



## Practice Advisory: The Utility of EEG Theta/Beta Power Ratio in ADHD Diagnosis

This is a summary of the American Academy of Neurology (AAN) practice advisory, "The Utility of EEG Theta/Beta Power Ratio in ADHD Diagnosis," which was published in *Neurology*® online on October 19, 2016, and appears in the November 29, 2016, print issue.

**Please refer to the full practice advisory at [AAN.com/guidelines](http://AAN.com/guidelines) for more information.**

### For patients with ADHD, does the combination of a clinical examination and an examination of the EEG theta/beta power ratio increase diagnostic certainty compared with clinical examination alone?

#### Conclusion

It is unknown whether a combination of standard clinical examination and EEG theta/beta power ratio increases the diagnostic certainty of ADHD compared with clinical examination alone (1 Class III study).

#### Clinical Context

A single Class III study results in the ranking of very low confidence in the evidence. Such a ranking leads to a U or R recommendation level after the modified Delphi process is applied, because the data resulted from too high a risk of bias, regardless of whether the study in question is positive or negative.

#### Recommendation

##### Level R

Clinicians should inform patients with suspected ADHD and their families that the EEG theta/beta power should not be used to confirm an ADHD diagnosis or to support further testing after a clinical evaluation, unless such diagnostic assessments take place within the limits of a research study.

Note: Level R recommendations are ones that "the guideline authors assert should be applied only in research settings."<sup>8</sup>

### For patients with a possible but uncertain diagnosis of ADHD, how accurately does the EEG theta/beta power ratio identify patients with ADHD compared with a clinical evaluation?

#### Conclusion

Because of the combined estimate of medical errors in the United States of 5%, which was considered an unacceptably high rate of errors,<sup>13</sup> the false-positive rate of >5% was considered an unacceptably high false-positive rate. EEG frontal power and theta/beta ratio is not an effective diagnostic test for ADHD because of this unacceptably high false-positive rate (2 Class I studies).<sup>11,12</sup>

#### Clinical Context

In examining [the] 2 [Class I] studies in aggregate, one risks identifying participants as having ADHD when they do not have the diagnosis. In the studies, 19 of the 185 participants were misidentified. The accuracy rate for this test is too low for it to supplant the standard clinical evaluation.<sup>2,3</sup> Because of a positive cutoff of the theta/beta power ratio of 1.5 SDs above the mean, it seems unlikely that this test will achieve a higher accuracy rate without a different approach.

Theta activity is increased by drowsiness and medication effects and is increased in many neurologic disorders. Theta power is known to be a highly nonspecific feature of EEGs. Likewise, there are many reasons (other than ADHD) why frontal beta power values may be higher or lower than average in certain individuals. These values also change with the patient's state of awareness, so values may differ when a patient is retested just minutes after the previous testing.

There is low diagnostic certainty for replacing a standard clinical evaluation with a measurement of EEG theta/beta power ratio because of the lack of generalizability of the 2 Class I studies.<sup>11,12</sup> One study used a medication washout period of more than 3 days,<sup>12</sup> a timeframe which may have mixed acceptance in a clinical setting. The studies also excluded participants on more than one medication and failed to assess for sleep deprivation. Without data to establish the EEG theta/beta power ratios for conditions that could be confused with ADHD, it is impossible to distinguish patients with ADHD from those with conditions that mimic ADHD.

Recommendations	
<b>Level B</b>	Clinicians should inform patients with suspected ADHD and their families that the combination of EEG theta/beta power ratio and frontal beta power should not replace a standard clinical evaluation.
<b>Level B</b>	There is a risk for significant harm to patients of being misdiagnosed with ADHD because of the unacceptably high false-positive diagnostic rate of EEG theta/beta power ratio and frontal beta power.

## References

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