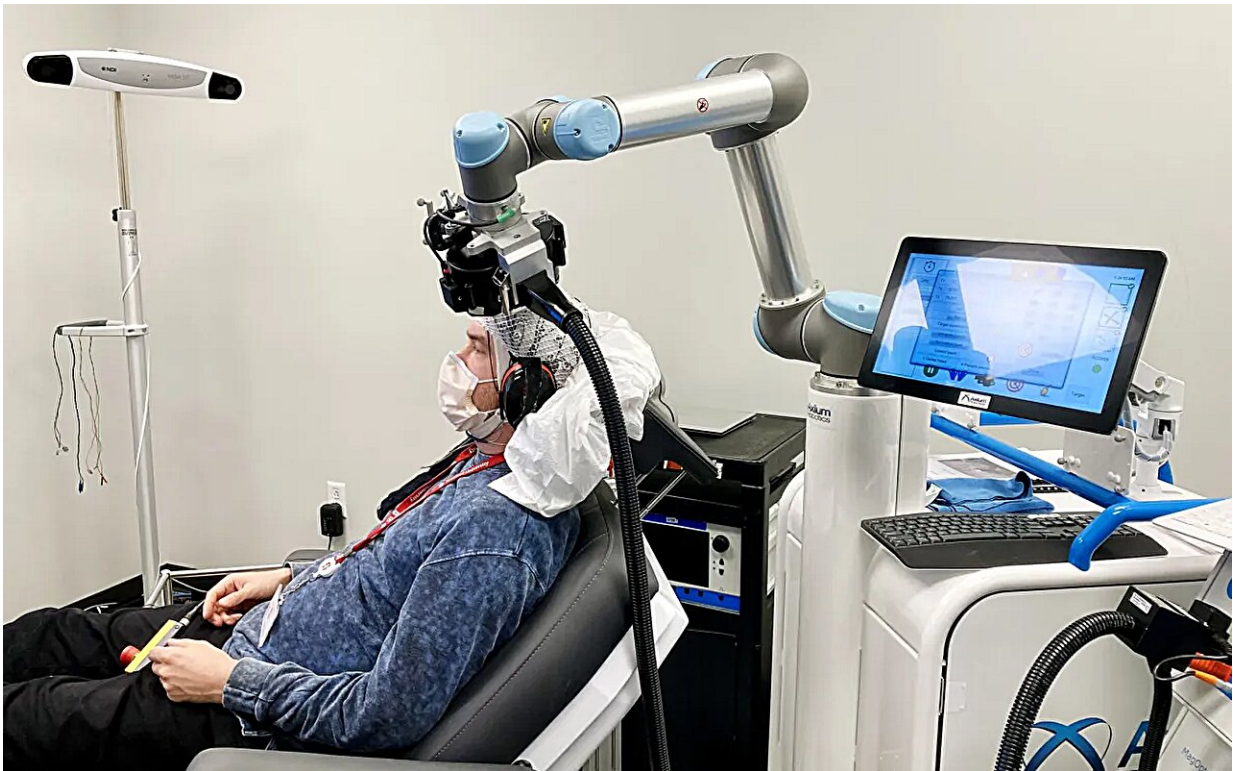


# Personalized magnetic stimulation may help in treating depression

June 24 2024

---



Brain electrical responses can be studied by measuring EEG simultaneously with brain stimulation. In the picture, a robotic arm holds the TMS coil. Credit: Juha Gogulski

Not all patients with depression respond to medication. Two recently published studies provide additional information on how an alternative

treatment, transcranial magnetic stimulation (TMS), could be further enhanced. TMS differs from electroconvulsive therapy (ECT), which is also used to treat depression.

Researchers from the University of Helsinki and Stanford University investigated which factors in targeting TMS influence the brain's electrical responses. They examined the behavior of a specific electrophysiological marker. This marker could potentially be used as a biomarker in the future to measure the efficacy of TMS treatment and thus help target and tailor the therapy.

"Magnetic stimulation is an effective treatment for patients whose depression is not alleviated by medication. However, currently, about half of these patients do not receive significant help from TMS.

"The biomarker we studied may help predict who will benefit from the therapy. In the future, it may also be possible to tailor the treatment individually," says postdoctoral researcher Juha Gogulski from Stanford, University of Helsinki and Aalto University.

## **Individual optimization is worthwhile**

The [first study](#), published in *Clinical Neurophysiology*, addressed an electrophysiological marker that describes cortical excitability and the sources of error affecting its measurement.

Researchers studied healthy subjects to determine how magnetic stimulation targeted to the prefrontal cortex and the angle of the stimulation coil affected cortical excitability, that is, the responses measured on an electroencephalogram (EEG) immediately after the stimulation pulse.

"The results showed that targeting of the stimulation coil in different

parts of the prefrontal cortex significantly affected the quality of electrical responses. Additionally, we found indications that individual optimization of the stimulation site and coil angle may further improve the quality of this metric," says Gogulski.

The [second study](#), published in *Cerebral Cortex*, dealt with the reliability of the same electrophysiological marker in the prefrontal cortex. The study revealed that the most significant factor affecting reliability was the stimulation site.

"Before we can develop personalized TMS therapy, we must ensure that the excitability of the prefrontal cortex can be measured as accurately as possible in individual patients to be able to monitor how TMS treatment changes brain excitability. Determining reliability is also essential before this type of biomarker can be applied clinically," says Gogulski.

## **Potential benefits are significant, more research needed**

Magnetic stimulation already helps some people with depression, but according to Gogulski, the effectiveness of TMS therapy varies between individuals. More precisely tailored treatment might improve outcomes.

"There are many possible factors in TMS therapy that could be used for individual tailoring, such as the stimulation site, the number and frequency of pulses, the intensity of the stimulation, and the number of treatment sessions. The side effects of TMS therapy are minimal, with the most common being a temporary, mild headache."

According to Gogulski, what makes the new studies significant is that this detailed systematic mapping of the electrical responses of the [prefrontal cortex](#) and their reliability has not been done before. The

researchers hope that in the future, the effectiveness of TMS therapy can be monitored by measuring the brain's electrical responses during treatment. Based on these measurements, it might be possible to fine-tune the stimulation if necessary, even during the treatment.

"The results of both studies will be utilized in the future when designing individual brain stimulation therapies based on electrical biomarkers. However, more research is needed before new treatment methods can be implemented," says Gogulski.

**More information:** Juha Gogulski et al, Mapping cortical excitability in the human dorsolateral prefrontal cortex, *Clinical Neurophysiology* (2024). [DOI: 10.1016/j.clinph.2024.05.008](https://doi.org/10.1016/j.clinph.2024.05.008)

Juha Gogulski et al, Reliability of the TMS-evoked potential in dorsolateral prefrontal cortex, *Cerebral Cortex* (2024). [DOI: 10.1093/cercor/bhae130](https://doi.org/10.1093/cercor/bhae130)

Provided by University of Helsinki

Citation: Personalized magnetic stimulation may help in treating depression (2024, June 24) retrieved 28 June 2024 from <https://medicalxpress.com/news/2024-06-personalized-magnetic-depression.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.