National University Hospital

NUS National University of Singapore

MEDIA RELEASE

ONE OF THE WORLD'S FIRST PERSONALISED BRAIN STIMULATION STUDIES SHOWS PROMISE FOR SEVERE OCD WITH NUH AND NUS MEDICINE EXTENDING THE APPROACH TO DEPRESSION AND ANXIETY

Building on an established NUH–NUS Medicine collaboration, the work combines clinical expertise and cutting-edge neuroimaging to improve outcomes for patients who have not responded to standard treatments

SINGAPORE — Mental health treatments such as transcranial magnetic stimulation (TMS) have helped many individuals with major depressive disorder. In standard practice, TMS protocols are typically applied uniformly, with an electromagnetic coil used to deliver magnetic pulses to the same predefined brain region across all patients. The National University Hospital (NUH) and Yong Loo Lin School of Medicine, National University of Singapore (NUS Medicine) are exploring a more personalised approach through two frontier studies. By combining advanced brain imaging with tailored TMS targeting, the research aims to identify and treat the specific brain circuits linked to each patient's symptoms.

The first, a now-completed study in patients with severe obsessive-compulsive disorder (OCD), is one of the first in the world to guide this type of TMS using "causal" brain circuits – circuits known to relieve OCD symptoms when stimulated through brain surgery – and has produced encouraging early results. The second, in patients with depression and anxiety, begins in October 2026.

While research is still evolving, past studies suggest that this strategy may lead to improved outcomes. A clinical study[1] on standard TMS showed a 21 per cent response rate among participants. In contrast, a separate study[2] on personalised TMS (pTMS) reported far higher success: 70 per cent responded within the month following treatment, with 31 per cent of participants maintaining response after 12 weeks.

The studies described here involve participants across distinct clinical groups: one with OCD and one focused on individuals with depression who also experience anxiety symptoms. The studies are led by Adjunct Associate Professor Tor Phern Chern, Senior Consultant, Department of Psychological Medicine, NUH, and Associate Professor Thomas Yeo, Deputy Head, Centre for Translational Magnetic Resonance Research (TMR), NUS Medicine. Assoc Prof Yeo also has a joint appointment with the Department of Electrical and Computer Engineering in the College of Design and Engineering at NUS.

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[1] Ye SJ, Lu L, Phu HH, Tan XW, Tor PC. Repetitive transcranial magnetic stimulation for major depression and obsessive-compulsive disorders in Singapore. Ann Acad Med Singap. 2024 Aug 29;53(8):471-480. doi: 10.47102/annals-acadmedsg.202496. PMID: 39230315.

[2] Kong R, Tan XW, Xue A, Ooi LQR, Goh SE, Lee JJ, Cheng J, Tan TWK, Tan RSY, Koh JZJ, Singh HKG, Chai JH, Shi L, Yeo BTT, Tor P-C. Efficacy of Personalized Connectivity-Guided Accelerated Brain Stimulation in a Naturalistic Treatment-Resistant Depression Population. https://doi.org/10.64898/2026.01.11.26343900

Tailoring TMS to the individual symptoms and brain

Across the studies, participants undergo a standardised pTMS workflow. Functional magnetic resonance imaging (fMRI) is first used to map each participant's unique brain circuitry at the NUS Medicine Centre for TMR. These scans are then analysed using an algorithm[3] first developed by Assoc Prof Thomas Yeo and Dr Ru Kong, who are both also from the Centre for Sleep and Cognition at NUS Medicine. The resulting data personalises the delivery of magnetic pulses to each individual's identified stimulation target via a neuro-navigation robotic arm, using intermittent theta-burst stimulation (iTBS), a shorter form of TMS in which each treatment session takes about nine minutes rather than the conventional 37.5 minutes[4]. Treatment is administered at the Centre for Interventional Psychiatry at NUH.

To better understand treatment response, participants in these studies undergo intensive monitoring with frequent and repeated fMRI scans across the study period. This more advanced approach, not typically used in routine TMS studies, enables researchers to track how brain circuits change over the course of treatment and how these changes relate to symptom improvement, helping to guide the development of more targeted and personalised interventions.

OCD study shows promise of personalised TMS for severe OCD

This completed study, one of the first in the world to use causal-circuit, fMRI-guided iTBS for OCD, investigated the use of pTMS in four participants with severe, treatment-resistant OCD. OCD is one of the hardest mental health conditions to treat. The only medicines approved for it belong to a single drug class, serotonin reuptake inhibitors, and 40 to 60 per cent of patients do not respond adequately to them.[5][6] For those who have not improved with medication and psychotherapy, the most intensive remaining option is deep brain stimulation, which requires brain surgery. A non-personalised form of TMS, cleared for OCD in the United States since 2018, helps about 40 per cent of these patients,[7] but it stimulates the same brain region in every patient.

The OCD research study was supported by a NUH Clinician Scientist Programme grant, and by funding from the Centre for TMR at NUS Medicine. It first uses causal brain circuits – circuits in which Deep Brain Stimulation (DBS)[8] has been shown to

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[3] The brain imaging analysis technology was developed at NUS and subsequently commercialised through B1Neuro, a local NUS spin-off. B1Neuro provides this technology to NUH and Mount Alvernia Hospital. Dr Ru Kong, Assoc Prof Thomas Yeo, and Adj Assoc Prof Tor Phern Chern serve as the Chief Scientific Officer, Scientific Advisor and Clinical Advisor respectively.

[4] Blumberger DM, Vila-Rodriguez F, Thorpe KE, et al. Effectiveness of theta burst versus high-frequency repetitive transcranial magnetic stimulation in patients with depression (THREE-D): a randomised non-inferiority trial. Lancet. 2018;391(10131):1683-1692. doi:10.1016/S0140-6736(18)30295-2.

[5] Kaplan A, Hollander E. A review of pharmacologic treatments for obsessive-compulsive disorder. Psychiatr Serv. 2003;54(8):1111-1118. doi:10.1176/appi.ps.54.8.1111.

[6] Pallanti S, Quercioli L. Treatment-refractory obsessive-compulsive disorder: methodological issues, operational definitions and therapeutic lines. Prog Neuropsychopharmacol Biol Psychiatry. 2006;30(3):400-412.

[7] Carmi L, Tendler A, Bystritsky A, et al. Efficacy and safety of deep transcranial magnetic stimulation for obsessive-compulsive disorder: a prospective multicenter randomized double-blind placebo-controlled trial. Am J Psychiatry. 2019;176(11):931-938. doi:10.1176/appi.ajp.2019.18101180.

[8] Deep Brain Stimulation (DBS) is a neurosurgical treatment that involves implanting electrodes in specific areas of the brain through surgery to modulate abnormal activity. It is commonly used to treat conditions such as OCD, epilepsy and Parkinson's disease.

relieve OCD symptoms[9] – to identify a general treatment region, which is then refined to each participant's own default mode network using fMRI and the NUS Medicine–developed algorithm to determine each participant's precise stimulation target. Unlike DBS, pTMS is non-invasive and requires no surgery.

Of the four participants enrolled between January and July 2026, two withdrew from the study before completing treatment, while the remaining two completed the full treatment course of 40 short iTBS sessions delivered over five days. Both experienced a substantial reduction in their OCD symptoms, measured using the Obsessive-Compulsive Inventory–Revised (OCI-R), a standard OCD symptom questionnaire.[10] In one patient, symptom scores fell by 78 per cent by the end of the treatment week and reached zero, with no symptoms reported on the questionnaire, six weeks later.

The other patient improved more gradually, with a 35 per cent reduction in symptoms four weeks after treatment. While this second patient experienced a return of symptoms about 12 weeks later and underwent an additional two-day booster treatment, the patient again showed substantial improvement afterwards. These early findings support further evaluation of pTMS as a safe and effective option for treating OCD. If confirmed in larger studies, it could offer new hope to Singaporeans living with OCD who have not responded well to conventional treatments.

Adj Assoc Prof Tor Phern Chern said, "For people with severe OCD who have tried medication and therapy without success, there have been very few genuinely new treatment options in decades. Being able to reach the circuits that deep brain stimulation targets, without surgery and in a single week of treatment, is what makes these early results so encouraging."

Extending pTMS to broader patient groups with depression and co-occurring anxiety symptoms

The other study will involve a larger participant group over a longer study period, examining how brain networks and symptoms change during pTMS in individuals with depression who also experience anxiety. This is particularly relevant given findings from the National Council of Social Service's 2025 Quality of Life study[11], which reported that 26 per cent of adults experience mild depressive or anxiety symptoms, 19 per cent moderate symptoms and 7 per cent severe symptoms.

The study, which aims to recruit 30 participants, will begin in October this year and run until early 2029. Moving beyond the conventional approach of targeting a single brain region commonly used for depression, the study will use two types of personalised stimulation targets, linked respectively to depression- and anxiety-related circuits. Repeated fMRI and symptom assessments will allow researchers to investigate how different stimulation locations affect changes in the brain and in symptoms within individuals over time. Participants will have up to 48 hours of MRI scans over 10 months, providing an unusually detailed view of brain network changes within

[9] Li N, Baldermann JC, Kibleur A, et al. A unified connectomic target for deep brain stimulation in obsessive-compulsive disorder. Nat Commun. 2020;11:3364. doi:10.1038/s41467-020-16734-3.

[10] Foa EB, Huppert JD, Leiberg S, et al. The Obsessive-Compulsive Inventory: development and validation of a short version. Psychol Assess. 2002;14(4):485-496.

[11] National Council of Social Service, "Beyond the Label Collective rallies workplaces to break stigma and champion mental health", 13 September 2025, https://isomer-user-content.by.gov.sg/24/e2f934fc-530e-43ef-a377-e4470eac7423/ncss_13Sep2025_mr_beyond_the_label_fest_2025.pdf.

individuals over time. Insights from this work will support the development of more precise, individualised brain target maps to personalise future pTMS treatments in this patient group. The study is funded by the National Research Foundation, Singapore.

Assoc Prof Thomas Yeo said, “These studies represent an important step towards a more precise and individualised approach to mental health care. By combining brain imaging with computational modelling, we are able to better understand how each patient’s symptoms are reflected in their brain circuitry, and translate that insight into targeted treatment. This integrated approach has the potential to reshape how we deliver TMS and improve outcomes for patients who have not benefitted from conventional methods.”

Chinese Glossary

National University Hospital (NUH)	国立大学医院(国大医院)
National University of Singapore Yong Loo Lin School of Medicine (NUS Medicine)	新加坡国立大学杨潞龄医学院（国大杨潞龄医学院)
College of Design and Engineering National University of Singapore	新加坡国立大学设计与工程学院
Translational Magnetic Resonance Research (TMR) at NUS Medicine	国大杨潞龄医学院磁共振转化研究中心
National Research Foundation, Singapore	国立研究基金会
Personalised Transcranial Magnetic Stimulation	个性化经颅磁刺激
Centre for Interventional Psychiatry	干预性心理医疗中心
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About the National University Hospital (NUH)

The National University Hospital (NUH) is Singapore's leading university hospital. While the hospital at Kent Ridge first received its patients on 24 June 1985, our legacy started from 1905, the date of the founding of what is today the NUS Yong Loo Lin School of Medicine. NUH is the principal teaching hospital of the medical school.

Our unique identity as a university hospital is a key attraction for healthcare professionals who aspire to do more than practise tertiary medical care. We offer an environment where research and teaching are an integral part of medicine, and continue to shape medicine and transform care for the community we care for.

We are an academic medical centre with over 1,200 beds, serving more than one million patients a year with over 50 medical, surgical and dental specialties. NUH is the only public and not-for-profit hospital in Singapore to provide trusted care for adults, women and children under one roof, including the only paediatric kidney and liver transplant programme in the country.

The NUH is a key member of the National University Health System (NUHS), one of three public healthcare clusters in Singapore. For more information, visit www.nuh.com.sg

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About the Yong Loo Lin School of Medicine, National University of Singapore (NUS Medicine)

The NUS Yong Loo Lin School of Medicine is Singapore's first and largest medical school. Our enduring mission centres on nurturing highly competent, values-driven, and inspired healthcare professionals to transform the practice of medicine and improve health around the world.

Through a dynamic and future-oriented five-year curriculum that is inter-disciplinary and inter-professional in nature, our students undergo a holistic learning experience that exposes them to multiple facets of healthcare and prepares them to become visionary leaders and compassionate doctors and nurses of tomorrow. Since the School's founding in 1905, more than 12,000 graduates have passed through our doors.

In our pursuit of health for all, our strategic research programmes focus on innovative, cutting-edge biomedical research with collaborators around the world to deliver high impact solutions to benefit human lives.

The School is the oldest institution of higher learning in the National University of Singapore and a founding institutional member of the National University Health System. It is one of the leading medical schools in Asia and ranks among the best in the world (Times Higher Education World University Rankings 2026 by subject and the Quacquarelli Symonds (QS) World University Rankings by subject 2026).

For more information about NUS Medicine, please visit https://medicine.nus.edu.sg/