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SPECIAL ARTICLES

Use of Actigraphy for the Evaluation of Sleep Disorders and Circadian Rhythm Sleep-Wake Disorders: An American Academy of Sleep Medicine Clinical Practice Guideline

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Introduction: The purpose of this guideline is to establish clinical practice recommendations for the use of actigraphy in adult and pediatric patients with suspected or diagnosed sleep disorders or circadian rhythm sleep-wake disorders.

Methods: The American Academy of Sleep Medicine (AASM) commissioned a task force of experts in sleep medicine to develop recommendations and assigned strengths based on a systematic review of the literature and an assessment of the evidence using the GRADE process. The task force provided a summary of the relevant literature and the quality of evidence, the balance of benefits and harms, patient values and preferences, and resource use considerations that support the recommendations. The AASM Board of Directors approved the final recommendations.

Recommendations: The following recommendations are intended as a guide for clinicians using actigraphy in evaluating patients with sleep disorders and circadian rhythm sleep-wake disorders, and only apply to the use of FDA-approved devices. Each recommendation statement is assigned a strength ("Strong" or "Conditional"). A "Strong" recommendation (ie, "We recommend…") is one that clinicians should follow under most circumstances. A "Conditional" recommendation (ie, "We suggest…") reflects a lower degree of certainty regarding the outcome and appropriateness of the patient-care strategy for all patients. The ultimate judgment regarding any specific care must be made by the treating clinician and the patient, taking into consideration the individual circumstances of the patient, available treatment options, and resources.

1. We suggest that clinicians use actigraphy to estimate sleep parameters in adult patients with insomnia disorder. (Conditional)
2. We suggest that clinicians use actigraphy in the assessment of pediatric patients with insomnia disorder. (Conditional)
3. We suggest that clinicians use actigraphy in the assessment of adult patients with circadian rhythm sleep-wake disorder. (Conditional)
4. We suggest that clinicians use actigraphy in the assessment of pediatric patients with circadian rhythm sleep-wake disorder. (Conditional)
5. We suggest that clinicians use actigraphy integrated with home sleep apnea test devices to estimate total sleep time during recording (in the absence of alternative objective measurements of total sleep time) in adult patients suspected of sleep-disordered breathing. (Conditional)
6. We suggest that clinicians use actigraphy to monitor total sleep time prior to testing with the Multiple Sleep Latency Test in adult and pediatric patients with suspected central disorders of hypersomnolence. (Conditional)
7. We suggest that clinicians use actigraphy to estimate total sleep time in adult patients with suspected insufficient sleep syndrome. (Conditional)
8. We recommend that clinicians *not* use actigraphy in place of electromyography for the diagnosis of periodic limb movement disorder in adult and pediatric patients. (Strong)

Keywords: actigraphy, circadian rhythm, clinical practice guideline, sleep disorder

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INTRODUCTION

This clinical practice guideline is intended to update the previously published American Academy of Sleep Medicine (AASM) practice parameters on the use of actigraphy[1] in patients with suspected or diagnosed sleep disorders or circadian rhythm sleep-wake disorders (CRSWDs) and reflects the current recommendations of the AASM. The prior practice parameters established the validity of actigraphy to assess sleep in normal, healthy adult populations, and therefore, this guideline does not address the use of actigraphy to assess normal sleep.

Actigraphy is a procedure that records and integrates the occurrence and degree of limb movement activity over time. Actigraphic devices can be worn on the wrist, ankle or waist, relatively unobtrusively over a period of days to weeks. For sleep applications, the devices are typically worn on the wrist or ankle. Mathematical algorithms are then applied to these data to estimate wakefulness and sleep. In addition to providing a graphical summary of wakefulness and sleep patterns

over time, actigraphy generates estimates of certain sleep parameters that are also commonly estimated by using sleep logs, or measured directly by polysomnography (PSG), the gold standard measure of sleep.

This guideline, in conjunction with the accompanying systematic review,[2] provides a comprehensive update of the recent available evidence and a synthesis of clinical practice recommendations for the assessment and treatment of patients with suspected or diagnosed sleep disorders and CRSWDs. It is intended to optimize patient-centric care by broadly informing clinicians who care for adult and pediatric patients with sleep disorders and CSRWDs.

METHODS

The AASM commissioned a task force (TF) of sleep medicine clinicians with expertise in the use of actigraphy. The TF was required to disclose all potential conflicts of interest (COI), per the AASM's COI policy, prior to being appointed to the TF and throughout the research and writing of these documents. In accordance with the AASM's conflicts of interest policy, TF members with a Level 1 conflict were not allowed to participate. TF members with a Level 2 conflict were required to recuse themselves from any related discussion or writing responsibilities. All relevant conflicts of interest are listed in the Disclosures section.

The TF conducted a systematic review[2] of the published scientific literature, focusing on patient-oriented, clinically relevant outcomes. The review focused exclusively on clinical grade devices approved by the FDA as an actigraphy device or equivalent device that uses an accelerometer to measure limb activity associated with movement during sleep for physiologic applications. The review did not cover consumer wearable devices,[3] or other non-prescription devices directly marketed to consumers, which are beyond the scope of this clinical practice guideline. The purpose of the review was to compare actigraphy to both sleep logs and PSG to determine whether actigraphy provides information that is distinct from patient-reported data and consistent enough with results of PSG to use as an objective measure. The clinical practice recommendations were then developed according to the Grading of Recommendations Assessment, Development and Evaluation (GRADE) process.[4,5] The TF assessed the following four components to determine the direction and strength of a recommendation: quality of evidence, balance of beneficial and harmful effects, patient values and preferences, and resource use. Details of these assessments can be found in the accompanying systematic review.[2] Taking these major factors into consideration, each recommendation statement was assigned a strength ("Strong" or "Conditional"). Additional information is provided in the form of "Remarks" immediately following the recommendation statements, when deemed necessary by the TF. Remarks are based on the evidence evaluated during the systematic review and are intended to provide context for the recommendations and to guide clinicians in the implementation of the recommendations in daily practice.

The recommendations in this guideline define principles of practice that should meet the needs of most patients in most situations. A "Strong" recommendation is one that clinicians should follow for almost all patients (ie, something that might qualify as a Quality Measure). A "Conditional" recommendation reflects a lower degree of certainty in the appropriateness of the patient-care strategy for *all* patients. It requires that the clinician use clinical knowledge and experience, and strongly considers the individual patient's values and preferences to determine the best course of action. The ultimate judgment regarding any specific care must be made by the treating clinician and the patient, taking into consideration the individual circumstances of the patient, available treatment options, and resources.

The AASM expects this guideline to have an impact on professional behavior, patient outcomes, and—possibly—health care costs. This clinical practice guideline reflects the state of knowledge at the time of publication and will be reviewed and updated as new information becomes available.

CLINICAL PRACTICE RECOMMENDATIONS

The following clinical practice recommendations are based on a systematic review and evaluation of evidence using the GRADE process. The implications of the strength of recommendations for guideline users are summarized in **Table 1.** Remarks are provided to guide clinicians in the implementation of these recommendations. The recommended duration of actigraphy recording is a minimum of 72 hours to 14 consecutive days, in accordance with the Current Procedural Terminology (CPT) coding requirements.[6]

Use of Actigraphy in the Evaluation of Insomnia in Adults

Recommendation 1: We suggest that clinicians use actigraphy to estimate sleep parameters in adult patients with insomnia disorder. (Conditional)

Remarks: Objective monitoring is not required for the routine diagnosis of insomnia; however, it is useful in differential diagnosis and when objective estimates of sleep parameters are important to clinical decision making (eg, nonresponse to cognitive behavioral therapy for insomnia, patient requests increased hypnotic dose, patient reporting is of questionable validity).

The TF compared actigraphy to sleep logs and PSG for the assessment and evaluation of treatment response in total sleep time (TST), sleep latency (SL), wake after sleep onset (WASO), and sleep efficiency (SE) in adult patients with suspected or diagnosed insomnia. The TF identified 46 studies that provided data suitable for meta-analyses. For assessment, meta-analyses comparing actigraphy and sleep logs demonstrated clinically significant large mean differences for TST, SL, and SE. Meta-analyses comparing actigraphy to PSG demonstrated clinically significant narrow ranges of mean differences for TST and SL. For the evaluation of treatment

Table 1—Implications of "Strong" and "Conditional" recommendations for users of AASM clinical practice guidelines.

User	Strong Recommendations "We Recommend…"	Conditional Recommendations "We Suggest…"
Clinicians	Almost all patients should receive the recommended course of action. Adherence to this recommendation could be used as a quality criterion or performance indicator.	Most patients should receive the suggested course of action, however, different choices may be appropriate for different patients. The clinician must help each patient determine if the suggested course of action is clinically appropriate and consistent with his or her values and preferences.
Patients	Almost all patients should receive the recommended course of action, although a small proportion of patients would not.	Most patients should receive the suggested course of action, though some would not. Different choices may be appropriate for different patients. The patient should work with their clinician to determine if the suggested course of action is clinically appropriate and consistent with his or her values and preferences.
Insurance Providers	The recommended course of action can be adapted as policy for most situations. Adherence to the recommended course of action could be used as a quality criterion or performance indicator.	The ultimate judgment regarding the suitability of the suggested course of action must be made by the clinician and patient together, based on what is best for the patient. This decision-making flexibility should be accounted for when establishing policies.

AASM = American Academy of Sleep Medicine.

response, meta-analyses comparing actigraphy to PSG demonstrated clinically significant narrow ranges of mean differences for SL. Together these findings indicate that actigraphy provides objective data that is both consistent with PSG and unique from patient-reported data.

The overall quality of evidence was moderate due to imprecision. Potential benefits of actigraphy include convenience, relatively low patient burden, longitudinal assessment capability, and relatively low cost. Actigraphy may provide additional benefits for certain patient subgroups, including those with suspected paradoxical insomnia or those at risk for cardiometabolic, other medical, and psychiatric comorbidities impacted by short sleep duration. Based on their clinical experience, the TF concluded actigraphy may be more feasible and cost effective than PSG in obtaining objective measurement of sleep parameters, particularly if longitudinal objective measurement of sleep is needed. Additionally, patients with insomnia may have difficulty sleeping in a center setting and may prefer to remain at home for evaluation. Potential harms include minor skin irritation in some patients. Insomnia patients can be impacted by a host of environmental factors. Some complain of difficulty sleeping because of having the testing device in place. Nonetheless, the actigraphy device is easier to tolerate than the multiple PSG leads. The TF also determined that if actigraphy is used in the context described in the recommendation and remarks, the risk of harm is minimized and the probability of clinical benefits increased. Finally, based on their clinical experience, the TF determined that actigraphy provides outcomes that patients value with minimal undesired effects and that the vast majority of patients would elect to use actigraphy.

Use of Actigraphy in the Evaluation of Insomnia in Pediatric Populations

Recommendation 2: We suggest that clinicians use actigraphy in the assessment of pediatric patients with insomnia disorder. (Conditional)

Remarks: Though pertaining to the general pediatric population, this recommendation also includes pediatric patients with developmental disorders, based on one study that included patients with autism and suspected insomnia. Studies reviewed included young children and adolescents ranging in age from 3–19 years old.

The TF compared actigraphy to sleep logs for the assessment and evaluation of treatment response in TST, SL, WASO and SE in pediatric patients with suspected or diagnosed insomnia. The TF identified a total of 6 studies, including one study of non-specific sleep disorders (some with suspected insomnia) in children with autism. Because of the small number of studies reporting baseline data and heterogeneity of the studies, meta-analyses were not conducted for baseline data. For assessment, 3 studies comparing actigraphy to sleep logs demonstrated clinically significant large mean differences for TST and WASO. The study of non-specific sleep disorders (including patients with insomnia) in children with autism, also demonstrated a clinically significant large mean difference for TST. For the evaluation of treatment response, meta-analysis of 4 studies comparing actigraphy and sleep logs demonstrated large clinically significant mean differences for WASO. Overall, these findings indicate that actigraphy provides objective data that is consistent and also unique from patient-reported data, suggesting that actigraphy may be more sensitive in identifying sleep maintenance problems and reduced sleep duration in pediatric patients with insomnia. The overall quality of evidence was moderate due to imprecision and the small sample size. Potential benefits of actigraphy include reduced caregiver burden, increased feasibility of prolonged monitoring, increased sensitivity over sleep logs in identifying short sleep duration and increased WASO. Additional benefits supporting the use of actigraphy include: the consideration that children and some adolescents are unable to accurately or reliably keep sleep logs (especially outside of controlled research settings) and that sole reliance on caregiver data yields estimates that are variable in quality. The TF determined that the benefits of

using actigraphy outweigh the harms. Based on their clinical experience, the TF determined that the vast majority of patients/guardians would use actigraphy. The prevalence of multiple sleep disorders in young children and adolescents, and their association with many important developmental, medical and psychiatric outcomes[7] favors use of actigraphy.

Use of Actigraphy in the Evaluation of Circadian Rhythm Sleep-Wake Disorders in Adults

Recommendation 3: We suggest that clinicians use actigraphy in the assessment of adult patients with circadian rhythm sleep-wake disorder. (Conditional)

Since actigraphy can be used to assess patterns of sleep and wakefulness over multiple days, it is appealing for the evaluation of sleep patterns in adult patients with suspected CRSWD. The TF compared actigraphy to sleep logs and PSG for the assessment and evaluation of treatment response in sleep onset and sleep offset times in patients with suspected or confirmed CRSWDs. The TF identified two studies in patients at risk for circadian rhythm sleep-wake phase disorders. The small number of studies precluded meta-analysis. Results show that actigraphy is useful in the assessment of sleep onset and offset times and in the evaluation of treatment outcomes in some patients with CRSWD. The overall quality of the evidence was very low due to small sample size and imprecision. The potential benefit of objective measurement with actigraphy includes lower patient burden relative to sleep logs. PSG is not typically used in the assessment of CRSWDs. Based on clinical experience, the TF determined that the potential benefits of objective measurement of sleep onset and offset and the limited patient burden outweigh the potential harms, which are minimal. The TF also determined that the majority of patients would use actigraphy for the evaluation and treatment of CRSWDs.

Use of Actigraphy in the Evaluation of Circadian Rhythm Sleep-Wake Disorders in Pediatric Populations

Recommendation 4: We suggest that clinicians use actigraphy in the assessment of pediatric patients with circadian rhythm sleep-wake disorder. (Conditional)

Remarks: Though pertaining to the general pediatric population, this recommendation also includes patients with developmental delays, based on two studies that included participants with autism and other developmental disorders. Studies reviewed included patients ranging in age from 2–21 years old.

The TF compared actigraphy to sleep logs for the assessment and evaluation of treatment response in TST, SL, sleep onset, and sleep offset in pediatric patients with suspected or diagnosed CRSWD. The TF identified 4 studies of children and adolescents with delayed sleep phase syndrome, including one study of non-specific sleep disorders in children with autism (we use the term "delayed sleep phase syndrome" describing literature that used this nosology, which is similar to the newer ICSD-3 nosology, delayed sleep-wake phase disorder). All the studies reviewed were of suspected or diagnosed delayed sleep phase syndrome. For assessment, meta-analysis of 3 studies comparing actigraphy to sleep logs demonstrated a clinically significant large mean difference for TST. One additional study of non-specific sleep disorders (including patients with suspected delayed sleep phase syndrome) in children with developmental disorders, also demonstrated a large clinically significant mean difference for TST. One study demonstrated a large clinically significant mean difference for sleep offset time. For the evaluation of treatment response, meta-analysis of 3 studies demonstrated a clinically significant large mean difference for TST. Additionally, the study of non-specific sleep disorders in children with developmental disorders also demonstrated a large clinically significant mean difference for TST. One study of CRSWD demonstrated a clinically significant large mean difference for sleep offset. Overall, these findings indicate that actigraphy can provide objective data that is consistent and unique from patient-reported data.

The overall quality of evidence was low due to imprecision and small sample sizes. Potential benefits of actigraphy include reduced caregiver burden, increased feasibility of prolonged monitoring, increased sensitivity over logs in assessing reduced sleep duration and earlier sleep offset, and improved reliability compared to self-reported sleep parameters. Potential harms of actigraphy are minor, and include skin irritation. Although overall costs are relatively low, actigraphy is higher cost relative to paper logs. Based on their clinical expertise, the TF determined that the benefits of using actigraphy outweighs the harms. The TF also determined that the vast majority of patients would use actigraphy. The prevalence of multiple sleep disorders in infants, children and adolescents, and their association with many important developmental, medical and psychiatric outcomes[7] favors use of actigraphy.

Use of Actigraphy in the Evaluation of Sleep-Disordered Breathing with Home Sleep Apnea Tests in Adults

Recommendation 5: We suggest that clinicians use actigraphy integrated with home sleep apnea test devices to estimate total sleep time during recording (in the absence of alternative objective measurements of total sleep time) in adult patients suspected of sleep-disordered breathing. (Conditional)

Remarks: This recommendation only applies to patients who are appropriate candidates for a home sleep apnea test (HSAT).[8]

It has been well established that testing with an HSAT, in comparison to PSG, typically underestimates the severity of sleep-disordered breathing (SDB).[8] A component of this underestimation arises from the event-per-hour indices used for the diagnosis and severity determination of obstructive sleep apnea (OSA). Specifically, whether the denominator of hours reflects sleep as determined by sleep staging from electroencephalogram (EEG), electrooculography (EOG), and electromyography (EMG) during PSG; estimated sleep time as reflected by actigraphy or another method; or by simply

recording time or time in bed, both of which include at least some wake time. In the current analysis, the TF evaluated the accuracy of TST estimation by actigraphy compared to PSG in adult patients with SDB. The TF also sought to evaluate accuracy in the assessment of SDB severity when actigraphy was integrated with HSAT devices. The TF identified 6 studies, none of which directly compared the accuracy of the respiratory event index (REI) with and without actigraphy integrated into HSAT units, and simultaneously compared those REIs to apnea-hypopnea index (AHI) as determined by PSG as a gold standard. For the estimation of TST measured by actigraphy as compared to PSG, meta-analyses of 5 studies demonstrated a clinically significant small mean difference, but the range of possible differences exceeded the clinical significance threshold. In 3 studies that reported accuracy of AHI detected by HSAT (or similar set up) calculated with actigraphy-estimated TST, sensitivity ranged from 84% to 100% and specificity ranged from 88% to 100% in identifying cases of moderate to severe OSA when compared to PSG measurements. These data demonstrated slight improvement in the diagnostic accuracy of OSA with the use of integrated actigraphy to estimate TST during HSAT when compared with only using total time in bed or total recording time with HSAT, particularly in cases of severe OSA.

The overall quality of evidence was low, due to imprecision, small sample size and only indirect comparison of HSAT with actigraphy versus PSG (instead of directly comparing HSAT with and without integrated actigraphy). The TF determined that there are potential benefits to achieving a more accurate assessment of SDB by integrated actigraphy in the setting of HSAT, while there is negligible harm. The TF also determined that this recommendation should only apply to the use of HSAT devices with integrated actigraphy that are commercially available, as opposed to the use of HSAT devices with separate non-integrated actigraphy, for three reasons. First, it is improper coding for actigraphy testing (95803) to be coded concurrently with an HSAT (95800, 95801 and 95806). Secondly, as a separate service using a stand-alone actigraphy device, the code for actigraphy (CPT 95803) specifically requires a minimum of 72 hours of testing.[6] Third, it is impractical to separately collect and analyze actigraphy data and subsequently synchronize it with the HSAT recording to generate a combined study report.

Based on clinical experience, the TF determined patients will likely value the potentially more accurate assessment of SDB severity that could be obtained from use of actigraphy integrated with an HSAT, which in turn can impact access to treatment. There is an inherent risk of false negative results when using an HSAT, thus use in patients with an increased pretest probability of moderate-to-severe OSA has been recommended.[8] If the patient has comorbid insomnia or suspected comorbid sleep disorders, the risk of underestimating the severity of OSA is greater, and PSG is preferred.[8] It should be noted that in the 2007 Practice Parameters,[1] the use of actigraphy with an HSAT was a "Standard" recommendation based on the Oxford methodology used and the evidence available at that time.[1] In this guideline, which uses the GRADE methodology, the TF determined that based on existing evidence, the use of actigraphy technology integrated with HSAT devices is a "Conditional" recommendation.

Use of Actigraphy in the Evaluation of Central Disorders of Hypersomnolence With the Multiple Sleep Latency Test in Adult and Pediatric Populations

Recommendation 6: We suggest that clinicians use actigraphy to monitor total sleep time prior to testing with the Multiple Sleep Latency Test in adult and pediatric patients with suspected central disorders of hypersomnolence. (Conditional)

Remarks: Actigraphy can be used for 7–14 days prior to the PSG/Multiple Sleep Latency Test (MSLT) to assure adequate sleep time leading up to the testing.[6] Actigraphy can also be used to establish habitual sleep-wake timing. Actigraphy does not replace PSG prior to the MSLT.

Actigraphy is a diagnostic procedure that can be used in the evaluation of central disorders of hypersomnolence.[9] The TF compared actigraphy to sleep logs and PSG for the assessment of TST prior to MSLT in adult and pediatric patients with suspected central disorders of hypersomnolence. The TF identified one study that directly addressed this comparison in adults. When comparing TST estimated by actigraphy to sleep logs in the 2-week period prior to the MSLT, the study demonstrated a clinically significant large mean difference. When comparing TST recorded by actigraphy to PSG on the night before the MSLT, the study demonstrated a clinically significant small mean difference; however, the range of possible differences exceeded the clinical significance threshold. These data, in conjunction with supporting evidence from other sleep disorders described in this clinical practice guideline demonstrate that actigraphy provides objective data that are unique from patient-reported data. Data collected from actigraphy may be useful in the clinical assessment of patients with suspected hypersomnia (see accompanying systematic review[2]). The overall quality of evidence was moderate, downgraded due to imprecision and indirectness of additional evidence from other recommendations. The TF determined that the potential benefits of using actigraphy are large, based on the value of using actigraphy to assess TST and confirm that the patient has sufficient sleep prior to an MSLT. This would result in improved diagnostic accuracy and clinical utility of the resulting MSLT, and reducing the likelihood of misdiagnosis as well as unnecessary or inappropriate treatment. Additionally, actigraphy may be useful to establish habitual sleep-wake timing in the evaluation of patients with complaints of hypersomnia, which may reveal other sleep disorders such as insufficient sleep syndrome and CRSWDs, and may impact the interpretation of the MSLT. While data used in the included study came from an adult population only, and no pediatric studies were identified, the TF determined that the recommendation may also be relevant to the pediatric population, particularly in the adolescent population. The TF determined that the vast majority of patients would want to receive a correct clinical diagnosis in the evaluation for hypersomnia disorders and would therefore choose actigraphy as part of the evaluation. Of note,

actigraphy is obtained *prior to* the PSG/MSLT and is therefore billed separately from the PSG/MSLT.

Use of Actigraphy in the Evaluation of Insufficient Sleep Syndrome in Adults

Recommendation 7: We suggest that clinicians use actigraphy to estimate total sleep time in adult patients with suspected insufficient sleep syndrome. (Conditional)

Remarks: The duration of recording is recommended to be 2–3 weeks or more depending on the specific needs of the patient and the clinical issues[6,9]

The TF compared actigraphy to sleep log estimates of TST for the assessment and evaluation of treatment response for adult patients at risk for insufficient sleep syndrome. The TF identified 11 studies. For assessment, meta-analysis of 10 studies found a large mean difference in estimates of TST that was clinically significant. These data indicate that actigraphy yielded lower estimates of TST compared to sleep logs. For the assessment of treatment response, 2 of 3 studies demonstrated large mean differences that were clinically significant. These data indicate that actigraphy provides objective data that is unique from patient-reported data and may be useful in the assessment of insufficient sleep. The overall quality of evidence was moderate due to imprecision, heterogeneity, and small sample sizes in the treatment response studies. The potential benefit of actigraphy to assess insufficient sleep includes increased sensitivity over sleep logs in identifying short sleep duration. This is important due to the high prevalence of insufficient sleep and its association with medical and psychiatric morbidity and deleterious societal effects such as motor vehicle accidents and poor work performance. Additional benefits include the objective nature of the data. Potential harms of actigraphy are negligible and rare and include skin irritation. Although overall costs are low relative to more sophisticated, multiple sensor home sleep testing devices that can be worn over multiple days, actigraphy is higher in cost relative to paper logs. The TF determined that the benefits of using actigraphy outweigh the harms. Based on their clinical experience, the TF determined that the vast majority of patients would use actigraphy.

Use of Actigraphy in the Evaluation of Periodic Limb Movement Disorder in Adult and Pediatric Populations

Recommendation 8: We recommend that clinicians *not* use actigraphy in place of electromyography for the diagnosis of periodic limb movement disorder in adult and pediatric patients. (Strong)

Assessment of periodic limb movement disorder (PLMD) was not addressed in previous clinical practice guidelines; however, there is a growing interest in tests conducted out of the sleep center, and studies have explored whether actigraphy devices placed on the ankle or foot are a viable alternative to in-laboratory EMG in conjunction with PSG (as required by current diagnostic criteria[9]). The TF compared actigraphy to EMG for the assessment of periodic limb movements in adult and pediatric patients, to evaluate whether actigraphy could be used in place of EMG during PSG to assess the periodic limb movements of sleep index (PLMSI) and diagnose PLMD. The TF identified 5 studies (4 adult, 1 pediatric), one of which did not provide mean and standard deviation values and one of which used two actigraphy comparators. The small number of studies and sample heterogeneity precluded meta-analysis. Across the studies, the PLMSI as measured by actigraphy differed significantly from EMG measures in both adult and pediatric populations, demonstrating that actigraphy does not produce reliable estimates of periodic limb movements. The overall quality of evidence was moderate due to low sample size and imprecision. The TF determined that the potential for overestimating or underestimating PLMSI could lead to potentially unnecessary treatment or to missed cases of PLMD. In addition, without evaluation of simultaneous EEG, the evaluation of arousals from sleep is not possible with actigraphy alone. Thus, the TF concluded that the potential harms of misclassification outweighed the benefits of ease of monitoring with actigraphy versus EMG during PSG. Based on clinical expertise, the TF determined that the vast majority of patients would not use actigraphy in place of EMG, given the poor correspondence between the PLMSI as measured with actigraphy versus gold-standard EMG during PSG. The recommendation against using actigraphy in place of EMG for the diagnosis of PLMD is primarily a result of the unreliable estimates of periodic limb movement and the potential for misdiagnosis.

DISCUSSION

Wrist actigraphy was originally developed as a research-based method for estimating sleep parameters across multiple nights in the home sleep environment rather than measuring sleep during a single night in the sleep laboratory environment. In the last 15 years, actigraphy has been viewed as a useful clinical tool, particularly in the evaluation of patients with suspected or confirmed sleep disorders for whom understanding sleep/wake habits across multiple nights can inform clinical decision-making. Importantly, actigraphy can be used in both pediatric and adult patient populations. It is important to recognize that actigraphy is not a substitute for in-laboratory PSG when there is an indication for in-laboratory testing, however it can provide useful objective metrics across a variety of sleep-wake disorders to assist in the assessment and monitoring of treatment response. In general, we found that for many sleep parameters, actigraphy yields significantly distinct information from sleep logs and in some instances provides parameters estimates that are sufficiently similar to PSG. The parameters differ somewhat by disorder and application. With the exception PLMD, this general pattern of findings supports the utility of actigraphy to provide useful information in the diagnosis and monitoring or treatment as indicated in each of the 8 recommendations.

In February of 2008, actigraphy transitioned from a Current Procedural Terminology (CPT) Category III (emerging technology) to a Category I code (95803), which is a stand-alone code. These clinical practice guidelines are intended to

inform use of actigraphy as described under this code. When implementing the above recommendations, clinicians should be aware that, as noted by the descriptor for actigraphy, a minimum of 72 hours (with a maximum of 14 days) of consecutive recording is required, and the code cannot be used concurrently with HSAT or PSG codes.[6] In particular, HSAT devices that incorporate actigraphy should be coded only as HSAT, and actigraphy should not be coded separately.[6]

It should be noted that cost issues can influence patient preferences regarding use of actigraphy and must be considered when implementing these recommendations. At present, although many third-party payers reimburse for actigraphy procedures, there is significant variability from region to region and payer to payer as a clinical assessment tool, thereby impacting its use. However, if this procedure were reimbursed by payers and patient costs were reduced, this may change patient preferences regarding the use of actigraphy in clinical practice.

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