

University of Texas Medical Branch Sleep Disorder Center Policy: 08.06.18 Scoring Sleep Stage, Adult	Effective Date: January 2013 Revised Date: June 2012 Review Date: January 2013
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Scoring Sleep Stage: ADULT

- Audience:** All personnel in the Sleep Disorder Center.
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- Purpose:** The use of an established scoring system for sleep stages assures reliability of scoring and contributes to the accuracy of the diagnosis from all sleep tests.
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- Policy:** To establish and formalize the scoring system of sleep stage of polysomnograms and PAP studies. All sleep records will be scored using established criteria by the latest edition of *The American Academy of Sleep Medicine (AASM) Manual for the Scoring of Sleep and Associated Events, Rules Terminology and Technical Specifications*.
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- Procedure:** *Monitoring Sleep For Staging:*
- Electroencephalogram (EEG) electrode placement is by the accurate measurement of the skull according to the International 10-20 System of Electrode Placement which is required for recording EEG activity during sleep and for documenting and localizing epileptiform activity.
 - Recommended derivations are: F4-M1, C4-M1, O2-M1. Backup electrodes should be placed at F3-M2, C3-M2, O1-M2.
 - M2 and M1 are the right and left mastoids, respectively.
 - Electrooculogram (EOG) determine eye movements. Recommended derivations are E1/M2, where E1 is placed 1 cm below the left outer canthus (LOC) and E2/M2, where E2 is placed 1 cm above the right outer canthus (ROC). Alternative acceptable derivations are: Place E1 1 cm below and 1 cm lateral to the LOC and E2 1 cm below and 1 cm lateral to the ROC.
 - Electromyogram (EMG) monitor chin muscle activity. Three electrodes are recommended. One in midline 1 cm above the inferior edge of the mandible. One 2 cm below the inferior edge of the mandible and 2 cm to the right of midline. One 2 cm below the inferior edge of the mandible and 2 cm to the left of the midline.
 - EMG deriviations consist of either of the electrodes below the mandible referred to the electrode above the mandible. The other inferior electrode is a backup should one of the primary electrodes malfunction.
- Scoring Sleep Stages*
- Score sleep stages in 30 second sequential epochs.
 - Assign a stage to each epoch.

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- If two or more stages coexist during a single epoch, assign the stage comprising the greatest portion of the epoch.
- Keyboard designations: Use the number key pad on the keyboard to designate sleep stage.
 - 0 - Wake
 - 1 – Stage 1
 - 2 – Stage 2
 - 3 – Stage 3
 - 5 - REM
 - Decimal (.) – No Stage

Stage W (wakefulness)

- Defined by alpha activity (8-13 cps) in the occipital region for more than 50% of the epoch.
- Score stage W if epochs are without visually discernable alpha rhythm but have eye blinks at a frequency of 0.5 – 2 Hz, reading eye movements, or irregular conjugate rapid eye movements associated with normal to high chin muscle tone.

Stage N1

- Defined by attenuated alpha rhythm replaced by low amplitude, mixed frequency activity for more than 50% of the epoch.
- Prominence of theta (2 -7 cps) activity, vertex sharp waves, slow eye movements (SEM) and chin muscle tone below relaxed wakefulness.

Stage N2

- Defined by the presence of sleep spindles (12 – 14 cps activity lasting at least 0.5 seconds) and K-complexes (well –delineated negative sharp wave immediately followed by a positive component with a duration ≥ 0.5 seconds).
- Begin scoring stage N2 if one or more K-complexes not associated with arousals, and/or one or more trains of sleep spindles occur during the first half of that epoch or occur during the last half of the previous epoch.
- Continue to score epochs with low amplitude, mixed frequency EEG activity without K-complexes or sleep spindles stage N2 if they are preceded by 1) K-complexes unassociated with arousals or 2) sleep spindles.
- End stage N2 when one of the following occurs: 1) transition to W, 2) transition to stage N1 due to arousal or major body movement, 3) transition to stage N3, 4) transition to stage R.

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Stage N3

- Defined as slow wave activity (a frequency of 0.5Hz to 2 Hz and a peak to peak amplitude $>75\mu\text{V}$) persisting for 20% or more of the epoch.
- Sleep spindles may be present, eye movements are typically not seen and chin EMG is of variable low amplitude.

Stage R

- Defined by the appearance of relatively low voltage, mixed frequency EEG activity accompanied by episodic REMs. The EEG pattern resembles the one described in Stage 1, except that vertex sharp waves are not prominent in Stage REM. “Saw-tooth” waves may be noted with bursts of REM. Alpha activity may be somewhat more prominent during Stage REM than during Stage 1 and the frequency is generally 1-2 cps slower than during wakefulness. There is an absence of K-complexes and sleep spindles.
- Score epochs at the transition between stage N2 and R as follows:
 - 1) In between epochs of stage NR (non-REM) and R, score an epoch R if the previous epoch was R and if during the first half of the next epoch the chin EMG drops even in the absence of REMs and there is, a) an absence of non-arousal associated K-complexes and b) an absence of sleep spindles.
 - 2) In between epochs of stage N2 and R, score an epoch N2 if the previous epoch was R and if during the first half of the next epoch the chin EMG is down and there is a) an absence of REMs and b) a presence of non-arousal associated K-complexes or sleep spindles.
 - 3) In between epochs of stage N2 and R, score an epoch R if the previous epoch was R and if during the first half the next epoch the chin EMG has minimal tone and there are a) the absence of REMs, b) the absence of non-arousal associated K-complexes and c) the absence of sleep spindles.
- Continue to score stage R even without the presence of REMs if the EEG shows low amplitude, mixed frequency activity without K-complexes or sleep spindles and the chin EMG tone remains low.
- End stage R when the following occurs: 1) there is a transition to W, N3, N2) there is an increase in chin EMG tone and N1 criteria are met, 3) one or more non-arousal associated K-complexes or sleep spindles are present in the first half of the epoch and there are no REMs even if the chin EMG remains low.

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- For further details on staging see *The American Academy of Sleep Medicine (AASM) Manual for the Scoring of Sleep and Associated Events, Rules, Terminology and Technical Specifications, version 2.*

Stage Movement

- Defined by movement and muscle artifact obscuring the EEG for more than half an epoch to the extent that the sleep stage cannot be determined.
- Score an epoch with a major body movement as follows:
 - If alpha rhythm is present for part of the epoch (even <15 seconds duration), score as stage W.
 - If no alpha rhythm is discernible, but an epoch scorable as stage W either precedes or follows the epoch with a major body movement, score as stage W.
 - Otherwise, score the epoch as the same stage as the epoch that follows it.

Stage No Stage

- Defined by indiscernible EEG data, such as poor signal quality, no head box connection, ie. Patient up for restroom.

References:

American Academy of Sleep Medicine (AASM). Accreditation Reference Manual For Policies and Procedures, Documentation and Reporting. May 2007. Web. June 2012.

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