

# Functional imaging-based targeting of transcranial magnetic stimulation for treatment-resistant depression

<b>Submission date</b> 14/07/2023	<b>Recruitment status</b> Recruiting	<input checked="" type="checkbox"/> Prospectively registered <input type="checkbox"/> Protocol
<b>Registration date</b> 14/08/2023	<b>Overall study status</b> Ongoing	<input type="checkbox"/> Statistical analysis plan <input type="checkbox"/> Results
<b>Last Edited</b> 22/01/2025	<b>Condition category</b> Mental and Behavioural Disorders	<input type="checkbox"/> Individual participant data <input checked="" type="checkbox"/> Record updated in last year

## Plain English summary of protocol

### Background and study aims

The symptoms of depression can vary, but the cardinal features are persistent low mood and/or inability to feel pleasure. Transcranial magnetic stimulation (TMS) is a noninvasive procedure that uses magnetic fields to stimulate nerve cells in the brain to improve symptoms of depression. TMS is typically used when other depression treatments haven't been effective. The present randomized study aims to test whether a new targeting method of repetitive transcranial magnetic stimulation (rTMS) improves outcomes in depression.

### Who can participate?

Patients whose doctors have referred them to the Helsinki University Central Hospital for rTMS for major depressive disorder (MDD) are asked to participate.

### What does the study involve?

The study involves a 2-hour visit to Aalto University Advanced Magnetic Imaging Centre for magnetic resonance imaging (MRI). This is followed by a 2-hour meeting with a psychiatrist including an interview and definition of dose and targets for the treatment. A nurse delivers the treatment to each side of the forehead. S/he or the patient does not know whether the targeting is based on individual brain imaging or on average measures. Treatment visits take about 30 min 3-5 times a week up to 25 visits.

### What are the possible benefits and risks of participating?

Possible benefits of the study include improved outcomes of rTMS treatment. Risks include uncomfortable stimulation site sensations and mild tiredness after treatment.

### Where is the study run from?

HYKS Psykiatriakeskus, Helsinki (Finland)

### When is the study starting and how long is it expected to run for?

September 2022 to May 2026

Who is funding the study?

1. Academy of Finland (Research Council of Finland), Helsinki and Uusimaa Hospital District (Finland)
2. Finnish Cultural Foundation (Suomen Kulttuurirahasto) (Finland)
3. Jalmari and Rauha Ahokas Foundation (Jalmari ja Rauha Ahokkaan Säätiö) (Finland)

Who is the main contact?

Dr Tuukka Raij, [tuukka.raij@hus.fi](mailto:tuukka.raij@hus.fi)

### **Study website**

<https://www.hus.fi/psykiatrian-tutkimukset#potilaita-ja-kontrollihenkil%C3%B6i>

## **Contact information**

### **Type(s)**

Principal Investigator

### **Contact name**

Dr Tuukka Raij

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## **Additional identifiers**

### **EudraCT/CTIS number**

Nil known

### **IRAS number**

### **ClinicalTrials.gov number**

Nil known

### **Secondary identifying numbers**

HUS/12135/2022

## **Study information**

### **Scientific Title**

Comparison of Helsinki individual targeting and regular targeting in TMS treatment of depression

**Acronym**

HIT2

**Study objectives**

Functional imaging-based targeting results in better outcome than regular scalp measure-based targeting

**Ethics approval required**

Ethics approval required

**Ethics approval(s)**

Approved 31/05/2023, HUS regional medical research ethics committee (HUS Keskuskirjaamo, Helsinki, PO Box 200, Finland; +358403594618; eettiset.toimikunnat@hus.fi), ref: HUS/12135/2022

**Study design**

Interventional double-blind randomized controlled trial

**Primary study design**

Interventional

**Secondary study design**

Randomised controlled trial

**Study setting(s)**

Hospital

**Study type(s)**

Efficacy

**Participant information sheet**

See study outputs table

**Health condition(s) or problem(s) studied**

Major depressive disorder, resistant to at least two antidepressants

**Interventions**

Current interventions as of 22/01/2025:

Targeting is alternated every 5th treatment session between:

1. Targeting based on group average of functional imaging
2. Targeting based on individual functional imaging

The order of the targeting is randomized 1:1 according to a list for randomization. The patient and the research nurse who delivers treatment are blind to the treatment arm. Repetitive theta burst stimulation is delivered at 120% (or the nearest tolerated intensity) of the motor threshold up to five times a week for a total of 25 treatment visits.

Previous interventions:

Targeting is alternated every 5th treatment session between:

1. Regular targeting method based on scalp metrics
2. Individual targeting based on functional imaging

The order of the targeting is randomized 1:1 according to a list for randomization. The patient

and the research nurse who delivers treatment are blind to the treatment arm. Repetitive theta burst stimulation is delivered at 110% (or the nearest tolerated intensity) of the motor threshold up to five times a week for a total of 25 treatment visits.

**Intervention Type**

Device

**Pharmaceutical study type(s)**

Not Applicable

**Phase**

Not Applicable

**Drug/device/biological/vaccine name(s)**

Transcranial magnetic stimulation

**Primary outcome measure**

Depressive symptoms measured using the Beck's Depression Inventory-21 (BDI) at baseline, before 6th, 11th, 16th, and 21th and after 25th treatment visit

**Secondary outcome measures**

Depressive symptom reduction measured using a subjective Visual Analogue Scale (VAS) at baseline, before 6th, 11th, 16th, 21th and after 25th treatment visit

**Overall study start date**

01/09/2022

**Completion date**

31/05/2026

## Eligibility

**Key inclusion criteria**

1. Diagnosis of major depressive disorder (DSM-IV) as the principal diagnosis
2. Patient Health Questionnaire-9 score >14
3. Inability to tolerate antidepressant medication or unresponsiveness to minimum of two trials of more than 60 days with adequate dose of antidepressant
4. No change in antidepressive medication within four weeks prior to treatment

**Participant type(s)**

Patient

**Age group**

Adult

**Lower age limit**

18 Years

**Upper age limit**

67 Years

**Sex**

Both

**Target number of participants**

20

**Key exclusion criteria**

1. Previous rTMS treatment
2. Borderline personality features exceeding 7 points in McLean Screening Instrument for Borderline Personality Disorder, or other somatic or psychiatric conditions that likely interfere with recovery from depression with TMS (an unstable severe medical illness, substantial neurological illness, chronic pain, psychotic disorder or current psychotic symptoms, substance abuse or dependency within last 3 months, >2 mg lorazepine equivalents benzodiazepine use daily or any anticonvulsant, or lifetime history of non-response to an adequate course—ie, a minimum of eight treatments—of electroconvulsive therapy)
3. Safety risks including active suicidality, pregnancy, magnetic metal or leads in the upper body, or history of seizures

**Date of first enrolment**

01/02/2025

**Date of final enrolment**

31/12/2025

**Locations****Countries of recruitment**

Finland

**Study participating centre**

**HYKS Psykiatriakeskus**

Välskärinkatu 12

Helsinki

Finland

PL590, 00029 HUS

**Sponsor information****Organisation**

Hospital District of Helsinki and Uusimaa

**Sponsor details**

Välskärinkatu 12, PL590

Helsinki

Finland

00029 HUS  
+358 0504631142  
piia.frondelius@hus.fi

**Sponsor type**

Hospital/treatment centre

**Website**

<https://www.helsinki.fi/fi/laaketieteellinen-tiedekunta/tutkimus/tieteenalat/psykiatrian-osasto>

**ROR**

<https://ror.org/020cpqb94>

## **Funder(s)**

**Funder type**

University/education

**Funder Name**

Academy of Finland

**Alternative Name(s)**

Suomen Akatemia, Finlands Akademi, Academy of Finland, AKA

**Funding Body Type**

Government organisation

**Funding Body Subtype**

Universities (academic only)

**Location**

Finland

**Funder Name**

Suomen Kulttuurirahasto

**Alternative Name(s)**

Finnish Cultural Foundation, SKR

**Funding Body Type**

Private sector organisation

**Funding Body Subtype**

Trusts, charities, foundations (both public and private)

**Location**

Finland

**Funder Name**

Jalmari ja Rauha Ahokkaan Säätiö

**Alternative Name(s)**

Jalmari and Rauha Ahokas Foundation

**Funding Body Type**

Private sector organisation

**Funding Body Subtype**

Trusts, charities, foundations (both public and private)

**Location**

Finland

## Results and Publications

**Publication and dissemination plan**

Findings are published in congress abstracts and peer reviewed Journals.

**Intention to publish date**

31/12/2026

**Individual participant data (IPD) sharing plan**

The datasets generated during and/or analysed during the current study are not expected to be made publicly available due to the need to protect privacy of the participants. New researchers may however join the research group and use the data for scientific purposes.

**IPD sharing plan summary**

Not expected to be made available

**Study outputs**

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
<a href="#">Participant information sheet</a>	version 3	19/05/2023	11/08/2023	No	Yes
<a href="#">Participant information sheet</a>	version 4	17/12/2024	22/01/2025	No	Yes