



Brain Vitals

A TRANSFORMATIVE PLATFORM FOR ADVANCING PRECISION PSYCHIATRY

Amit Etkin, MD, PhD, Professor of Psychiatry and Behavioral Sciences

450 million

people currently struggle with a mental or neurological disorder, placing mental disorders among the leading causes of ill health and disability worldwide.

20 percent

of Americans live with a mental disorder; 46.6 million as of 2017.

33 percent

of people with a known mental disorder never seek help from a health professional.

25 years

the average amount of time an American living with a serious mental disorder will die before those without a mental disorder.



Amit Etkin, MD, PhD

In many ways, psychiatry is flying blind. Today it would be unthinkable to diagnose a patient with chest pain without performing an EKG, or to treat a broken bone without taking an X-ray. Yet psychiatry still relies almost completely on patients' subjective descriptions of their symptoms, without any information about the underlying biology of their disease. This results in an inefficient trial-and-error approach, sometimes taking years to find the right therapy for a specific patient. Even then, many only experience partial relief, and some never improve at all.

“Over time, I’ve gotten more and more impatient with this approach,” says Amit Etkin, MD, PhD, professor of psychiatry and behavioral sciences. His frustration drives his neuroscience research, and he draws on his deep clinical experience as a psychiatrist to investigate the neural basis of emotional disorders.

Dr. Etkin’s work is based on a core premise: that many psychiatric disorders are caused by problems in brain circuitry, and identifying and correcting these circuits can help psychiatrists zero in on the best treatment for each patient. His groundbreaking studies identified brain patterns in patients with post-traumatic stress disorder (PTSD) and depression that made them more likely to respond well to certain treatments. In 2017, these innovative discoveries earned him an NIH Director’s Pioneer Award, which recognizes exceptionally creative scientists pursuing game-changing approaches.

Now he’s taking it to the next level. “I’m trying to address a huge missing piece, which is understanding how to say something about an individual patient over time, and use that to directly guide their treatment,” says Dr. Etkin. “The problem is, most psychiatric studies provide a very shallow assessment, measuring a single point in time for many people. Patients tell us this just doesn’t capture their experience, and it can lead to fundamental errors in how we understand cause and effect in terms of the brain and mental illness. What if we turned that model sideways and said, perhaps the ‘big data’ we are after should be a lot of time points for individual people? Right now there is almost no data of this sort, even in healthy people.”

That’s the idea behind Brain Vitals, a revolutionary new platform that could fundamentally improve the lives of people with mental illness. It provides a way to routinely collect a panel of in-depth data about each patient’s brain activity over time, much like getting vitals done every time you go to the doctor. This approach would enable psychiatrists to accurately diagnose a condition and address the root causes. The Brain Vitals platform is also deliberately not limited to specific diagnoses or treatments.

Brain Vitals seeks to transform psychiatry’s approach from “one-size-fits-all” to precision mental health. It starts with recording electroencephalographs (EEGs) of patients to measure key brain signals. Using machine learning approaches created by Dr. Etkin and his collaborators, the Brain Vitals platform identifies “brain signatures” associated with healthy people and those with brain circuitry disorders. By continuing to collect EEGs from patients, the Brain Vitals platform develops an increasingly robust understanding of how brain signatures change over time in response to variations in stress levels, sleep patterns, social interactions, and other factors.

All these data streams feed into a “digital twin,” a predictive mathematical formulation of brain circuit functioning for each patient. As the platform collects more information, this digital twin grows and predicts and tracks that patient’s outcomes with increasing accuracy. By comparing the digital twin with data from many other patients, Brain Vitals also can predict which therapies have the greatest chance of success for that individual. For example, Dr. Etkin’s lab is beginning to identify which patients are most likely to experience improvement while getting antidepressant medication, non-invasive brain stimulation, psychotherapy, or even participating in a drug rehabilitation program.

It could also provide real-time treatment guidance. For example, it could detect warning signs that a patient with bipolar disorder is on the verge of a manic episode, enabling his psychiatrist to adjust his medications or schedule more clinic visits to prevent a crisis. Similarly, it could indicate early on how well a patient with depression responds to a new medication. If her brain signature improves, her psychiatrist could continue the therapy and optimize it based on subsequent EEGs. If her brain signature stays the same or worsens, her psychiatrist could quickly switch to another approach.

In addition, Brain Vitals could accelerate the development of effective new treatments. Some patients do not respond to any existing therapies, but their brain signatures could serve as a target for designing novel interventions to correct malfunctioning circuits. “Brain Vitals allows me to take that signal and try to move it,” says Dr. Etkin. “It helps me develop new treatments in a rigorous way, based on their brain rather than their symptoms.”

Brain Vitals is affordable, accessible, and scalable. Recent neuroscience research has relied heavily on functional magnetic resonance imaging (fMRI), which requires expensive equipment operated by highly trained technicians. By contrast, EEGs use inexpensive technology that is already approved by the U.S. Food and Drug Administration (FDA). It’s a tool that can be used in many settings, including at clinical points of care, in rural clinics, and the developing world. EEGs are simple to administer, only take about 20 minutes to record, and yield an incredibly rich source of data that can be uploaded and analyzed in the cloud—making Brain Vitals easy to scale.

This platform can also be used across diseases: it can be flexibly deployed to diagnose and treat any brain condition, including depression, addiction, obsessive-compulsive disorder, schizophrenia, chronic pain, and stroke, among many others. To ensure real-world functionality, Dr. Etkin is in regular dialogue with the FDA about the Software as Medical Device regulatory pathway, ensuring that his lab’s data collection methods will meet requirements for FDA approval.

Brain Vitals could transform the lives of patients with mental illness—and not a moment too soon. “I don’t like the ‘last paragraph effect,’ where you get to the end of a paper and it says, ‘In the future, X may be possible,’” says Dr. Etkin. “If there’s an interesting speculation, *that’s* what we should be going after. We need to pursue the most important problems, even if they’re the hardest ones.”

“I’m always looking for innovations that have the potential to completely change the landscape of everyday life. Dr. Etkin refuses to accept the status quo. His bold investigations could revolutionize the way we diagnose and treat psychiatric illnesses. Brain Vitals is a brilliant, elegant framework that could help millions of people worldwide. That’s why my family has chosen to invest philanthropically in him and his vision.”

–Jamie Shennan

Philanthropist, Venture Capitalist

Opportunities for Partnership

Brain Vitals has already developed an effective framework

through its pilot studies. It is now poised to scale up to much larger clinical studies. Philanthropic support will allow Dr. Etkin's lab to greatly accelerate the pace of discovery into the next three stages of development:

Stage 1—Collect Brain Vitals data from a growing number of healthy volunteers as well as clinic patients across the country who are living with conditions such as depression, anxiety, and chronic pain. Support bioinformatics and machine learning experts as they analyze the data and refine the Brain Vitals predictive model.

Stage 2—Use the Brain Vitals data to select the best treatments for each patient, based on his or her brain signature, and create a feedback loop to optimize the application of these therapies.

Stage 3—For patients who are not responsive to any existing treatments, use Brain Vitals data to develop novel therapies that repair brain circuit deficiencies and produce lasting improvement.

With your partnership, we will fundamentally transform the way that mental illness is diagnosed and treated, and help millions of people around the world live happier, more fulfilling lives.

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