Reading the Brain: FDA Approves First Scan for Diagnosing ADHD

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It's the first test to diagnose the behavioral disorder using brain wave patterns, but it won't be the last. The idea of reading the brain's activity for clues to mental illness is gaining ground.

As Roxanne Khamsi reported in TIME recently, researchers are learning enough about the signature patterns of normal, and abnormal brain activity that they believe it may be possible to diagnose mental illnesses ranging from depression, schizophrenia, autism and attention deficit-hyperactivity disorder (ADHD) by studying readouts of brain waves, much in the way they now rely on elecrocardiograms (EKGs) to diagnose heart problems.

The Food and Drug Administration (FDA) approved Neba Health's device for children aged six years to 17 years. It relies on electroencephalogram (EEG) readings, which track electrical impulses released by active nerves. The test lasts 20 minutes and records the frequency of impulses emitted every second. By studying the resulting wave pattern, doctors can determine with relative confidence whether the child has ADHD, which is characterized by difficulty concentrating and paying attention.

As Khamsi wrote, researchers are also investigating how more sophisticated brain imaging techniques, including functional MRI (fMRI) could also improve diagnosis of ADHD:

> Other researchers have found evidence that such fMRI scans might also help diagnose attention-deficit/hyperactivity disorder (ADHD), schizophrenia and depression. In an experiment appearing in the forthcoming July issue of *Psychiatry Research*, Dr. Jonathan Posner of Columbia University and his colleagues looked at 22 children with ADHD who were not yet on medication and compared them with 20 youngsters around the same age without the disorder. Compared with the healthy children, those with ADHD had, on average, less coordinated brain activity between regions such as the prefrontal cortex, an area at the front of the brain thought to be involved in decisionmaking, and the caudate, a region located toward the base of the brain involved in controlling impulses. Such patterns could one day help identify children at highest risk of developing ADHD and provide them with behavioral or educational support to address symptoms early on, when such interventions might have the biggest impact.

It's also possible that brain waves can inform treatment of mental illnesses:

> “I am most interested in us[ing] resting-state fMRI to really examine the effects of treatment,” says Posner. He also published a paper in *JAMA Psychiatry* last spring showing that antidepressants successfully quieted hyperconnectivity in the brains of individuals with chronic depression.
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> That trial compared brain scans from 32 people with depression with those from 25 healthy counterparts and confirmed that the former group had more activity in what is known as the default mode network, a collection of disparate brain regions that makes up the baseline, or default level of brain activity necessary to keep a body functioning. When a person performs a mental task, this default network is suppressed. But in the depressed patients, this network was overactive, and that was associated with increased rumination — or overfixating on a thought that could contribute to depression.
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> The patients with depression were then given a 10-week course of either the antidepressant Cymbalta (duloxetine) or a placebo. At the end of the trial, patients who received the drug showed similar connectivity patterns to those seen in healthy individuals, but the depressed participants who received placebo did not. (The study received some funding support from the pharmaceutical company Eli Lilly, which markets Cymbalta.)

Experts say that advanced in brain imaging technology are making it possible to discern patterns of activity that could distinguish normal cognitive development from cases of autism, ADHD or other disorders. With autism in particular, having such a non-invasive way of identifying infants who are at risk may help them to avoid some of the condition’s more severe symptoms:

> With autism, for example, doctors are “really desperate for a biological marker to help with diagnosis and [measuring] treatment response,” says Daniel Smith, senior director of discovery neuroscience at Autism Speaks. Currently, most children are diagnosed around the age of 2, when the behavioral symptoms of inattention and repetitive actions tend to emerge. More studies suggest, however, that intervening with behavioral therapy in children as young as 6 months old could reduce, or even normalize, some of the aberrant brain changes responsible for the disorder, so diagnosing the condition as early as possible could become critical.

Doctors don’t expect that such tests will serve as the only diagnostic tool for detecting complex mental health conditions such as ADHD — indeed, the FDA says the device should be used in combination with medical and psychological evaluations. But they could become an important way of improving diagnosis and identifying patients at earlier phases of their disease, when treatments may be more effective.