Predicting therapeutic response in depressed teen girls

September 16 2020

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The risk of developing major depressive disorder (MDD) surges during adolescence–particularly for girls. Cognitive behavioral therapy (CBT) can be an effective treatment, but only about half of girls diagnosed with

depression show significant improvement. Researchers at Harvard Medical School and McLean Hospital have now identified a non-invasive test of brain function that could help predict who will respond to CBT.

The article appears in *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*.

"The study is very significant because it suggests that readily acquired EEG measures related to processing of rewards and losses can serve as biomarkers for predicting treatment response and tracking the effects of therapy in the brain," said Cameron Carter, editor of *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*. "Future work using these measures may help clinicians determine the best treatment—for example, CBT versus medications—for a given young person suffering with depressive symptoms."

The study included 36 teenage girls with MDD and 33 healthy control adolescents. Girls with MDD were offered a 12-week course of CBT. Overall, the girls who underwent treatment saw a significant improvement in their symptoms from the "severe" to "mild" range.

At the start of the study, all participants were assessed for mental health and were given a task, much like a video game, in which they could win or lose money. The researchers used electroencephalography (EEG), which measures brain activity from outside the skull, to test participants' brain responses during the task. The girls repeated the task (and the EEG test) at the midpoint of treatment, and again after completion of treatment. Control participants, who did not receive CBT, also performed the task and EEG measurements at three corresponding times.

The researchers measured brain signals called event-related potentials

(ERP), which are signature responses seen during such tasks. One type of ERP reflects the brain's immediate response to monetary rewards vs. losses; this measure did not predict who would respond to CBT. Another, longer-lasting type of ERP reflects the brain's more sustained emotional processing of rewards vs. losses.

"We found that the brain measure of sustained—but not initial—responsiveness to rewards predicted greater symptom improvement, which may help to inform which depressed adolescents are most likely to benefit from CBT," said Christian Webb, Ph.D., lead author of the study.

The girls with a larger ERP response showed greater improvement in symptoms.

Although the precise mechanisms that account for symptom improvement in CBT for depressed teens is not yet clear, this study also revealed that EEG responses to monetary loss changed over time with treatment. That finding, Dr. Webb said, may reflect that, "in addition to reducing depressive symptoms, successful CBT may attenuate underlying neural hypersensitivity to negative outcomes among depressed adolescent girls," ultimately leading to symptom improvement.

More information: Christian A. Webb et al. Reward-Related Neural Predictors and Mechanisms of Symptom Change in Cognitive Behavioral Therapy for Depressed Adolescent Girls, *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging* (2020). DOI: 10.1016/j.bpsc.2020.07.010

Provided by Elsevier

Citation: Predicting therapeutic response in depressed teen girls (2020, September 16) retrieved 27 April 2024 from https://medicalxpress.com/news/2020-09-therapeutic-response-depressed-teen-girls.html