Survey Regarding Limited Diagnostic Systems for Sleep Apnea

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To the editor:

There has been considerable controversy about the role of unattended limited recording systems (those that do not record the electroencephalogram [EEG], electrooculogram [EOG], and sub-mental electromyogram [EMG]) for the diagnosis and follow-up of sleep apnea, but little has been written about what signals should be recorded. What basic information is needed to adequately determine if someone has abnormal breathing during estimated or behavioral sleep? The issue of portable monitoring for OSA was first systematically examined by the Standards of Practice Committee of the American Sleep Disorders Association in 1993, leading to a review and recommendations published in 1994.1, 2 They developed a classification of recording systems which was standardized and convenient but was not based on expert consensus of what physiologic information was needed. Nor was it based on outcome studies, of which there were none. Subsequent systematic reviews have continued the rather arbitrary and increasingly dated division of recording systems into only 4 levels.

• Level I: Standard polysomnography: Minimal requirements include recording of EEG, EOG, chin EMG, ECG, airflow, respiratory effort, and oxygen saturation. Body position must be documented or objectively measured. Trained personnel must be in constant attendance and able to intervene. Leg movement recording is desirable but optional.
• Level II: Comprehensive portable polysomnography: Same as for level I, except heart rate instead of ECG is acceptable, and having trained personnel present and able to intervene is not required for all studies.
• Level III: Modified portable sleep apnea testing: Minimum requirements include recording of ventilation (at least 2 channels of respiratory movement, or respiratory movement and airflow), ECG or heart rate, and oxygen saturation. Personnel are needed for preparation, but the ability to intervene is not required for all studies.
• Level IV: Continuous (single or dual) bioparameter recording: Only 1 or 2 physiologic variables need be recorded. The ability to intervene is not required.

In the 13 years since the original classification there have been substantial advances in sensor and recording technology. I found 6 peer-reviewed validation studies (n=453 comparisons) with 5 limited channel diagnostic systems (loosely fitting into the Level III category)3-8 comparing in-home recordings to laboratory polysomnography published subsequent to the review conducted by Flemons et al. in 2003.3 It should be noted that none of these studies were available when the most recent Joint Task Force concluded that the evidence remained insufficient to recommend the use of portable monitoring.

More recently, and in part as a response to the Institute of Medicine report on Sleep Disorders and Sleep Deprivation,9 there appears to be a shift by the AASM toward acceptance of portable monitoring under conditions deemed appropriate by a sleep specialist.10 It seems clear that all stake-holders, including sleep specialists, primary care physicians, insurers, device manufacturers, and patients, would benefit from consensus as to what features are considered important in portable systems. Obviously the final decision on what information is important to capture will depend on outcome studies, but until these become available I believe experts in the field should be responsible for defining what those systems should measure, how they work, and how they are validated.

I recently surveyed 175 members of the American Academy of Sleep Medicine, chosen primarily because of their reputation as experts in sleep disordered breathing. I targeted particularly those trained in pulmonary medicine and physiology but also included colleagues whose backgrounds were in other disciplines. I specifically did not exclude experts because of their beliefs about the role, if any, of limited monitoring. I conducted a mailing, and after 3 weeks I followed up with an e-mail request to complete the survey.

After some gentle prodding, 75 responses were obtained. About 90% of the responders were from the United States, but Australia, Canada, Sweden, and United Kingdom were also represented. Seventy-five percent of those who responded had 16 or more years in the practice of sleep medicine, 23% had 11 to 15 years in the practice, and 2% did not respond to the question. Of the 73 that responded to a question about parent discipline, 50 years in the practice, and 2% did not respond to the question. Of the 73 that responded to a question about parent discipline, 50 years in the practice, and 2% did not respond to the question. Of the 73 that responded to a question about parent discipline, 50 years in the practice, and 2% did not respond to the question. Of the 73 that responded to a question about parent discipline, 50 years in the practice, and 2% did not respond to the question. Of the 73 that responded to a question about parent discipline, 50 years in the practice, and 2% did not respond to the question. Of the 73 that responded to a question about parent discipline, 50 years in the practice, and 2% did not respond to the question. Of the 73 that responded to a question about parent discipline, 50 years in the practice, and 2% did not respond to the question. Of the 73 that responded to a question about parent discipline, 50 years in the practice, and 2% did not respond to the question. Of the 73 that responded to a question about parent discipline, 50 years in the practice, and 2% did not respond to the question. Of the 73 that responded to a question about parent discipline, 50 years in the practice, and 2% did not respond to the question. Of the 73 that responded to a question about parent discipline, 50 years in the practice, and 2% did not respond to the question.

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Disclosure Statement

Dr. Philip Westbrook is an officer, shareholder and employee of Advanced Brain Monitoring, Inc. Advanced Brain Monitoring, Inc. assisted Dr. Westbrook in conducting the survey.

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The results of the survey are interesting in several respects. First, there were 15 measurements or features with a mean rating from desirable (3) to necessary (1), indicating that most sleep medicine specialists want quite sophisticated portable diagnostic systems. Note that a full disclosure recording and qualitative respiratory effort had a median rating of necessary, but that qualitative respiratory effort had the largest standard deviation of any of the top 15 measurements or features, suggesting less group consensus about the contribution of this signal. All of the parameters for assessing the quality of the validation study for a device were, on average, rated at least desirable; the distributions across the standard deviations suggest little disagreement about the importance of each of these study parameters. Six of 11 parameters had a median rating of necessary.

Sleep specialists will decide for themselves what they want in a diagnostic system for sleep apnea, and will take into account information such as cost, which was not addressed in this survey. However, it might be helpful for them to know what their colleagues in the field consider important. If sleep apnea can be compared to other chronic common diseases, then the initial detection and quantification of that disorder will often be done by primary care physicians. It would make sense that the system they use to diagnose OSA be one acceptable to sleep specialists, and indeed provide a record that the specialist can review, so that unnecessary duplication of diagnostic testing can be avoided. The information in this survey should be useful to insurers when deciding what limited recording systems to reimburse. It could also guide future development of portable systems for evaluating sleep disordered breathing. Finally, patients could potentially use this survey to decide if a system proposed to evaluate their condition was considered adequate by independent experts.

REFERENCES:

5. Reichert JA, Bloch BA, Cundiff E, Votteri BA. Comparison of the


