that it was closed for business due to “circumstances beyond its control.”
Home testing for sleep apnea bankrupting U.S. sleep centers

Home Sleep Apnea Testing: New Standard is Bad Deal for Sleep Docs

Sleep doctors in the U.S. have been doubling up on their Prilosec and putting their accountants on speed-dial since the federal government and insurers began signaling they plan to eventually run the $2,000-per-sleep-study gravy train off its rails. With an estimated 18 million people with obstructive sleep apnea in the U.S., the established system for diagnosis and management of OSA was seen as financially untenable (except to the sleep centers) and has long been a declared target for cost-cutting administrators.

PulmCCM Journal Oct 17, 2013
Home testing for sleep apnea bankrupting U.S. sleep centers

Home sleep apnea testing is inferior to in-lab polysomnography in terms of precision. However, multiple randomized trials have showed home sleep apnea testing worked just as well as in-lab sleep studies at diagnosing obstructive sleep apnea in people with moderate-to-high pretest probability for OSA. Many in the sleep community had their fingers crossed that home sleep testing would be a flash in the pan, but among the bureaucrats and payers who effectively set U.S. health policy, it's caught fire.

At reimbursement rates as low as $86.46 a piece for home sleep studies, sleep centers haven't rushed to convert their business models to feature home sleep apnea testing. Besides the obvious financial disincentives, sleep physicians prefer the higher quality information provided by full polysomnography, and the variety of home testing devices and non-standardization of their data feeds create confusion as well.

Payers aren't waiting for the sleep community to voluntarily embrace home sleep testing, though. Insurers are simply mandating their use, in some cases suddenly cutting off the revenue streams of well-established sleep centers.
Home testing for sleep apnea bankrupting U.S. sleep centers

Further shifting the landscape, device manufacturers and testing companies are increasingly bypassing sleep centers altogether, sensing that their real market is the much larger pool of primary care physicians who first encounter obstructive sleep apnea patients. **Auto-titrating positive airway pressure (APAP) machines are being marketed as the replacement for in-lab CPAP titration during polysomnography.** Here, too, randomized trials support the conclusion that home sleep apnea testing followed by APAP treatment **results in similar outcomes as sleep lab CPAP titration.**

However, it still takes someone knowledgeable in sleep medicine to adequately supervise home sleep testing programs and interpret the sometimes confusing results. Here, too, insurance companies are cutting sleep centers out of the deal, instead partnering with "sleep benefits management services" to oversee the whole operation. In so doing, insurers are also establishing their control, by instituting mandatory precertification prior to home sleep testing, requiring use of their preferred home sleep testing vendors, cutting reimbursement for home sleep testing, and specifying which devices may be used.
Thought leaders have advised practicing sleep physicians to "embrace home sleep apnea testing," "become a center of excellence for the management of OSA," and change their approach "from a focus on testing to a chronic disease management model focused on improvements in meaningful patient outcomes." All good advice, but with polysomnography paying the bills, a financially successful transition incorporating such fundamental changes to their business model will be a tall order for most sleep centers. It seems safe to expect more dislocation and financial pain in the sleep community as home sleep apnea testing proliferates across the U.S.
“With wireless sleep technology, the people in my dreams can send e-mail and faxes to the people in your dreams!”
There are major changes in health care that will impact all areas of medicine, including sleep medicine. Given the growing cost of health care and the current fiscal state of the United States, there is no doubt that more changes are coming. Added to these general changes, there are specific issues facing sleep medicine. The major financial base of sleep medicine is reimbursement for in-laboratory polysomnography. The recent change in moving to home-based sleep studies is a disruptive innovation.

Many aspects of our economy are facing change due to new technology and other factors. This includes bookstores, companies renting home movies, newspapers, etc. The challenge is to recognize the need for change and implement change strategies before it is too late. That sleep medicine has recognized the need for change is indisputable as the excellent commentary by Dr. Patrick Strollo, then President of the American Academy of Sleep Medicine, wrote last year in this journal.\(^1\) What is unclear is whether, as a field, we have a strategy to address change. Change is hard and the natural tendency is to try to maintain the status quo. However, given the forces currently at play, maintaining the status quo is a high risk strategy, and if pursued for too long could have a devastating outcome on our field and the patients we serve.

\(^1\) J Clin Sleep Med. 2011 Dec 15; 7(6) 577-579
Our Industry Demands Change

"...if the rate of change inside the institution is less than the rate of change outside, the end is in sight. The only question is the timing of the end."

Jack Welch
Former CEO General Electric
Sleep Medicine: Strategies for Change

In brief, a relatively small, central Massachusetts-based insurance company, Fallon Community Health Plan (FCHP), initially made the change in 2010 and was swiftly followed by Tufts Health Plan (THP) in January of 2011. Each signed a contract with Sleep Management Solutions (SMS) and CareCore National (a national benefits management company) to manage sleep studies and associated DME needs of their non-Medicare/Medicaid HMO and PPO subscribers. CareCore National acts as gatekeeper, through a prior authorization process, and directs patients requiring sleep studies to specific modalities (HST vs. in-lab) based on CareCore National criteria. SMS is the exclusive provider of HST and the corresponding PAP therapy for the Fallon Plan. SMS is the exclusive provider of HST for the Tufts plan, and existing, qualified network providers may provide PAP therapy regardless of whether the study was requested by a sleep physician at a sleep center.

J Clin Sleep Med. 2011 Dec 15; 7(6) 577-579
Sleep Medicine: Strategies for Change

This transformation came rapidly in Massachusetts over a period of 18 months. Sleep centers were initially caught off guard. It has resulted in a number of sleep centers in Massachusetts closing. Currently Sleep HealthCenters, that services some of the Harvard hospitals, has seen 10% to 20% of its activity overall switched from in-laboratory to in-home sleep studies, though the percentages are up to 60% for the previously specified healthcare plans. They anticipate that once the largest plan—Blue Cross—goes in this direction as well, that 50% to 60% of their sleep study activity will be home studies (personal communication—Dr. L. Epstein, Chief Medical Officer, Sleep HealthCenters).

J Clin Sleep Med. 2011 Dec 15; 7(6) 577-579
Unattended home diagnosis and treatment of obstructive sleep apnea without polysomnography

OBJECTIVE:
To test the effectiveness of unattended home monitoring along with automatic titrating continuous positive airway pressure (auto-CPAP) as an acceptable method for diagnosing and prescribing proper CPAP pressure for treatment of patients presenting with classic symptoms of obstructive sleep apnea (OSA).

DESIGN:
Nonrandomized, prospective case study of 63 patients with a presumptive diagnosis of OSA. Fifty-eight men and 5 women were recruited for symptoms of excessive daytime sleepiness, heavy snoring, and witnessed apnea.

INTERVENTION:
Subjects with 10 or more respiratory events per hour were titrated by automatic, unattended home monitoring to an optimal CPAP pressure.

RESULTS:
Fifty-four (86%) of 63 patients completed sufficient diagnostic studies, and in 45 (83%) of these, a diagnosis of OSA was established. Nine subjects were unable to adjust to the nasal mask study. Thirty-five of the subjects diagnosed with OSA accepted the auto-CPAP machine into their home, while 30 used it for therapy longer than 3 weeks. The estimated cost of performing in-home studies was less than one fourth of the estimated cost for in-laboratory polysomnographic examinations had they been performed for an adequate diagnostic recording, and 9 had fewer than 10 respiratory events per hour. Ten subjects with OSA could not complete a titration.

CONCLUSION:
Unattended monitoring plus auto-CPAP allows cost-effective diagnosis and CPAP titration of most patients with OSA with straightforward symptoms.

Fletcher et al, Arch Fam Med. 2000 Feb;9(2):168-74
Empiric auto-titrating CPAP in people with suspected obstructive sleep apnea.

Abstract

OBJECTIVE:

Efficient diagnosis and treatment of obstructive sleep apnea (OSA) can be difficult because of time delays imposed by clinic visits and serial overnight polysomnography. In some cases, it may be desirable to initiate treatment for suspected OSA prior to polysomnography. Our objective was to compare the improvement of daytime sleepiness and sleep-related quality of life of patients with high clinical likelihood of having OSA who were randomly assigned to receive empiric auto-titrating continuous positive airway pressure (CPAP) while awaiting polysomnogram versus current usual care.

METHODS:

Serial patients referred for overnight polysomnography who had high clinical likelihood of having OSA were randomly assigned to usual care or immediate initiation of auto-titrating CPAP. Epworth Sleepiness Scale (ESS) scores and the Functional Outcomes of Sleep Questionnaire (FOSQ) scores were obtained at baseline, 1 month after randomization, and again after initiation of fixed CPAP in control subjects and after the sleep study in auto-CPAP patients.

RESULTS:

One hundred nine patients were randomized. Baseline demographics, daytime sleepiness, and sleep-related quality of life scores were similar between groups. One-month ESS and FOSQ scores were improved in the group empirically treated with auto-titrating CPAP. ESS scores improved in the first month by a mean of -3.2 (confidence interval -1.6 to -4.8, p < 0.001) and FOSQ scores improved by a mean of 1.5, (confidence interval 0.5 to 2.7, p = 0.02), whereas scores in the usual-care group did not change (p = NS). Following therapy directed by overnight polysomnography in the control group, there were no differences in ESS or FOSQ between the groups. No adverse events were observed.

CONCLUSION:

Empiric auto-CPAP resulted in symptomatic improvement of daytime sleepiness and sleep-related quality of life in a cohort of patients awaiting polysomnography who had a high pretest probability of having OSA. Additional studies are needed to evaluate the applicability of empiric treatment to other populations.

AND THIS CPAP MODEL ADJUSTS ITSELF... BUT IT IS KIND OF CREEPY.
Sleep Medicine: Strategies for Change

As indicated in the 2006 Institute of Medicine Report, “Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem,” sleep medicine is a chronic disease management knowledge-based discipline, not a diagnostic discipline.

Sleep Medicine: Strategies for Change

The report recommended that accreditation standards should focus primarily on outcomes of care. It is unfortunate that much of our focus has been on the diagnostic aspects of the polysomnogram, not on quality outcomes. That sleep medicine should focus on outcomes of care rather than the diagnosis was also proposed in 2006 by one of the pioneers of our field—Dr. Peretz Lavie—who is now President of the Technicon University in Israel.

This argument leads to a clear vision (a subsequent necessary step in the transformation process), i.e., that sleep medicine should be a field with a focus on quality outcomes of care. This should not just be for sleep apnea, but for all sleep disorders.

J Clin Sleep Med. 2011 Dec 15; 7(6) 577-579
Sleep Medicine: Strategies for Change

Thus, the fundamental themes of this commentary are the following: a) **change in sleep medicine is essential and the time is now**; b) the American Academy of Sleep Medicine needs to **take the lead in indicating the urgency of the situation**, based on the sub-optimal Massachusetts experience; c) **the vision for our field should be a quality outcomes-based chronic disease management discipline for all sleep disorders, not just for sleep apnea**; d) the American Academy of Sleep Medicine should lead change and use the power of the accreditation process to **move our field to a quality outcomes field**. It is time to be proactive, not reactive; and e) there is a need for all stakeholders to work together to develop the information technology we need.

The time is NOW. It is time to act. Groups who act can lead the change in the best interest of the people we serve, i.e., the millions of Americans with chronic sleep disorders.

*J Clin Sleep Med. 2011 Dec 15; 7(6) 577-579*
ESTIMATED SLEEP MARKET STUDY VOLUMES AND REVENUES

- Total Studies
- In Lab Studies
- OCST Studies
- $ Volume

HST Proj Mkt Share
- 2011: 5%
- 2012: 15%
- 2013: 30%
- 2014: 40%
- 2015: 47.5%
- 2016: 50%

$3,931,514,303
$3,013,474,370
$2,882,594,166

Number of Sleep Tests

Estimated Annual Retail Revenues

Effect on Total Studies as OCST Share Increases

As OCST share increases to 50% of the diagnostic studies, in lab studies decline by ≈1.4 million/yr, while OCST volume grows to ≈850K/yr. The net revenue effect to sleep labs is a loss of just over $1B resulting in the closing of nearly 1,000 sleep labs.
The Future: Should you decide to participate

- 1,000 fewer labs by 2015
  - Down from peak of 3,700 in 2009
- Total volume / lab increases
  - Reaching levels last seen in 2007
- All volume increases are OCST
  - How to make a profit
- Average revenue / lab increases slightly
  - Approaches 2009 levels due to volume increases
- Average $ / study declines
  - Due to combination of decreasing FFS payments and shift to OCST
- Rural areas continue to support independent labs
  - Much harder in metro areas due to health system dominance
- ACOs & value based pricing >30%
  - The whole world flips
The Effect of the Transition to Home Monitoring for the Diagnosis of OSAS on Test Availability, Waiting Time, Patients' Satisfaction, and Outcome in a Large Health Provider System

Comparisons were made between 2007 and 2008 (in-lab PSGs) and 2010 and 2011 (when most studies were ambulatory).

- 1471 sleep studies were performed during 2007-2008 compared to 2794 tests during 2010-2011.
- The average waiting time was 9.9 weeks in 2007-2008 compared to 1.1 weeks in 2010-2011 (P < 0.05).
- The overall patients' satisfaction was similar, but discomfort tended to be higher in the in-laboratory group (4.1 vs 2.7 in a scale of 0-10; P = 0.11).
- Switching to ambulatory diagnosis improved the test accessibility and reduced the waiting times.
- Patients' satisfaction remained similarly high.
- The total direct cost of OSA management was reduced.

A Safadi, et al. Sleep Disord 2014:418246
Dixie Regional Sleep Disorders Center
Total Sleep Tests per year

- 2009: 600
- 2010: 619
- 2011: 828
- 2012: 1043
- 2013: 1004
- 2014: 979
- 2015: 909
Dixie Regional Sleep Disorders Center
Total in-lab PSG per year
Dixie Regional Sleep Disorders Center
Total Home Sleep Tests per year


0 33 81 211 224 333 532
Dixie Regional Sleep Disorders Center
Total Titration Tests per year

- 2009: 109
- 2010: 88
- 2011: 167
- 2012: 313
- 2013: 257
- 2014: 234
- 2015: 155
Dixie Regional Sleep Disorders Center
Home Sleep Test % of Total Diagnostic Studies

- 2009: 0%
- 2010: 6.50%
- 2011: 12.70%
- 2012: 29.30%
- 2013: 31.50%
- 2014: 47.70%
- 2015: 70.20%
How do we make the change?

1. Adopt a financially feasible model for incorporating home sleep testing in our clinical model.
2. Change our clinical paradigms to providing chronic long-term management for Obstructive Sleep Apnea and the other chronic sleep conditions we treat.
3. Expand clinical skills of RPSGT’s to fit the rapidly evolving field of Sleep Medicine.
4. Expand our expertise in long-term management of alternative treatments for Obstructive Sleep Medicine.
Summary

Sleep Medicine is changing. We will need to adapt and change or we will not survive.

“The definition of insanity is doing the same thing over and over again, but expecting different results.”