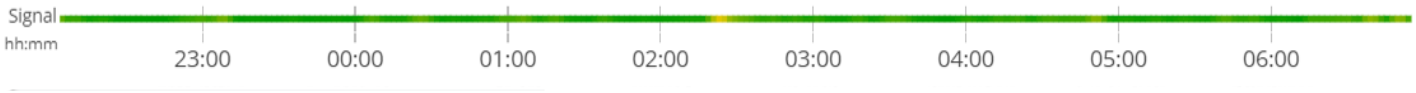
VivoScore

Basic Review of a SleepImage Report

STEP 1

Make Sure the Test Is Valid

There needs to be a minimum duration of four hours and an average signal quality of **at least 85%**. Reference the Test Summary box.



Test Summary:

Patient: 33 year old Female

Average Signal Quality is **95** %.
Sleep Quality is **below** expected value.
Sleep Efficiency is **below** expected value.
Sleep Duration is **within** expected value.

DURATION 8h:34m

Expected 7-9 hours

STEP 2

Review AHI

AHI: This number represents the sum of the number of apneas (pauses in breathing) plus the number of hypopneas (periods of shallow breathing) that occur on average every hour. These events must have a duration of at least 10 seconds. The AHI (Apnea Hypopnea Index) ranges in adults from normal (<5) to mild (5–14), moderate (15–29), and severe (30 and above). For children, normal (<1) to mild (1–4), moderate (5–9), and severe (10 and above).

Sleep Apnea

$sAHI_{4\%}$ 12

MILD

Medicare and Medicaid guidelines state that the sleep test must be scored off of 4% desaturations in oxygen. This is also true for any medical insurance that follows Medicare guidelines.

$sAHI_{3\%}$ 17

MODERATE

The American Academy of Sleep Medicine (AASM) continues to recommend scoring these hypopneas using the 3% criterion. (aasm.org)

STEP 3

Review RDI (Respiratory Disturbance Index)

The RDI is a score that includes **Respiratory Event Related Arousals (RERAs)** in addition to the hypopneas and apneas.

RERAs are arousals that do not meet the criteria to be called an apnea or hypopnea occurrence but may disrupt sleep and cause fragmentation and may therefore provide information for a more comprehensive evaluation of respiratory disturbances during sleep.

	Desaturations 3%	4%
$sAHI_{TOTAL}$	17	12
$sAHI_{OBSTRUCTIVE}$	16	11
$sAHI_{CENTRAL}$	1	1
sRDI	23	19
ODI	13	7

The American Academy of Sleep Medicine uses RDI to determine the severity of Obstructive Sleep Apnea according to the following range: 5–14.9 for mild, 15–29.9 for moderate, and 30+ for severe, similar to the one used in the AHI.

What Is Upper Airway Resistance Syndrome (UARS)?

UARS has been discussed and researched for many years. However, there is still no clear consensus on what diagnostic criteria should be used or whether UARS represents a distinct syndrome from OSA.

One of the main parameters of UARS includes flow limitation during sleep without significant desaturation and not meeting the definition of hypopnea. These frequent unexplained arousals are associated with increased respiratory effort and lead to sleep fragmentation, resulting in fatigue and excessive daytime sleepiness.

(https://www.ncbi.nlm.nih.gov/books/NBK564402/)

One possible interpretation is a score of AHI <5 and RDI > 10.

STEP 4

Sleep Pathology

Fragmentation is an indicator of pain, upper airway resistance, and obstructive sleep apnea (OSA). It is a subset of low-frequency coupling during NREM sleep.

In a normal sleep cycle, you travel from wakefulness to light to REM to deep sleep. This happens all night long like a perfect roller coaster. Perfect sleep architecture would have you running smoothly through each stage throughout the night. Fragmentation is when you're going down the roller coaster into the deep stages of sleep, where all the good stuff happens, but something is waking you up and pulling you to the top of that roller coaster. This could be upper airway resistance, restless leg syndrome, a pulled muscle, alcohol, or even traveling and sleeping in a different bed.

Sleep Pathology

FRAGMENTATION 25%	PERIODICITY 2%
Expected <15%	Expected ⩽2%

Periodicity is a detection of periodic-type breathing patterns that may occur in REM or NREM, which could indicate periods of central sleep apnea.

If this number is over 2%, do multiple night tests to confirm data is repeatable. According to our sleep physicians, 10% would indicate a need to refer that patient to a sleep physician.

STEP 5

Sleep Opportunity

Duration includes total sleep time and any time the patient was awake after sleep onset. The score is also based on age groups.

Latency is how long it takes you to fall asleep. If latency is high, it could be an indicator of insomnia.

Sleep Opportunity

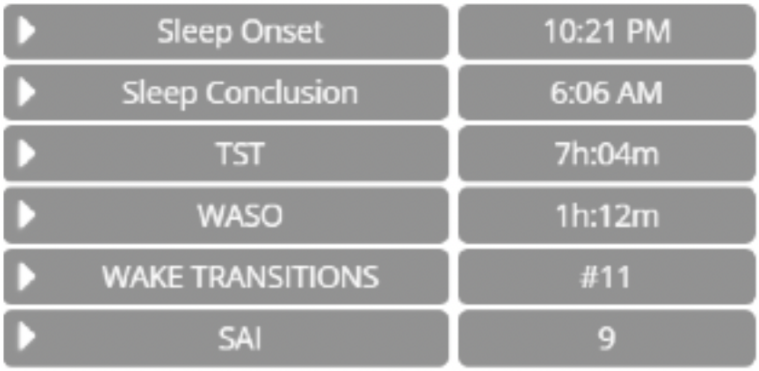
LATENCY 0h:17m	DURATION 8h:34m
Expected <30 min	Expected 7-9 hours

STEP 6
Sleep Quality

SQI (Sleep Quality Index) indicates sleep health. It's a summary of **sleep stability**, **fragmentation**, and **periodicity** on a scale of 0–100. The greatest value is to track sleep quality for each individual over time. A gradual reduction of SQI values can be a normal part of healthy aging.

Sleep Efficiency is the ratio of total sleep time divided by sleep opportunity. It should be >85%.

- While you are in bed, how efficient of a sleeper are you?
- TST (total sleep time)
- WASO (wake after sleep onset) = the total amount of time the patient was awake after falling asleep
- Wake transitions = how many times the patient woke up
- SAI = Sleep apnea indicator (see Step 8)

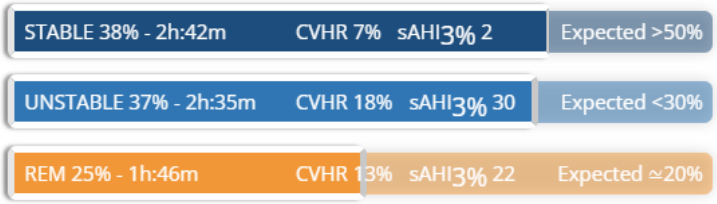


STEP 7
Sleep Stability

Stable = includes deep sleep (high-frequency coupling – parasympathetic dominance)

Unstable = includes light sleep (low-frequency coupling – sympathetic dominance)

Wake and REM = very low-frequency coupling



- There are two things being measured with CPC (cardiopulmonary coupling): the heart rate and the respiratory rate.
- If these two items are coupling at a high frequency, they are categorized as stable sleep.
- When they are coupling at a low frequency, they are categorized as unstable or REM sleep.
- Oscillations between stable and unstable sleep are expected to occur in 60- to 90-minute cycles and correspond to the alternating periods of NREM and REM sleep (four to eight cycles for an adult's eight-hour healthy sleep).

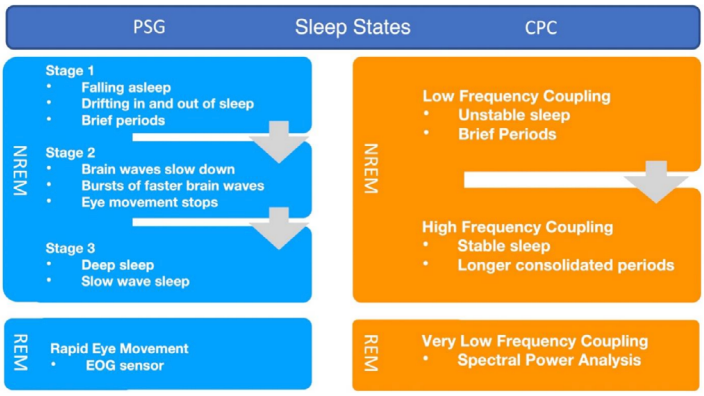


Figure 4. The relationship between conventional sleep system and the cardiopulmonary coupling (CPC) scoring system

STEP 8

Review CVHR/SAI (Sleep Apnea Indicator)

SAI is based on cardiovascular reaction to paused breathing (CVHR, or cyclic variation of heart rate) during unstable sleep with a scale of 0–100.

During each apnea event, blood oxygen decreases and is accompanied by a physiological reaction of bradycardia and, when breathing resumes, a relative tachycardia. Hypoxemia is reflected in the SleepImage output as SAI.

Evaluating CVHR events in relation to sleep stability may help clinical evaluation of apnea **severity** beyond the **prevalence** that is reported by the AHI and/or RDI that adds RERAs to the AHI metrics.

Sleep Onset	10:21 PM
Sleep Conclusion	6:06 AM
TST	7h:04m
WASO	1h:12m
WAKE TRANSITIONS	#11
SAI in Sleep Duration	9

An AHI is recorded when you stop breathing for 10 seconds or more. What happens if you stop breathing for eight seconds? Is this important? Even if you stop breathing for eight seconds, your heart is working harder than it should to get oxygen to your body.

STEP 9

Review Oxygen Desaturations

If you have ever been to the doctor or hospital and had the oxygen sensor on your finger, when your oxygen goes below 90%, that is when the alarms in the hospital go off.

This is the total amount of time that the patient's blood oxygen levels went below 90%, 88%, or 80%. The value in the <90% box will also include any time in the boxes below it as well.

SpO_2 <90%	0h:03m - 1%
SpO_2 <88%	0m:22s - 0%
SpO_2 <80%	0h:0m - 0%
MIN-MAX-MEAN SpO_2	86% - 97% - 94%

The percentage of oxygen saturation of <90%, <88%, and <80% are indicators of hypoxemia severity during sleep, in addition to the min, max, and mean SpO_2 during the sleep period.

REFERENCE:
https://sleepimage.com/wp-content/uploads/Introduction-to-SleepImage.pdf