

GENERAL

G.1.

I see that the STANDARDS FOR ACCREDITATION state that we are to use the recommended AASM guidelines, when available. Does this mean if our medical director chooses for us to use an alternative rule that our accreditation is at risk?

The AASM Manual for the Scoring of Sleep and Related Events is not a guideline or practice parameter, and uses slightly different terminology. The key on page 15 indicates that "recommended," "alternative," and "optional" rules are all methods acceptable by AASM for scoring. An accredited center must follow all of the rules, but based on the discretion of the clinician or investigator a specific center may use "alternative" or "optional" rules in the place of the "recommended" rule. The use of "alternative" or "optional" rules would not create any risk to accreditation.

The term "recommended AASM guidelines" in the accreditation standards refers to the set of guideline papers published by the AASM [<http://www.aasmnet.org/PracticeParameters.aspx>]. Each paper has recommendations based on evidence and/or consensus with terms ("standard," "guideline" or "option") that are used to reflect the strength of evidence and/or consensus. An accredited center must follow all of the "standard" recommendations, and may or may not follow the "guidelines" or "options."

G.2.

When/where will the committee's response to this (and other) questions be published?

The Steering Committee provides responses to specific questions sent to the national office by e-mail to rosenberg@aasmnet.org such as the one you are reading. Questions of more general interest have been posted on the over the past year at this website [<http://www.aasmnet.org/Resources/PDF/FAQsScoringManual.pdf>].

G.3.

Is the Steering Committee you referred to the Standards of Practice Committee or is this an extension of the Task Force for Unattended Testing?

The Steering Committee referred to in the "Clinical Guidelines for the Use of Unattended Portable Monitors in the Diagnosis of Obstructive Sleep Apnea" was appointed the AASM Board of Directors to develop, in conjunction with task forces and approval of the AASM Board, the scoring rules published in "The Scoring of Sleep and Associated Events: Rules, Terminology, and Technical Specifications."

TECHNICAL SPECIFICATIONS

T.1.

I have just bought NEW PSG EQUIPMENT. Do I need to change my equipment again to become compliant with the technical specifications on pages 19-21?

No, for AASM accredited centers and laboratories, all new equipment purchased after July 1, 2008 will need to be in compliance with the technical requirements on pages 19-21. However, even with existing equipment, by July 1, 2008, you will need to:

1. Be compliant with the new rules for EEG, EOG, EMG and respiratory signals, including using both thermal and nasal pressure sensors to record respiratory events (pages 45 and 48)
2. Have modified your reporting software to reflect the parameters to be reported (pages 17-18) and the new sleep stage terminology (page 24)
3. Be scoring stages and events according to the new rules

T.2.

Is there a requirement for CONTINUOUS AUDIO RECORDING during polysomnography under the new guidelines?

The manual does not specifically require audio recording. Most laboratories incorporate it within the required video recording process however because there are so many clinical situations in which audio is extremely useful, including but not limited to bruxism, snoring, behavioral disorders, parasomnias, seizures and catathrenia.

T.3.

If my AMPLIFIER, purchased prior to July 1, 2008, does not have enough inputs to allow for the additional EEG and EMG channels, and I am not required to replace this equipment, then how am I to stage sleep using the new criteria?

Please refer to FAQ T.1. The exception granted for equipment purchased prior to July 1, 2008 refers only to the technical requirements listed on pages 19-21. This does not include the number of amplifier channels. By July 1, 2008, you will need to have equipment enabling compliance with the new rules for scoring sleep using EEG, EOG and EMG signals. Therefore an adequate number of amplifier inputs to allow recording of the required number of EEG and EMG derivations will be needed.

T.4.

I AM BUYING NEW EQUIPMENT in May 2008 with capabilities that will not be compliant with some of the scoring manual specifications. When must I replace or modify the equipment?

Please note that it is only the technical specifications listed on pages 19-21 that need not be present in equipment purchased prior to July 1, 2008. All other requirements must be met as specified in FAQ T.1. The AASM has not set a specific date by which older equipment not fulfilling all the specifications on pages 19-21 need be replaced or modified. Any replacement equipment purchased after July 1, 2008 must be in full compliance with all technical requirements.

VISUAL RULES

V.1.

Is it permissible to use the RECOMMENDED EOG derivations AND the ALTERNATIVE EEG derivations for the same study, or must we use either the recommended or the alternate derivations for both EEG and EOG?

You may choose between the recommended and alternative derivations for EEG and EOG within the same study.

V.2.

I currently use EOG derivations similar to the alternative ones (page 24, B.2.) but the REFERENCE FOR EYE LEADS is Fz rather than Fpz. Is this permissible?

No, in the interests of standardization, the EOG derivations in the manual (recommended or alternative) should be followed exactly.

V.3.

I currently record LEFT-SIDED EEG (F₃, C₃, O₁) and reference to M₂. This is the mirror image of the recommended derivations (page 23, A.1.) Is this permissible?

No, in the interests of standardization, the routine EEG derivations in the manual (recommended or alternative) should be followed exactly. Exceptions are allowed only in individual cases when applications are prevented by local conditions such as scalp conditions or focal encephalomalacia.

V.4.

I plan to use the recommended EEG derivations (page 23, A.1.) If the C₄ ELECTRODE BECOMES DISCONNECTED during the study, can I replace C₄ with C₃ and continue to record F₄-M₁ and O₂- M₁, or must I then change all 3 derivations to recording from the left side of the head?

You need only change the derivation that incorporates the faulty electrode. However, in the scenario described above, you would change to C₃-M₂, rather than C₃-M₁, even if the M₁ electrode is intact.

V.5.

I plan to use the alternative EEG derivations (page 23, A.2). The amplitude of EEG activity during stage N3 sleep should be measured using the frontal derivation (page 27, definition). Won't the use of the bipolar derivation Fz-Cz result in EEG CANCELLATION EFFECTS, reducing the amplitude of the signal compared to a referential derivation, such as F₄-M₁?

You are correct. Fz-Cz is not appropriate for measuring the amplitude of frontal activity for the reason you describe. If you are using the alternative EOG derivations (page 24, B.2.), then we recommend you use the E₁-Fpz derivation to measure frontal slow wave amplitude. Used in this

way, Fpz will be the active electrode recording frontal activity and E₁ the reference electrode in a referential derivation. If you are using the recommended EOG derivation (page 24, B.1.), then we suggest you measure EEG amplitude using the C₄-M₁ derivation.

V.6.

Regarding the END OF A PERIOD OF STAGE R SLEEP RULE [page 28, 7.C.]: Epoch 50 (see Figure 1 below) is typical R sleep, epoch 51 is R sleep with a K complex (but no arousal) in the 2nd half of the epoch, epoch 52-54 have low amplitude mixed frequency EEG activity and low muscle tone but no REMs or K complexes, epoch 55 has low amplitude mixed frequency EEG, low muscle tone and REMs in the first half of the epoch. Should epochs 52-54 be scored N2 or R?

According to the rules for ending a period of stage R sleep (page 28, C1.e and page 29, Figure 7), epoch 51 would be scored as R and epoch 52 would be scored as N2. According to the rules for the transition between stage N2 and R (page 30, D.3), epochs 53- 54 would be scored as R (see Figure 1 below).

V.6A.

This question is in response to a previous question (V.6.) concerning the END OF A PERIOD OF STAGE R SLEEP RULE [page 28, 7.c]. In the figure shown for question V.6., epoch 52 has no K complexes or spindles and maintains a low chin EMG. If we are indeed moving to an epoch by epoch scoring mandate then why would you score this epoch as N2 rather than REM? Rule 7 C specifically states ending stage R when the K-complex occurs in the first half of the epoch. The only exceptions I know of for the epoch by epoch staging mandate are those of when REM begins before eye movements are seen i.e. when chin EMG drops in the absence of K-complexes and spindles, and staging what used to be movement epochs which is now determined by the following epoch's stage provided there was sleep in the previous epoch.

The epoch 52 in V.6 should be scored as N2 because REMs do not appear following the epoch; this is consistent with both the right sided part of Figure 7 in the manual (p. 29) and the right sided part of Figure 9 (p. 30) which shows REM scoring if subsequent epochs demonstrate REMs. Please note also Rule 5.A.1 which mandates scoring stage N2 if a K complex or spindle occurred in the second half of the previous epoch. The Committee feels that their response to V.6 FAQ is a reasonable interpretation of an uncommon scenario.

V.7.

How are epochs BETWEEN an initial N1 with slow eye movements AND an epoch of R with rapid eye movements scored if all the epochs demonstrate low amplitude mixed frequency and there are no changes in the EMG?

There are no rules in the AASM manual specifically dealing with stage N1-R transitions. R will only commence when rapid eye movements are seen in association with low muscle tone and the typical EEG (Rule 7A. page 27).

V.8.

Occasionally FRONTAL derivations are the only derivations that DETECT spindles, or arousals during an epoch. Can these events be used to score sleep even if they are only found in the frontal derivations? The scoring manual indicates that spindles are “maximal in amplitude using central derivations” and that arousal should be scored from “both the occipital and central derivations.”

Yes. Although sleep spindles and frequency changes associated with arousals are more typically noted in the central and occipital derivations respectively, these events should be used to score sleep even if they are only noted in the frontal derivations.

V.9.

If a patient has a generalized tonic-clonic seizure during sleep, how do you score the following post-ictal slowing?

With the exception of epochs that meet criteria for movement time, epochs that cannot be scored as sleep or wake should be excluded from scoring and summary data. Appropriate comments should be included in the summary statement section of the report. In the example given, EEG slowing would not be scored or reported as wakeful or sleep time. The summary report would note the seizure as well as periods of post-ictal slowing that could not be scored.

V.10.

The rule for N3 sleep (p. 27) says that you should score N3 whenever 20% of the epoch consists of slow wave activity. This makes sense if the rest of the epoch is low amplitude mixed frequency EEG, but what if there is an awakening after 6 seconds of dense slow wave activity and alpha rhythm activity for the remainder of the epoch? Would this still be N3?

No, this would be scored as W using IV.2.B.3.

V.11.

R ends with a transition to W (p. 28), but doesn't end if there is an arousal that is not followed by slow eye movements. What if the arousal consists of a shift to alpha rhythm that lasts 3 seconds? Would that be a transition to W? How about 5 seconds? Or do you need an epoch of W to end R?

Arousals in R do not end R. A 3 or 5 second shift to alpha in R requires a 1 second rise in EMG to constitute an arousal in R under Rule V. An epoch containing alpha for greater than 15 seconds would be scored W, ending R.

AROUSALS

A.1.

Can you score AROUSALS IN AN AWAKE EPOCH if 10 seconds of sleep precedes the event and all other criteria are met?

Yes. Arousals meeting all scoring criteria but occurring during an awake epoch in the recorded time between “lights out” and “lights on” should be scored and used for computation of the arousal index.

CARDIAC

C.1.

On page 39, 2. A and B scoring of tachycardia and bradycardia, what is meant by “SUSTAINED”?

Sustained sinus bradycardia or tachycardia is defined by more than 30 seconds of a stable rhythm to distinguish it from transient responses associated sleep disordered breathing events or arousals.

MOVEMENT RULES

M.1.

In scoring the PSG FEATURES OF RBD, how many epochs of REM sleep must show either sustained or excessive transient muscle activity for REM sleep as a whole to be considered compatible with RBD?

The manual has deliberately not specified this as there are little normative data. Clinicians are encouraged to read the relevant section of the supporting paper (J Clin Sleep Med 2007;3:159-161) to help them decide how to address this issue in their own laboratories.

M.2.

There are numerous leg movement sensors available. We switched from electrodes to sensors several years ago and have been happy with the response. Will it be necessary to return to LEG ELECTRODES to score PLMS?

Bipolar EMG electrodes are required for PLM scoring as noted in Parameters to be reported (II. A. 4.) and the notes appended to PLM scoring rules (VII.1.notes).

M.3.

In our lab we score arousals associated with PLMs. Since you cannot score arousals unless there is 10 seconds of sleep preceding the arousal, can I score an arousal that is associated with a PLM when there can be as little as 5 seconds since the last PLM with arousal?

The short answer is no, you cannot score arousals with less than 10 seconds of intervening sleep. Members of the Movement Rules and Arousal Rule task forces were consulted on this question. The Movement Rules perspective was that conceptually it would be possible to have multiple limb-movement related arousals with the minimal interval between limb movements (5 seconds from onset to onset). However, the Arousal Rule perspective is that the scoring of such arousals would be technically quite difficult. Since an arousal must last a minimum of 3

seconds, this would leave only 2 seconds to determine that sleep had resumed. The Steering Committee reviewed both perspectives and determined that the arousal rule should hold and that a minimum of 10 seconds is necessary to reliably determine that the patient has returned to sleep. When periodic limb movements occur with an interval of less than 10 seconds and each is associated with a 3 second arousal, only the first arousal should be scored though both limb movements may be scored. In this scenario, the arousal index and PLM index with arousal but not the Periodic Limb Movement Index would be influenced by not scoring the second "arousal".

M.4.

Are limb movements counted even if they are isolated and do not occur in a series?

Limb movements are only counted if they meet all criteria in VII.1.A.1-5 and are incorporated within a PLM series as defined by VII.1.B.

M.5.

I discovered an issue for clarification in the scoring manual on p 41 concerning note 1 in the PLM section. It states "An LM should not be scored if it occurs during a period from 0.5 seconds preceding and apnea or hypopnea to 0.5 seconds following an apnea or hypopnea." I think the intent was to say that the LM should not be scored during a period from 0.5 seconds preceding to 0.5 seconds following the termination of an apnea or hypopnea. As stated, it indicates that no PLMs would be scored at all during a respiratory event.

Note 1. in VII.1. is correct as stated: *An LM should not be scored if it occurs during a period from 0.5 seconds preceding an apnea or hypopnea to 0.5 seconds following an apnea or hypopnea.* This period is inclusive and no LMs should be scored.

RESPIRATORY RULES

R.1.

I perform epidemiologic studies of sleep apnea. It is very important that all research studies use the same criteria for hypopneas to allow valid comparisons between different protocols. How will this be possible with TWO RULES FOR HYPOPNEAS?

We strongly recommend that investigators use the alternative rule for hypopneas (page 46, 4.B.) in all prospective epidemiological and outcome studies. For clinical purposes, sleep specialists may select either the recommended (pg 46, 4.A.) or alternative (page 46, 4.B.) rule. Certainly, for comparison purposes in clinical research or practice, both methods may be reported.

R.2.

What should be done when one AIRFLOW SENSOR FAILS? If I am monitoring with both a thermal sensor and a nasal pressure sensor and the nasal pressure sensor stops working, how can I now define hypopneas?

The manual recommends using back-up sensors when one fails. When the nasal pressure sensor fails, the oronasal thermal sensor should be used for scoring hypopneas. [pages 45 & 48, notes]

R.3.

Is CALIBRATED INDUCTANCE PLETHYSMOGRAPHY required for detection of respiratory effort?

No. The recommended sensors for detection of respiratory effort are either calibrated OR uncalibrated inductance plethysmography OR esophageal manometry.

R.4.

Are PIEZO BELTS acceptable as sensors for detection of respiratory effort?

No. The recommended sensors for detection of respiratory effort are calibrated OR uncalibrated inductance plethysmography OR esophageal manometry. As indicated in the supporting review paper, (J Clin Sleep Med 2007; 3:172), piezo belts are not felt to be a satisfactory reflection of respiratory effort.

R.5.

Can we score apneas and hypopneas during epochs scored as wake?

Although it is recognized that apneas and hypopneas can occur during drowsiness preceding stage N1 sleep, these should not be scored because of the difficulty of defining the denominator to calculate an apnea hypopnea index. If these events are prominent and interfere with sleep onset, their presence should be mentioned in the narrative summary of the study.

R.6.

During CPAP TITRATION, are both thermal sensors and nasal pressure sensors required for scoring apnea and hypopnea?

The scoring manual does not specifically apply to scoring of respiratory events during CPAP treatment. Alternative methods for verifying flow such as flow output from the CPAP device will be necessary during treatment as nasal pressure and thermal sensor measures may no longer be reliable.

R.7.

Are both a thermistor and a nasal pressure transducer recommended for detection of airflow?

Yes. A thermistor is recommended for detection of the absence of airflow for the purpose of identifying apneas. A nasal pressure transducer with or without square root transformation of

the signal is recommended for the detection of a flow reduction for the purpose of identifying hypopneas. As indicated in the scoring manual review paper, J Clin Sleep Med 2007; 3:169/, use of only a nasal pressure transducer can result in misclassification of hypopneas as apneas.

R.8.

Is arousal required for scoring RERAs in children?

Yes. Scoring of RERAs in both adults and children requires that the RERA be associated with an arousal that conforms to the recommended AASM arousal rule.

R.9.

The standards require an oximeter to have a maximum signal averaging time of 3 seconds. But some OXIMETERS' SAMPLING TIMES are linked to heart rate and thus may at times be longer during periods of bradycardia. Is this acceptable?

Yes, as long as the maximum signal averaging time at a heart rate of 80 beats per minute or more is 3 seconds or less.

R.10.

In some cases, APNEAS AND HYPOPNEAS may begin during an epoch scored as sleep, but end during an epoch scored as wake. Can these events be scored and used for the computation of apnea-hypopnea index?

Yes. If any portion of either the apnea or hypopnea occurs during an epoch that is scored as sleep, then the corresponding respiratory event can be scored and included in the computation of the AHI. This situation usually occurs when an individual has a high apnea hypopnea index with events occurring so frequently that sleep is severely disrupted and epochs may end up being scored as wake even though there are brief seconds of sleep between the respiratory events. However, if the apnea or hypopnea occurs entirely during an epoch scored as wake, it should not be scored or counted towards the apnea-hypopnea index because of the difficulty of defining a denominator in that situation. If these occurrences are a prominent feature of the polysomnogram and/or interfere with sleep onset, their presence should be mentioned in the narrative summary of the study as well.

R.11.

I am concerned about the requirement that 90% of the EVENT DURATION must meet the amplitude reduction criteria. I see that there was no evidence and no agreement by the respiratory task force, and that this criterion was adjudicated by the steering committee.

If the amplitude and/or desaturation criteria are met during any contiguous 10 seconds of an event that lasts longer than 10 seconds, then the event should be scored even if the duration of the amplitude reduction does not constitute 90% of the total event duration. In the example cited, any contiguous 10-second period during the 17 seconds would be scored and classified

based on the amplitude and/or desaturation criteria for hypopnea or apnea. The event duration would be that measured for the length of the entire episode.

R.12.

It does not make sense to me that a 17-second reduction in AMPLITUDE would not be counted if the event is 20 seconds long, but that a 9-second reduction would be adequate if the duration of the event is 10 seconds. What is the rationale for this criterion?

Scoring of hypopneas and apneas requires a minimum duration of 10 seconds. If the amplitude criteria are met during any contiguous 9 seconds of an event that lasts 10 seconds or longer then the event should be scored even if the duration of the amplitude reduction does not constitute 90% of the total event duration. In the example cited, any contiguous 9-second period during the 20 seconds would be scored and classified based on the amplitude and/or desaturation criteria for hypopnea or apnea. The event duration would be that measured for the length of the entire episode.

R.13.

What is meant by "BASELINE" in the new AASM scoring manual? We are using the alternative definition for hypopnea in non-Medicare patients. Hypopnea is defined as > 50% drop in the nasal pressure signal compared to baseline associated with either a 3% desaturation or an arousal. I am meeting with our techs on a regular basis in an attempt to insure uniform scoring under the new criteria. I have attached a typical example. The labeled events are those scored by the technologist. There are other events present which are associated with arousals which the tech did not score because he did not believe that there was a 50% drop in flow. There is a 50% drop in flow compared to the recovery breaths but this may not be "baseline" in that the patient is hyperventilating in response to the event. Is it acceptable to use the amplitude of these three to four breaths following the event as "baseline" and compare the reduced breaths to these?

If there is no clear baseline breathing to measure, due to a high frequency of abnormal respiratory events, then the recovery breaths between the frequent apneas or hypopneas would be acceptable to use for an approximate baseline against which to measure the percent of drop for the next reduction in airflow.

R.14.

Can the INTERCOSTAL EMG be used as an alternative sensor for detection of respiratory effort?

As noted in Section VIII, 1, Note 3 of the scoring manual, "An alternative sensor for detection of effort is diaphragmatic/intercostals EMG." However, it should be emphasized that an interpretable diaphragmatic/intercostal EMG signal is sometimes difficult to obtain especially in obese patients. Thus, sole use of this sensor to assess respiratory effort is not encouraged.

R.15.

Can the HYPOPNEA RULES 4a and 4b on page 46 be combined to compute a single AHI?

No. Each AHI reported should be based on consistent application of either rule 4a or 4b. Scoring using 4a and 4b cannot be combined to compute a single AHI. Laboratories that choose to use both rules must report AHI for each rule separately.

R.16.

What, according to the new standards of the AASM, do they want us to do with SNORING? Are we mandated to measure it? How are we to measure it? Score it? Interpret it?

The presence of snoring should be commented in the text of the report with interpretation of severity left to the discretion of the clinician/investigator. The scoring manual does recommend methods for data acquisition but not for reporting. Since there was insufficient evidence to specify an objective measure of snoring, specific reporting measures are not required. For example a statement such as follows may be an adequate way to handle the situation: "There were frequent, almost continuous moderately loud to loud snores present. These occurred in all positions but appeared to be worse supine. Intermittent snore related arousals appear independent of definable apneas and hypopneas."

R.17.

The new scoring manual indicates that piezo technology may not be used for chest and abdominal movement. Does this mean that piezo technology may not be used for other sensors such as nasal pressure?

The AASM scoring manual neither prohibits nor recommends the use of piezo technology for other than abdominal or chest movement. [A device used for measurement of nasal pressure should, however, provide semiquantitative airway pressure signal comparable to pressure measured by transducer].

R.18.

In your FAQ R 15, you state you can not combine 4a and 4b hypopneas. Are there any studies that have looked at this, comparing AHI for scoring by 4b vs. combining 4a and 4b? I have a problem ignoring hypopneas that fit your 4a recommended hypopneas rule, just to score more "liberally" under 4b; are we accurately describing the patient's true AHI if we ignore 4a hypopneas? Also, is there really a difference between a 30% and 50% drop in flow, when we are using qualitative rather than quantitative flow sensors? My understanding of thermistor and pressure monitor is that they both are not quantitative, so is talking in terms of a percent drop in flow really valid?

The AASM scoring manual has recommended standardization of rules to improve reproducibility of measures. This requires the choice of a recommended or alternative rule and sticking with it throughout the record. In the case of AHI, reproducibility would be degraded if some laboratories chose to combine hypopnea rules and others employed and identified single consistent rule.

R.19.

Is there a rule stating how many seconds from the end of a respiratory event until the beginning of an arousal for them to be associated with each other?

The scoring manual does not specify the time requirement linking arousals and respiratory events. Apneas and hypopneas did not require arousals for scoring. When arousals do occur with respiratory events, they usually occur within 5 seconds of airway opening.

R.20.

In the special article "Clinical Guidelines for the Use of Unattended Portable Monitors in the Diagnosis of Obstructive Sleep Apnea" published in the December, 2007 issue of JCSM, it is recommended in Section 2.2 that both nasal pressure transducers and thermistors be used to detect apneas. However, the article details the limitations of both of these methods, namely the inability to detect oral flow (nasal pressure devices) and the non-linear relation to airflow and overestimation of ventilation (thermistors). The guidelines also state in the next section (2.3) that respiratory inductance plethysmography, when appropriately calibrated, provides an accurate measure of tidal volume. Since $(\text{Tidal Volume}) = (\text{Flow}) \times (\text{Time})$, might a measurement of tidal volume calculated using calibrated RIP be an acceptable alternative for measuring flow? How might we initiate some dialog with AASM regarding this alternative?

There is insufficient evidence to support the use of RIP as an alternative to standard flow measurements in respiratory event scoring in clinical settings. Given the careful evidence review and consensus underpinning the decision to employ nasal pressure and thermal sensors for flow detection detailed in the review "The scoring of respiratory events in sleep: reliability and validity" [J Clin Sleep Med 2007;3:169-200], nasal pressure and thermal sensors are recommended for flow detection for both the laboratory setting ("The Scoring of Sleep and Associated Events: Rules, Terminology, and Technical Specifications") and in portable monitoring ("Clinical Guidelines for the Use of Unattended Portable Monitors in the Diagnosis of Obstructive Sleep Apnea").

R.21.

I am looking for clarification on the mixed apnea rule. It states, "Score a respiratory event as a mixed apnea if it meets apnea criteria and is associated with absent inspiratory effort in the initial portion of the event, followed by resumption of inspiratory effort in the second portion of the event." Previously, my lab has scored events as mixed only if effort was absent during the initial 10 seconds of the event. If the initial 10 seconds contained effort, it was classified as an obstructive event in my lab. Is there a time criteria given for "initial" and "second portion" in this rule?

There is not sufficient evidence to support a specific duration of the central and obstructive components of a mixed apnea, thus specific durations of these components were not recommended.

R.22.

I attended the June 8th APSS session, "Implementing the AASM Scoring Rules" in 2008. It was very informative and well presented, but I and another audience member had a question about the use of the word *contiguous* during the respiratory scoring lectures (and also in a FAQ answer) that seemed to change the meaning of a rule in the 2007 scoring manual. The FAQ question is R.11. The answer states that "if the amplitude criteria are met during any *contiguous* 9 sec of an event that lasts 10 sec or longer then the event should be scored..." The word *contiguous* was used on 6/8/08 by presenters as well. In the 2007 scoring manual, the word *contiguous* is not used as far as I could see. When the word *contiguous* is used, it seems to mean that apneas and hypopneas need only be 9 seconds in duration thus changing the duration criteria of the definitions. This is because the 1 second that does not meet amplitude criteria *must* be at the beginning or end of the event if the event is 10 seconds in duration. When the specification of being *contiguous* is *not* used it means that during a 10 second apnea or hypopnea there may be 1 second *at any point* during the event that does not meet amplitude criteria so the event is still defined as being 10 seconds long. We took the use of the word *contiguous* as meaning that now apnea and hypopneas are defined as being 9 seconds long since the first or last second of a 10 second event need not meet amplitude reduction criteria (even though I don't see the word *contiguous* in the 2007 scoring manual itself.) Also- In reading both R.10 and R.11, I'm thinking that in the context of the example of the 17 second event, I understand the recommendation to look for 9 contiguous seconds within that event. However for a 10 second event the manual does not specify that the 9 seconds be contiguous and this is what seems to change the event duration criteria to 9 seconds.

Respiratory events require a minimum duration of 10 seconds in adults and 2 breaths in children. The abnormality must last this specified duration though amplitude criteria are required for only 90% of the duration. Any event that does not have an abnormality lasting a total of 10 seconds [or 2 breaths in children] cannot be defined as an apnea or hypopnea. Abnormalities lasting only 9 seconds are not scored as respiratory events in adults. The published FAQ R12 states "Scoring of hypopneas and apneas requires a minimum duration of 10 seconds. If the amplitude criteria are met during any contiguous 9 seconds of an event that lasts 10 seconds or longer then the event should be scored even if the duration of the amplitude reduction does not constitute 90% of the total event duration." Thus relatively rare events that incorporate only 7 or 8 seconds meeting amplitude criteria will not meet criteria for an event.

R.23.

My question is about respiratory sighs during sleep. Was this normal, physiological event ever addressed during the creation of the new respiratory scoring rules? I would like to know how the committee feels about scoring or not scoring, single or multiple sighs during sleep. There is no mention of sighing at all in the new handbook.

Many phenomena that occur during the recording sleep studies were not included in the scoring manual because of their uncertain significance. Deep breaths that accompany arousals

may be followed by single central apneas though the significance of this phenomenon is not defined.

R.24.

We are puzzled by a hypopnea rule on page 46. It is 'note #2' under '4.Hypopnea Rules' which states that "classification of hypopneas as obstructive, central or mixed should not be performed without a quantitative assessment of ventilatory effort (esophageal manometry, calibrated inductance plethysmography, or diaphragmatic/intercostal EMG)."

The questions are as follows:

1) We don't understand how intercostal EMG channels can be quantitative. We use intercostal EMG channels. This is a basic EMG channel. Would this channel be quantitative if we added a grid to the display so that we could visualize the number of microvolts that represent the EMG changes? Is there some other way to make this parameter quantitative?

All surface electrical recordings are quantitative. Although voltage specifications for quantitative EMG are required for PLMs, there is no voltage requirement in recording respiratory muscle activity.

2) A further question is how does quantitative assessment of ventilatory effort allow someone to deduce whether or not a hypopnea is obstructive? Is the answer that when the efforts increase but the airflow does not then the hypopnea is obstructive? This is counterintuitive for me since the airflow channels are not quantitative and yet, to deduce whether or not an event is obstructive, they are used with the efforts channels which would be quantitative. (I would wonder why flattening of nasal pressure signal, paradoxical efforts in RIP channels or snoring couldn't be used as signs of obstruction.)

Classification of apneas as obstructive, central and mixed is recommended [VII.3.B] but classification and reporting of hypopneas as obstructive, central, or mixed was not recommended because of the lack of evidence for a reliable method for these classifications. It is recognized, however, that some respiratory events meeting criteria for hypopnea may occur as a result of decreased effort [for instance during REMs] rather than obstruction. The note VII.5.1 was provided for those who would like to add interpretive comment that would support obstructive or non-obstructive evidence. Reduction in semiquantitative measure of airflow with increase effort would suggest obstruction. We also agree that inspiratory flow flattening and snoring suggest obstruction. Paradoxical movement is may be present during REM [due to chest wall inhibition] without obstruction.

PEDIATRIC RESPIRATORY

P.R.1

Is ETCO₂ an acceptable air flow signal? Can it replace one or both of the others?

As specified in the notes following the technical considerations 1A and 1B on page 48, end-tidal PCO_2 may be used as an alternative sensor for the detection of apneas only when the oronasal thermal sensor is not reliable. It may not be used for detection of hypopneas.

P.R.2.

In reviewing the respiratory rules for hypopneas in children, the only alternative sensor for detection of airflow for identification of a hypopnea is an oronasal thermal sensor.

The option of using an uncalibrated or calibrated inductance plethysmography sensor when the nasal pressure device is not functioning is listed as an alternative option in the adult respiratory rules. It is NOT listed as an alternative for children. Is this an oversight?

It's important to have the option to use an inductance "sum" sensor in children. Directly measured airflow signals placed under the nose like nasal pressure (or even oronasal airflow) are frequently absent or poor quality because of mouth breathing or patient intolerance.

Slippage of the inductance plethysmography belts is common in children and the sum channel is not considered to be an accurate measure of flow. Airflow should be measured at the nose in children.