

Sleep Apnea - New Math

What are your numbers?

Sleep Apnea Obstructed Breath Index (OBI)			
Estimate of Attempts to Inhale Against an Obstructed Airway			
Apnea Hypopnea Index ("AHI" - events per hour)*			20
Sleep Time (hours / seconds)			8
Total Apneic / Cardiac Events Per Night			160
Average Time per Apneic Event (seconds)			20
Total Apneic Event Time (seconds / minutes / % of total)	3,200		53
Respiration Rate (breaths per minute)			15
Breaths per Second			0.25
Estimated Number of Breaths During Apneic Events			800
Estimated % Obstructive Apneas			90%
Estimated Attempts to Inhale Against an Obstructed Airway			720

* Mild Sleep Apnea = 5 - 15 per hour; Moderate = 15 - 30; Severe = > 30

	Apneas / Cardiac Events	Time in Apnea (minutes)	OBI ³
1 Night	160	53	720
1 Week	1,120	373	5,040
1 Month	4,480	1,493	21,600
1 Year	53,760	17,920	259,200
5 Years	268,800	89,600	1,296,000
10 Years	537,600	179,200	2,592,000

Estimated Attempts to Inhale Against an Obstructed Airway

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The Apnea Hypopnea Index (AHI) has been the gold standard adopted by the [American Academy of Sleep Medicine](#) and medical professionals to describe the severity of sleep apnea. AHI expresses the number of apneas and hypopneas per hour. In this index, "normal" is defined as five (5) or less per hour, "mild" is 5 – 15 per hour, "moderate" is 15 – 30, and "severe" is defined as more than 30 apneas per hour (which could total 240 or more per night). "Mild" sleep apnea with an AHI of only five (5) apneas per hour, however, equals forty (40) apneas in one night, 280 in one week, 1,120 in one month, and so on.

Not So Mild

Using the index, mild sleep apnea with an AHI of only five (5) apneas per hour, equals forty (40) apneas in one night. Doing the math, that means 280 apneas in one week, 1,120 in one month, and so on. The math suggests that mild sleep apnea may not be so mild after all when looking at the potential nightly and long-term numbers considering that apneas cause spikes in heart rate, awakenings, hypertension, and physical stress such as the extra effort required to inhale against an obstructed airway. An obstructive apnea lasting 40 seconds could involve eight (8) attempts to inhale against a closed airway at a respiration rate of one breath every five seconds.

With many such events in a single night, it is no wonder that untreated sleep apnea causes fragmented sleep and daytime fatigue.

A [Final Report on CPAP](#) published in December 2022 for the Centers for Medicare and Medicaid Services (CMS) suggested that AHI by itself is not a very good surrogate for actual clinical outcomes. Rather, the report suggests that oxygen deprivation at night (lifetime hypoxic burden) is proportional to the **duration** of each apnea, not the **number** per hour (frequency). In other words, the longer an apnea lasts, the worse the effect becomes on an individual's health including oxyhemoglobin saturation, heart rate variability, release of epinephrine and hypertension, increased physical effort to inhale, and other pathological responses. Further, the report cited research that found that the hypoxic burden, or "cumulative exposure to reduced airflow", is a better predictor of clinical outcomes than AHI. Specifically, the oxygen desaturation index (ODI) expresses the number of times (frequency) that blood oxygen levels drop to 3% and 4% below baseline (DO3) and (DO4). The amount of time (duration) spent in DO3 and DO4 was found by researchers cited in the report to CMS to be most closely associated with clinical outcomes, and perhaps is a valuable supplemental surrogate to AHI.

Similar to the significance of hypoxic burden, the cumulative physical stress of apneas, as expressed by the number of attempts to inhale against an obstructed airway over time, cannot be estimated based on AHI alone. Apnea duration, total sleep time, and respiration rate are also required, but a number can be estimated, and it can be large. In fact, the number is so much larger and possibly more impactful to patients than AHI that this metric could become a powerful motivating factor for patients to seek screening, diagnosis, and treatment when indicated.

To explore the new sleep apnea math, estimate your personal cumulative exposure to reduced airflow, and how many times you struggled to inhale against an obstructed airway, click [HERE](#) to download the OBI calculator and experiment with the variable input fields. You might be shocked to find out that what has traditionally been considered "mild" sleep apnea is anything but mild after all.

P. S. If you use CPAP, a mandibular advancement device, or hypoglossal nerve stimulation for only half the night, reduce AHI by half in the calculator.

About the Author

[Michael G. Nathans](#) is the CEO and Co-Founder of WhisperSom Corporation, a medical device and informatics company. He holds a degree in Biology and Pre-healing Arts from Franklin & Marshall College and has a 35-year business background that includes 5 years at PwC, two U.S. patents, and two grants from the Ford Foundation. Visit WhisperSom on [LinkedIn](#) and [Facebook](#) to follow more discussions about sleep apnea and raising the 10% diagnosis and 5% treatment rates through education and technology.