Home Sleep Apnea Test (HSAT) Rules for Adults

Part 1: HSAT Utilizing Respiratory Flow and/or Effort Parameters

Recommended Parameters to be Reported

- Type of device
- Type of airflow sensors
- Type of respiratory effort sensor (single or dual)
- Oxygen saturation
- Heart rate (ECG or derived from oximeter

Optional Parameters

Body position

Sleep/wake or monitoring time

- Must specify in the report whether sleep or monitoring time was used
  - If sleep, should be determined by EEG, EOG and chin EMG
  - Method to determine monitoring time must be listed in report

Snoring

Recommended Recording Data to be Reported if Sleep is NOT Recorded

- Recording start time (hr:min)
- Recording end time (hr:min)
- TRT (including wake and artifact)
- Monitoring time (MT)
  - Time used to calculate respiratory event index
- Average heart rate
- Number of respiratory events (RE)
  - Number of apneas
  - Number of hypopneas
- Respiratory event index (REI) based on MT
  - (# RE x 60) / MT in min
- Measure of oxygen saturation (one of these three)
  - Oxygen desat index (ODI) ≥ 3 or ≥ 4%
  - Arterial O2 saturation, mean value, maximum value, and minimum value
  - Arterial O2 saturation % of time at or below 88% or other thresholds

Optional Recording Data to be Reported if Sleep is NOT Recorded

- Highest heart rate
- Lowest heart rate
- Number of obstructive, central, and mixed apneas
- REI in the supine and non-supine positions
- Central apnea index (CAI)
  - (# central apneas x 60) / MT in min
- Occurrence of snoring (if recorded)

Notes for Recording Data to be Reported if Sleep is NOT Recorded

- Monitoring time (MT) = TRT minus periods of artifact and time the patient was awake as determined by actigraphy, body position sensor, respiratory pattern, or patient diary.
  - Method of determining should be stated
  - For reimbursement, indicate in report that MT is being used in place of TRT
- Respiratory event index (REI) = Total number of respiratory events x 60 divided by MT
  - For reimbursement, indicated in report that REI is substituted for AHI
- Central apnea index (CAI) from HSAT may differ from PSG due to use of MT rather than TST and reduced quality of respiratory effort signal during unattended studies
- Reporting all three oxygen saturation parameters may provide important information for the clinician
- ODI should report same desaturation as hypopneas
  - Example: If hypopnea scored based on ≥3% desaturation, ODI should be the number of ≥3% desaturations x 60 divided by MT

Recommended Recording Data to be Reported if Sleep is Recorded

- Recording start time (hr:min)
- Recording end time (hr:min)
- TRT (including wake and artifact)
- TST
- Heart rate (average, highest, lowest)
- Number of respiratory events (RE)
  - Number of apneas
  - Number of hypopneas
- AHI
- Measure of oxygen saturation (one of these three)
  - Oxygen desaturation index (ODI) ≥ 3 or ≥ 4%
  - Arterial O2 saturation, mean value, and minimum value
  - Arterial O2 saturation % of time at or below 88% or other thresholds

Optional Recording Data to be Reported if Sleep is Recorded

- Number of obstructive, central, and mixed apneas
- AHI in the supine and non-supine positions
- Central apnea index (CAI)
  - (# central apneas x 60) / TST in min
- Snoring (if recorded)

Summary Statements

- Date of test/date of interpretation
- Technical adequacy of the study
  - Document whether it was a repeat study due to technical failures
  - Limitations of study
- Interpretation of REI (based on MT) or AHI (if sleep recorded)
- Interpretation
  - Does patient have OSA or not?
  - Statement of diagnostic severity
- Recommendation for management that meets AASM clinical practice guidelines and practice parameters
- Optional:
  - Occurrence of snoring
  - Chain of custody (if applicable)

Technical and Digital Specifications for HSAT Equipment

- FDA approval or clearance of device
- Unique identifier for each unit
- Must meet minimum definition for CPT codes 95800, 95801, or 95806 (or equivalent G codes)
- Ability to:
  - Record oximetry and heart rate (including average heart rate)
  - Display raw data for review, manual scoring, or editing of automated scoring
  - Calculate REI based on MT as a surrogate for AHI determined by PSG
  - (Optional) Determine chain of custody
- Optional:
  - Recording highest and lowest heart rate
  - Ability to determine chain of custody

HSAT Respiratory Rules: Technical Specifications

- Must use at least one of the following for detection of RE:
  - Oronasal thermal sensor
  - Nasal pressure transducer
  - Alternative sensor
    - RIPsum or RIPflow
    - Acceptable = PVDFsum
- Must use one of the following for respiratory effort:
  - Dual thoracoabdominal RIP belts
  - Acceptable options are: Single thoracoabdominal RIP belts, single or dual thoracoabdominal PVDF belts, single or dual thoracoabdominal piezo belts, or single or dual pneumatic belts
- Must use pulse oximetry for oxygen saturation
  - Should meet same requirements as oximetry for in-lab PSG
- If monitoring snoring (optional parameter), use an acoustic sensor (microphone), piezoelectric sensor, or nasal pressure transducer

HSAT Respiratory Rules Notes

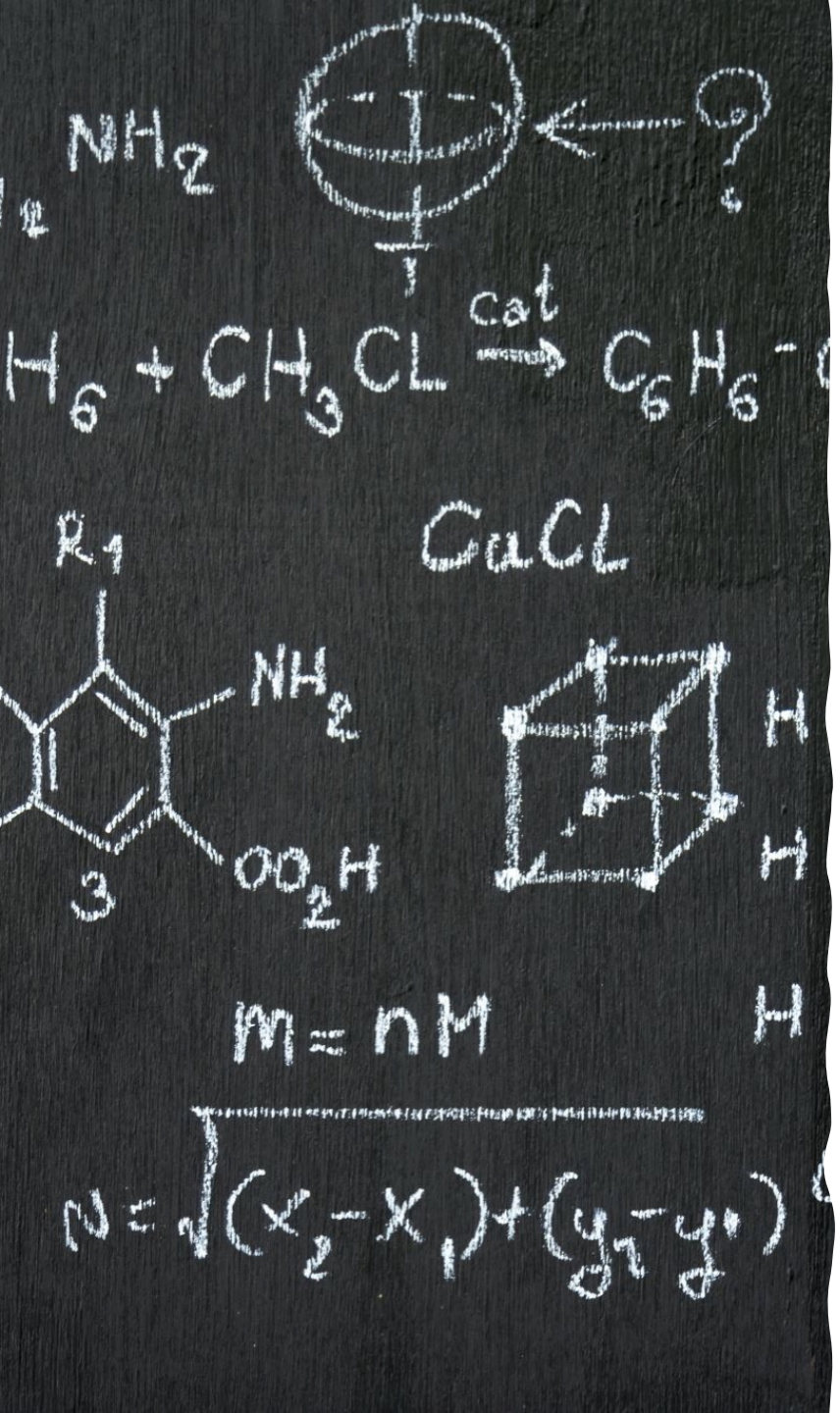
- At least one airflow sensor is required. Ideally should have both oronasal thermal sensor and nasal pressure transducer for airflow.
- Thermal sensors = Thermistors, thermocouples, or PVDF airflow sensors
- Using the nasal pressure signal without square root transformation for scoring sleep-related respiratory events (SRE) will result in a slightly higher hypopnea index than scoring using a square root transformation of the signal—not usually clinically significant
- If nasal pressure used without oronasal thermal sensor, some hypopneas may be classified as apneas.
- RIPsum is an estimate of tidal volume
- RIPflow is an estimate of airflow
- PVDFsum is sum of signals from thoracic and abdominal PVDF sensors (belts)

HSAT Respiratory Rules: Scoring Apneas Utilizing Respiratory Flow and/or Effort Sensors

- Score an RE as an apnea when BOTH are met:
  - ≥ 90% drop in peak signal from pre-event baseline
  - Duration of ≥ 90% drop is ≥ 10 seconds
- The rules for classification of obstructive, central, and mixed apneas are the same as a PSG
- No minimum desaturation required just like a PSG
- Some devices may not differentiate between the types of apneas

HSAT Respiratory Rules: Scoring Hypopneas Utilizing Respiratory Flow and/or Effort Sensors

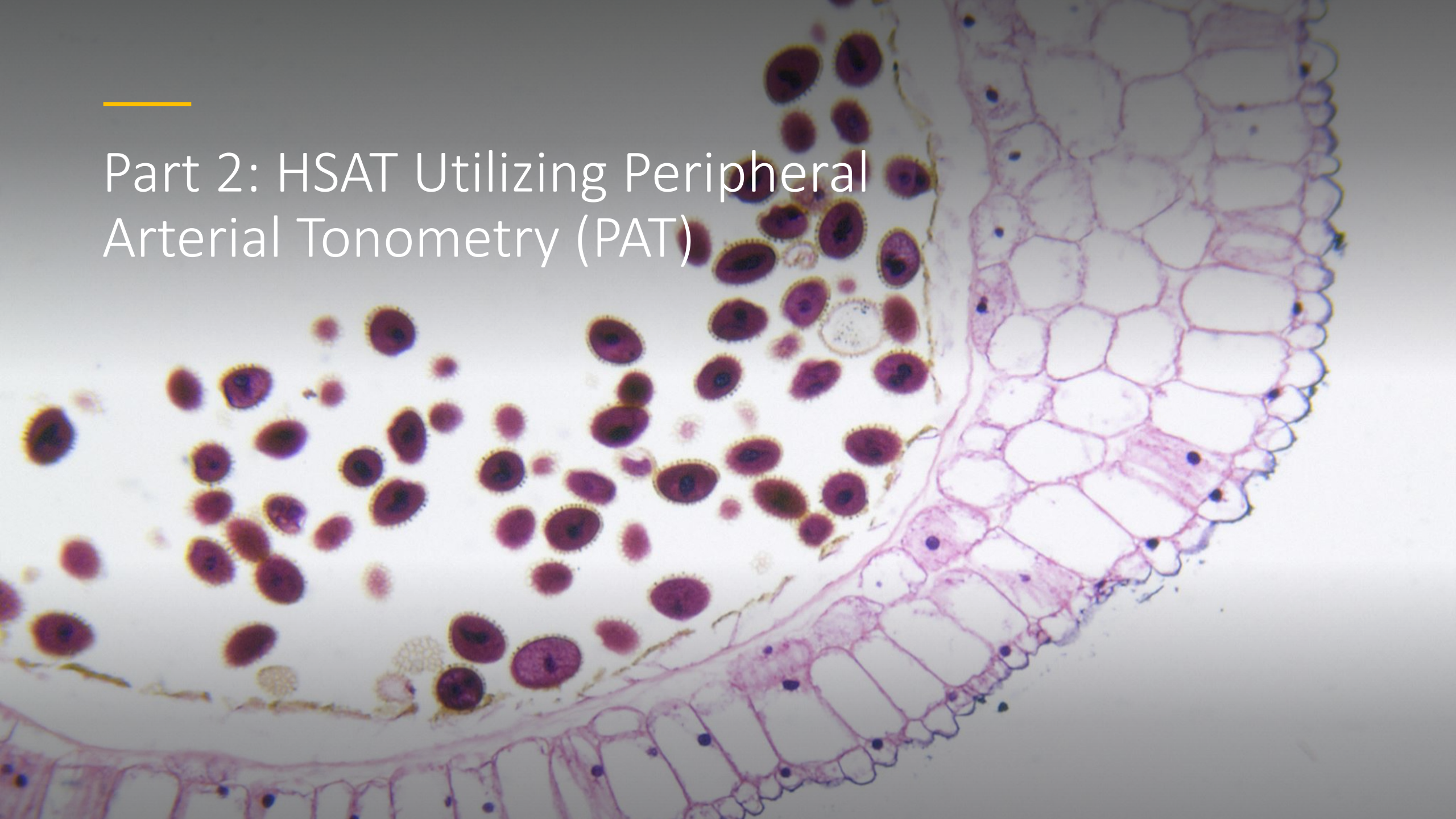
- If NO sleep recorded, score a RE as a hypopnea if ALL are met:
  - ≥ 30% drop in peak signal excursion from pre-event baseline
  - Duration of ≥ 30% drop is ≥ 10 seconds
  - There is a ≥ 3% oxygen desaturation from pre-event baseline (recommended rule)
    - The optional rule allows for a ≥ 4% oxygen desaturation from pre-event baseline
- If sleep IS recorded, score a RE as a hypopnea if ALL are met (recommended rule):
  - ≥ 30% drop in peak signal excursion from pre-event baseline
  - Duration of ≥ 30% drop is ≥ 10 seconds
  - There is a ≥ 3% oxygen desaturation from pre-event baseline, or the event is associated with an arousal

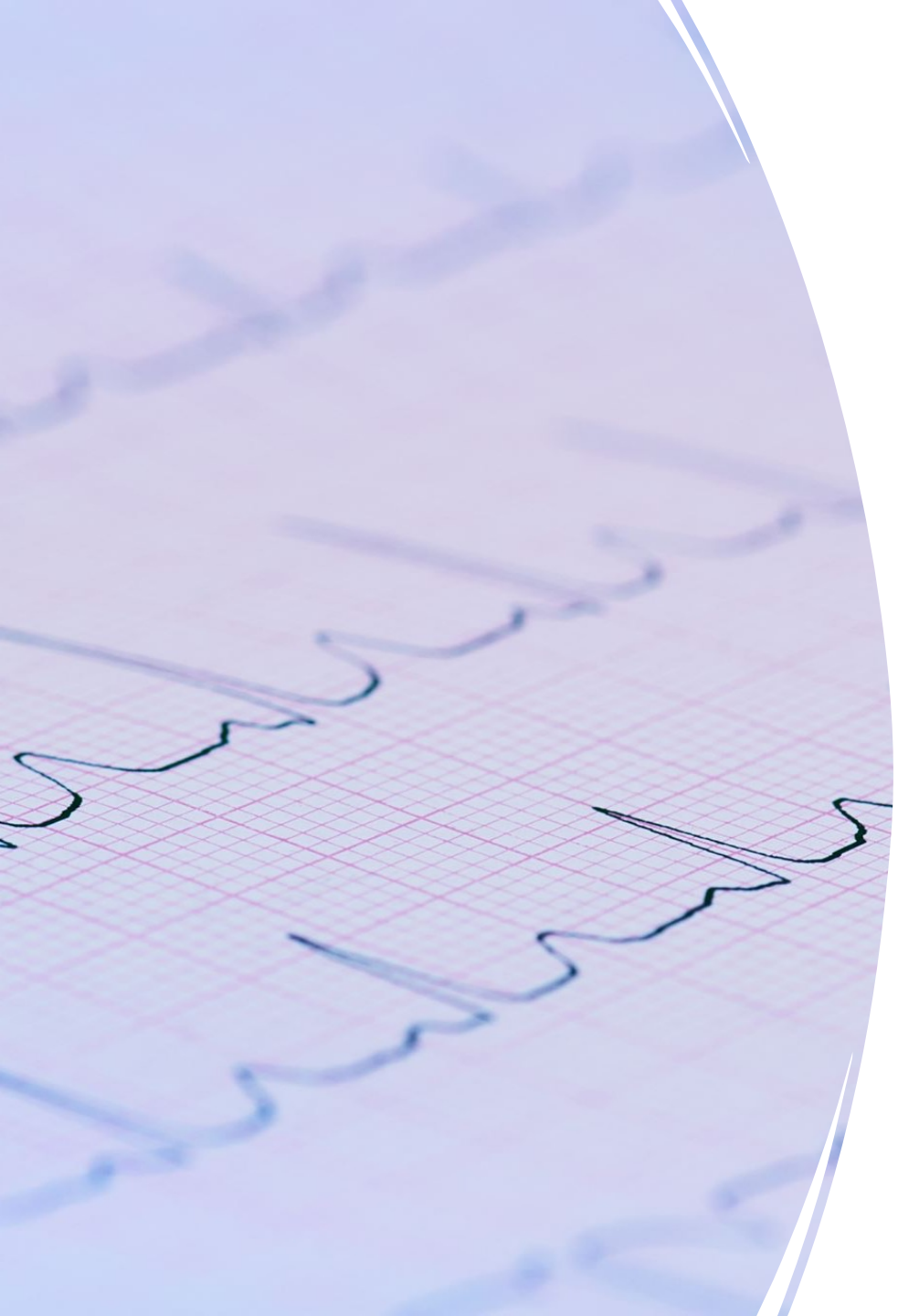


HSAT Respiratory Rules: Scoring Hypopneas Utilizing Respiratory Flow and/or Effort Sensors

- If sleep IS recorded, score a RE as a hypopnea if ALL are met (Acceptable rule):
  - ≥ 30% drop in peak signal excursion from pre-event baseline
  - Duration of ≥ 30% drop is ≥ 10 seconds
  - There is a ≥ 4% oxygen desat from pre-event baseline
- Must document in the report what rule was used in determining hypopneas
- Can only score hypopneas based on arousals if sleep is recorded

Part 2: HSAT Utilizing Peripheral Arterial Tonometry (PAT)





Parameters to be Reported

- Type of device
- Sleep/wake and REM time estimates
- Airflow/effort surrogate (peripheral arterial tone) signals
- Oxygen saturation
- Heart rate
- Optional parameters:
  - Occurrence of snoring (if recorded)
  - Body position (if recorded)

Recording Data to be Reported

- Recording start time (hr:min)
- Recording end time (hr:min)
- Duration of recording (hr:min)
  - TRT
- Estimated sleep time (in min)
  - Optional: Estimated % REM, deep sleep, light sleep
- Heart rate (average, highest, lowest)
- Respiratory event index (REI)
  - pAHI based on ≥3% desaturation
  - Optional: pAHI based on ≥4% desaturation
- Optional: ODI ≥3% or ≥4%
  - (# O2 desaturations ≥3% or ≥ 4% x 60) / MT in min

Summary Statements

- Date of test/date of interpretation
- Technical adequacy of the study
  - Document whether it was a repeat study due to technical failures
  - Limitations of study
- Interpretation of estimated sleep time
- Interpretation
  - Does patient have OSA or not?
  - Statement of diagnostic severity
- Recommendation for management that meets AASM clinical practice guidelines and practice parameters
- Optional statements:
  - Occurrence of snoring
  - Chain of custody (if applicable)

Technical and Digital Specifications for HSAT Equipment Recording Features

- FDA approval or clearance of device
- Unique identifier for each unit
- Must meet min definition for CPT codes 95800 or 95801
- Ability to:
  - Record oximetry and heart rate
  - Display raw data for review, manual scoring, or editing of automated scoring
  - Calculate REI based on MT as a surrogate for AHI determined by PSG
  - (Optional) Determine chain of custody

HSAT Respiratory Event Rules: Technical Specifications

- Acceptable: Must use the following for detection of RE:
  - Peripheral arterial tone
  - Oxygen desaturation
  - Changes in heart rate derived from oximetry
- The algorithm used by the device must meet current AASM accreditation standards
- Recommended: Use pulse oximetry for oxygen saturation