



Measurement of the severity of sleep-disordered breathing: a moving target

The Harvard community has made this article openly available. [Please share](#) how this access benefits you. Your story matters

Citation	Javaheri, Sogol, Rohit Budhiraja, and Stuart F Quan. 2020. "Measurement of the Severity of Sleep-disordered Breathing: A Moving Target." <i>Journal of Clinical Sleep Medicine : JCSM : Official Publication of the American Academy of Sleep Medicine</i> 16, no. 2: 337-38.
Published Version	https://jcsm.aasm.org/doi/10.5664/jcsm.8200
Citable link	http://nrs.harvard.edu/urn-3:HUL.InstRepos:42668874
Terms of Use	This article was downloaded from Harvard University's DASH repository, and is made available under the terms and conditions applicable to Open Access Policy Articles, as set forth at http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#OAP

Measurement of the severity of sleep disordered breathing – a moving target.
Response to: Gupta, *et al. Hypopneas With Arousals: An Important Feature of Central Nervous System Sympathetic Activation in Posttraumatic Stress Disorder (PTSD)*.

Sogol Javaheri, M.A., M.D., M.P.H.¹, Rohit Budhiraja, M.D.¹, Stuart F. Quan, M.D.^{1,2}

¹Division of Sleep and Circadian Disorders, Brigham and Women's Hospital, Harvard Medical School, Boston, MA; ²Department of Medicine, College of Medicine, University of Arizona, Tucson, AZ

Disclosure Statement: This was not an industry supported study. All authors have reported no financial conflicts of interest.

Authors' Financial Declarations: Dr. Javaheri serves as a consultant for Jazz Pharmaceuticals. Dr. Budhiraja reports no conflicts of interest or grant funding. Dr. Quan reports research funding from the National Institutes of Health, serves as a consultant to Jazz Pharmaceuticals and is a vice committee chair for the American Academy of Sleep Medicine.

There was no investigational or off label use.

This work was performed at Brigham and Women's Hospital.

All authors have seen and approved the manuscript.

No clinical trial is indicated.

0 figures and tables

Abstract word count: not applicable

Brief summary word count: not applicable

Manuscript word count: 405

Correspondent: Sogol Javaheri, M.A., M.D., M.P.H
Division of Sleep and Circadian Disorders
Brigham and Women's Faulkner Hospital
1153 Centre Street Suite 5K
Boston, MA 02131
Email: sjavaheri@bwh.harvard.edu

To the editor:

We thank Dr. Gupta for her comments on the importance of hypopneas with arousals causing sympathetic nervous system activation and consequent elevations in blood pressure¹. Dr. Gupta highlights the importance of incorporating arousals in the hypopnea definition, particularly in patients with posttraumatic stress disorder (PTSD) and other psychiatric conditions that are already associated with increased sympathetic activity^{1,2}. Given the high prevalence of OSA among individuals with PTSD², further studies are needed to evaluate whether arousal index and hypopneas resulting in arousals are indeed higher in this vulnerable population.

We also thank Drs. Javaheri and Gay for their comments on the potential adverse pathophysiologic consequences of arousals and chronic sleep fragmentation including increased sympathetic activation, inflammation, dysbiosis, and adverse structural vascular changes³.

Although some data suggest that hypoxia may be more predictive of adverse cardiovascular events in patients with sleep disordered breathing⁴, further studies in larger populations are needed to determine whether hypoxia, sympathetic activation, or other pathophysiological mechanisms in obstructive sleep apnea are the primary drivers for subsequent cardiovascular disease. The etiology is likely multifactorial and may vary among different populations such that different measures of sleep disordered breathing are more relevant. For example, in patients with heightened baseline sympathetic activation such as those with PTSD, hypopneas with arousals may be more relevant whereas in patients with heart failure, the time spent with oxygen saturation <90% may be a better predictor of subsequent morbidity.

It is possible that the current definition of apnea-hypopnea index (AHI) may still not be the optimum one. The current definitions of AHI do not incorporate duration of apneas and

hypopneas or duration of hypoxic events, which may be important in patients with comorbid cardiovascular disease (CVD) or more predictive of the development of incident CVD in certain populations. Future metrics incorporating these variables may potentially be more predictive of the adverse outcomes of OSA. It is also possible that different measures of sleep disordered breathing severity are relevant to different populations. Ultimately, more studies are needed to elucidate the potential phenotypes of sleep disordered breathing in diverse populations and to further understand the mechanisms underlying the associations between sleep disordered breathing and subsequent cardiovascular disease. However, pending new studies or metrics, we believe that universal acceptance of a hypopnea definition that includes both 3% desaturation and arousals is a step in the right direction and will expand appropriate access to much needed treatment of sleep disordered breathing.

References:

1. Gupta MA. Effect of Varying Definitions of hypopnea on the calculation of the apnea-hypopnea index may depend upon the level of sympathetic activation: results from a patient with posttraumatic stress disorder. *J Clin Sleep Med*. 2019 Oct 15;15(10):1555.
2. Zhang Y, Weed JG, Ren R, Tang X, Zhang W. Prevalence of obstructive sleep apnea in patients with posttraumatic stress disorder and its impact on adherence to continuous positive airway pressure therapy: a meta-analysis. *Sleep Med* 2017; 36: 125-132.
3. Javaheri S, Gay PC. To die, to sleep- to sleep, perchance to dream... without hypertension: Dreams of the visionary Christian Guilleminault revisited. *J Clin Sleep Med* 2019; 15(9): 1189-1190.
4. Azarbarzin A, Sands SA, Stone KL, Taranto-Montemurro L, Messineo L, Terrill PI, Ancoli-Israel S, Ensrud K, Purcell S, White DP, Redline S, Wellman A. The hypoxic burden of sleep apnoea predicts cardiovascular disease-related mortality: the Osteoporotic Fractures in Men Study and the Sleep Heart Health Study. *Eur Heart J*. 2019 Apr 7;40(14):1149-1157.