Recognition of central respiratory events in the diverse population of patients with sleep apnea has prompted an evolution in definitions of sleep apnea\textsuperscript{1} and the metrics used to define respiratory events.\textsuperscript{2,3} The diversity of therapy options in sleep apnea has placed increased emphasis on correct identification of the mechanisms causing respiratory events.

In this issue of SLEEP, Randerath and colleagues\textsuperscript{4} present validation for an algorithm to distinguish between obstructive and central hypopneas employing esophageal manometry in a selected population with an “unclear” initial study. A logical sequential approach is used with obstruction defined by either (1) inspiratory flattening or paradoxical movement or (2) early arousal, abrupt ventilatory recovery, or occurrence in stage R.

In managing patients with these disorders, distinguishing central from obstructive events would seem the first step in determining both the mechanism of the problem and the range of treatment options. In the case of apneas, central events can be inferred by the absence of respiratory effort. Hypopneas are not as intuitive. Diverse methods for distinguishing between obstructive and central hypopneas have been employed, though they have not been systematically validated by a gold standard such as esophageal manometry. In heart failure where both obstructive and central events coexist, operational definitions have hinged on indicators of obstruction including paradoxical movement of the rib cage and abdomen, flattening of inspiratory flow envelope, and low inspiratory flow amplitude relative to effort.\textsuperscript{5-8}

In the recent revision of the 2007 AASM scoring manual,\textsuperscript{2} consensus definitions for obstructive and central hypopneas incorporate previous operational definitions used in heart failure with an obstructive event including any of the following indicators relative to baseline: paradoxical movement, snoring, and inspiratory flattening. A central hypopnea requires the absence of all of these indicators. These indicators require visual interpretation and have varying underpinnings of their validity. Perhaps most thorny is the assumption that recorded sound indicates obstruction. Although the intensity of respiratory sounds correlates with intensity of obstructive sleep apnea,\textsuperscript{9} these measures can be confounded by recorded non-snoring sounds and their assessment for individual events lacks standardization relative to thresholds for timing and amplitude. Importantly, the substantial evidence supporting interaction between central and obstructive events\textsuperscript{10} should provide caution, and it encourages more emphasis be placed on identifying promoting causes such as heart failure, sleep disruption, and hypoxemia, in addition to distinguishing between obstructive and central events.

Although a consensus definition for central hypopnea is useful to direct consistency in practice, we are in need of validation for consensus-driven approaches. Our therapies would also be better grounded by knowing outcomes related to the management of the “new” central hypopneas that are identified by consensus. There are additional unresolved areas with some obstructive indicators including (1) the undefined amplitude and timing criteria for sound measurements defining obstruction, and (2) the confounding impact of stage R—paradoxical movement and amplitude fall in stage R occur during central respiratory inhibition associated with clusters of eye movements.\textsuperscript{11,12}

The performance of the algorithm by Randerath et al.\textsuperscript{4} has mixed results in the study population. Though their logic was intuitive, the findings were not robust. The validating tool, esophageal manometry, was not interpretable in 36% of their cases, and the accuracy of a combined logic for hypopnea definition was only 68%. Although 77% of central hypopneas were correctly identified, nearly 40% of obstructive events were misclassified. Clearly there is room for further improvements in both sensitivity and specificity for classifications.

Though not ready for prime time, the effort by Randerath et al.\textsuperscript{4} was a laudable first step and begs for further validation in defined populations that may be more suitable relative to performance of an algorithmic approach. Better definitions for central hypopneas using indicators proposed by Randerath et al. and current AASM respiratory scoring may help target management strategies, although as noted above, there is more work to be done to improve accuracy of interpretation of snoring sound and to characterize stage R central events. Characterization of the natural history of central events and the outcomes related to their presence may follow our ability to more precisely define these events. Finally, clinicians must use the metrics obtained in the context of the known interaction between central and obstructive respiratory events and the diversity of causes for each.

**CITATION**

**DISCLOSURE STATEMENT**
Dr. Iber has indicated no financial conflicts of interest.
REFERENCES