

Diagnosis of attention-deficit/hyperactivity disorder

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WHAT IS THE ARTICLE ABOUT? In their article “Practice advisory: The utility of EEG theta/beta power ratio in ADHD diagnosis,” Dr. Gloss et al.¹ question the available evidence regarding the usefulness of EEG in the diagnosis of attention-deficit/hyperactivity disorder (ADHD).

In October 2013, the US Food and Drug Administration (FDA) approved the Neuropsychiatric EEG-Based Assessment Aid (NEBA).² The NEBA test calculates the ratio of the theta and beta brain waves obtained by EEG. The brain wave pattern that seems to occur more often in people with ADHD is called the theta-beta ratio. The American Academy of Neurology (AAN) assembled a panel of experts to evaluate NEBA carefully and to develop a practice advisory. In developing the practice advisory, the panel looked at the published medical literature, and also reviewed the data presented to the FDA. When evaluating the medical articles, the panel used very strict criteria, developed by the AAN. These criteria carefully classify the level of evidence, giving higher levels (there are 5 levels: Level 1 is the highest, and mainly refers to randomized case-controlled clinical trials; Level 5 is the lowest, often referring to information derived from expert opinion) to studies that answer a question most clearly and with the fewest biases.

HOW DID THE PANEL DEVELOP THE PRACTICE ADVISORY? When they looked through the medical literature, the panel found 959 abstracts and articles that discussed theta/beta and the diagnosis of ADHD. Using strict criteria, the panel found 1 article (Level 3 evidence) that addressed a specific question: If EEG is added to the usual examination of people with ADHD, does it help to make the diagnosis clearer?

There are 2 considerations when evaluating a medical test in this circumstance. First, how sensitive is the test? Sensitivity also called the true positive rate. Another way of thinking of sensitivity is this: if I do

a test for a medical illness, how often is the test correct? What the researchers found was that the test was correct 88% of the time. This seems like a high number, but this number was compared to the sensitivity of the clinical examination. When carefully performed, the clinical examination has a sensitivity of 94%. In other words, adding the test to the clinical examination did not increase the certainty of diagnosis more than just the examination itself.

The second issue regarding medical testing is specificity. Specificity is also called the true negative rate. In other words, if the test is negative, how often is it correct? If negative, how often does the person not have the illness?

If the EEG does not necessarily help when added to an examination, how helpful is it in identifying a patient with ADHD? The panel identified 32 articles in the medical literature, 2 of which were Level 1. The others were Level 4 evidence. When they evaluated the 2 Level 1 articles, the panel found that the EEG was wrong 8% of the time. In 8% of people, the test said the person had ADHD, when in fact he or she did not. In most instances, an error rate of 5% is considered good; 8% is too high, and would mean that a lot of people who did not have ADHD could be incorrectly identified as having it.

WHAT WAS THE RESULT? The advisory panel concluded that there was not enough evidence to support the use of EEG in diagnosing ADHD. Further, EEG was not useful as an added test to increase confidence that the clinical diagnosis was correct.

Saying this, the authors admitted that more study may make these questions clearer. Many children with ADHD have an abnormal theta/beta ratio. Why is this present? What does it mean? How often does theta/beta happen in other illnesses like anxiety or depression? Perhaps by understanding these better, scientists will develop better testing for people with ADHD.

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About attention-deficit/hyperactivity disorder

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WHAT IS ADHD? ADHD is often diagnosed in children or adolescents. It is not uncommon for teachers to be the first to recognize this problem, because ADHD can be a cause of poor school performance. Saying that, there are many conditions and illnesses that could affect a student's schoolwork. ADHD is just one of these possibilities, which makes it very important to correctly identify the cause of the student's problems. If it is ADHD, there are specific treatments that can help.

DIAGNOSIS OF ADHD The diagnosis of ADHD is made based on a careful history and physical examination.³ Often, several people will be asked to help with the history. These are people who observe and interact with the student the most: the student, his or her parents, and his or her teachers. Questionnaires that investigate specific symptoms can be helpful in identifying children or adolescents who might have ADHD.

For people with ADHD, there are 2 main areas where the symptoms appear. The first is inattention. Inattention is the inability to complete a task carefully, pay attention, or think about, listen to, or watch someone or something. When it comes to ADHD, a person must have had 5 or 6 of the symptoms listed below for more than 6 months.^{3,4}

SYMPTOMS OF INATTENTION

1. Often fails to give close attention to details or makes careless mistakes in schoolwork, at work, or with other activities.
2. Often has trouble holding attention on tasks or play activities.
3. Often does not seem to listen when spoken to directly.
4. Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (e.g., loses focus, sidetracked).
5. Often has trouble organizing tasks and activities.
6. Often avoids, dislikes, or is reluctant to do tasks that require mental effort over a long period of time (such as schoolwork or homework).
7. Often loses things necessary for tasks and activities (e.g., school materials, pencils, books, tools, wallets, keys, paperwork, eyeglasses, mobile telephones).

8. Is often easily distracted.
9. Is often forgetful in daily activities.

People with ADHD also have problems with hyperactivity and impulsivity. Hyperactivity is simply having a high level of activity or excitement. Impulsivity is defined as acting suddenly on an idea or emotion, without first thinking it through. In order to diagnose hyperactivity/impulsivity, a person must have had 5 or 6 of the following symptoms for more than 6 months.

1. Often fidgets with or taps hands or feet or squirms in seat.
2. Often leaves seat in situations when remaining seated is expected.
3. Often runs about or climbs in situations where it is not appropriate (adolescents or adults may be limited to feeling restless).
4. Often unable to play or take part in leisure activities quietly.
5. Is often "on the go," acting as if "driven by a motor."
6. Often talks excessively.
7. Often blurts out an answer before a question has been completed.
8. Often has trouble waiting for his or her turn.
9. Often interrupts or intrudes on others (e.g., butts into conversations or games). Finally, in order for the diagnosis to be made, the following criteria also must be met:
10. Several inattentive or hyperactive/impulsive symptoms were present before age 12 years.
11. Several symptoms are present in 2 or more settings (such as at home, school, or work; with friends or relatives; in other activities).
12. There is clear evidence that the symptoms interfere with, or reduce the quality of, social, school, or work functioning.
13. The symptoms are not better explained by another mental disorder (such as a mood disorder, anxiety disorder, dissociative disorder, or a personality disorder). The symptoms do not happen only during the course of schizophrenia or another psychotic disorder.

In order to properly diagnose ADHD, a detailed series of questions must be answered. Family members,

teachers, and friends may need to be interviewed in order to more confidently establish the diagnosis.

OTHER ILLNESSES MIGHT LOOK LIKE ADHD What makes the diagnosis more difficult is that there are many medical conditions that cause problems with attention. For instance, some students may have behavioral problems. Children with behavioral problems can be easily upset or frustrated. They respond to these situations by acting angry, or being defiant. They may lose their temper easily, and often argue with parents, teachers, and others in a position of authority. They might intentionally annoy or bother people around them. When someone points out a problem, the student is likely to blame someone else for his or her mistakes.

Anxiety and depression can also cause problems with attention and schoolwork. A person with anxiety feels nervous. He or she can feel this way about many things, or in some people, the anxiety is specific to certain circumstances. In some, the anxiety comes out as a phobia. For instance, a fear of small enclosed spaces is called claustrophobia. A person who has this will become very fearful and anxious when encountering a small space like an elevator car. Depression causes a person to feel sad. Often a person with depression will have little or no interest in “fun” activities. They will have poor attention, and often report difficulty focusing on schoolwork or assigned projects. To complicate things further, many people who have anxiety also have depression.

Why is it important to distinguish among these diagnoses? Each of these illnesses may require different treatments. For instance, a medication that helps depression may not help ADHD. An incorrect diagnosis could lead to the wrong medication being prescribed. In some people, this could make the true diagnosis worse. In addition, medications can have side effects. Some side effects can be serious. Because ADHD (and these other illnesses) may require treatment over a long period of time, making the correct diagnosis and starting the correct treatment means that the person will

perform better, and hopefully with few or no side effects.

EEG AND ADHD Because the diagnosis of ADHD can be so challenging, doctors are interested in finding a medical test that can help them make the diagnosis of ADHD. One test that has been studied is EEG. By measuring the brain waves of people with ADHD, certain patterns have been recognized in specific regions of the brain. The brain wave pattern that seems to occur more often in people with ADHD is called the theta-beta ratio. The NEBA test calculates the ratio of the theta and beta brain waves obtained by EEG. In combination with a thorough medical examination and psychological assessment, NEBA has been reported to help confirm the diagnosis of ADHD.

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add.org

Learning Disabilities Association of America
ldaamerica.org

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ld.org

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