PRESS RELEASE

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Novel AI-powered eye scan predicts risk of cognitive decline and dementia

Researchers at the NUS Yong Loo Lin School of Medicine have validated a retinal ageing marker capable of predicting cognitive decline and dementia up to five years in advance. This non-invasive screening method could lead to early detection, enabling timely interventions and improving outcomes for patients at risk of dementia.

Singapore, 11 September 2025 — A new study led by researchers from the Yong Loo Lin School of Medicine at the National University of Singapore (NUS Medicine) has demonstrated that Artificial Intelligence (AI) analysis of retinal photographs can predict an individual's risk of cognitive decline and dementia. Published in *Alzheimer's & Dementia: The Journal of the Alzheimer's Association*, this first-of-its-kind study in Singapore highlights the potential of retinal ageing biomarkers as a novel tool for brain health management.

Jointly led by Professor Cheng Ching-Yu, Director, Centre for Innovation and Precision Eye Health, NUS Medicine, and Professor Christopher Chen, Deputy Chair, Healthy Longevity Translational Research Programme, NUS Medicine, the research team developed a novel deep-learning biomarker known as RetiPhenoAge, which estimates the biological age of the retina based on standard eye images. The study analysed data from over 500 participants recruited from memory clinics in Singapore. The findings showed that individuals with higher retinal biological age were at significantly greater risk (up to 25-40% increased risk, per standard deviation increase in RetiPhenoAge) of developing cognitive decline or dementia over a five-year period.

These findings were further validated in a larger population sample using data from more than 33,000 participants in the UK Biobank. In this cohort, elevated RetiPhenoAge was similarly associated with a higher risk of developing dementia over twelve years of follow-up, reinforcing its predictive utility across diverse populations. The study further showed that retinal ageing reflects key biological processes associated with neurodegeneration, with brain scans and blood markers used to validate RetiPhenoAge's link to brain changes and ageing-related changes in blood proteins. These associations offer a novel alternative for the use of retinal ageing as a proxy measure for cognitive health.

Prof Cheng said, “With RetiPhenoAge, we are able to non-invasively estimate an individual’s biological age, offering valuable insights for both cognitive health management and broader ageing research. This can help doctors identify people at risk of cognitive decline or dementia, before symptoms appear, enabling more targeted interventions. We hope to validate this screening tool in larger and more diverse populations, and assess its impact in clinical settings to guide earlier treatment of dementia.”

Prof Chen added, “With dementia numbers rising globally[1], we urgently need tools that are both scalable and predictive. RetiPhenoAge could hold the key to community-level screening that is both effective and affordable. These findings bring us closer to developing simple and affordable screening modalities that can be integrated into routine health checks, enabling earlier detection of dementia risk and timely support.” Prof Chen is also from the Department of Pharmacology at NUS Medicine, and is the Director of the Memory, Ageing and Cognition Centre, NUHS and Visiting Consultant, Department of Psychological Medicine, National University Hospital (NUH).

Co-first authors of the study, Dr Sim Ming Ann and Asst Prof Tham Yih Chung, added, “We hope that these findings will lead to improvements in care, which will help doctors identify people at risk of dementia before symptoms appear, which may lead to earlier interventions and improved patient outcomes.” Dr Sim is a Consultant at the Ng Teng Fong General Hospital and NUH, and a PhD candidate at NUS Medicine, while Asst Prof Tham is from the Centre for Innovation and Precision Eye Health, NUS Medicine.

This study marks a significant advancement in the field of digital biomarkers and demonstrates the potential of combining AI with non-invasive imaging to tackle pressing healthcare challenges. As RetiPhenoAge uses retinal scans from existing imaging tools already available in many Singapore polyclinics[2], it offers a convenient and scalable solution that can be seamlessly integrated into routine health checks. The research team is currently working to validate the biomarker across diverse populations in Asia and beyond, as well as to assess its applicability in both clinical and community healthcare settings.

Building upon this work, Prof Cheng and Prof Chen were recently awarded with a grant from the National Medical Research Council (NMRC) to use retinal imaging to screen people with cognitive impairment in the community. They are also exploring how RetiPhenoAge might be used to track individual responses to interventions aimed at slowing or preventing cognitive decline and dementia, such as lifestyle modifications, pharmacological treatments, and other therapeutic approaches.

This research is supported by the Singapore Ministry of Health through the National Medical Research Council (NMRC) Office, MOH Holdings Pte Ltd under the NMRC Clinician Scientist Award (NMRC/CSASI/0007/2016), NMRC Clinician Scientist – Individual Research Grant (NMRC/CIRG/1485/2018), NMRC Singapore Translational Research Investigator Award (MOH-000707), NMRC Centre Grant (NMRC/CG/M009/2017), NMRC Research Training Fellowship (MOH-001403), and the National Research Foundation, Singapore (NRF) under

[1] https://www.thelancet.com/commissions-do/dementia-prevention-intervention-and-care
[2] https://www.healthhub.sg/a-z/medical-and-care-facilities/diabetic-retinal-photography.

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For media enquiries, please contact:

Olivia CHOO
Communications Executive
Yong Loo Lin School of Medicine,
National University of Singapore
DID: +65 9056 7410
Email: medv4000@partner.nus.edu.sg

About National University of Singapore (NUS)

The National University of Singapore (NUS) is Singapore's flagship university, which offers a global approach to education, research, and entrepreneurship, with a focus on Asian perspectives and expertise. We have 15 colleges, faculties, and schools across three campuses in Singapore, with more than 40,000 students from 100 countries enriching our vibrant and diverse campus community. We have also established more than 20 NUS Overseas Colleges entrepreneurial hubs around the world.

Our multidisciplinary and real-world approach to education, research and entrepreneurship enables us to work closely with industry, governments, and academia to address crucial and complex issues relevant to Asia and the world. Researchers in our faculties, research centres of excellence, corporate labs and more than 30 university-level research institutes focus on themes that include energy; environmental and urban sustainability; treatment and prevention of diseases; active ageing; advanced materials; risk management and resilience of financial systems; Asian studies; and Smart Nation capabilities such as artificial intelligence, data science, operations research, and cybersecurity.

For more information on NUS, please visit http://www.nus.edu.sg/

About the NUS Yong Loo Lin School of Medicine (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 2025 by subject and the Quacquarelli Symonds (QS) World University Rankings by subject 2025).

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

About the National Medical Research Council (NMRC)

The NMRC was established in 1994 to oversee research funding from the Ministry of Health and support the development and advancement of biomedical research in Singapore, particularly in the public healthcare clusters and medical schools. NMRC engages in research strategy and planning, provides funding to support competitive research grants and core research enablers, and is responsible for the development of clinician scientists through awards and fellowships. The council's work is supported by the NMRC Office which is part of MOH Holdings Pte Ltd. Through its management of the various funding initiatives, NMRC promotes healthcare research in Singapore, for better health and economic outcomes.

About the National Research Foundation (NRF)

The National Research Foundation, Singapore (NRF), set up on 1 January 2006, is a department within the Prime Minister's Office. The NRF sets the national direction for research and development (R&D) by developing policies, plans and strategies for research, innovation and enterprise. It also funds strategic initiatives and builds up R&D capabilities by nurturing research talent. Learn more about the NRF at www.nrf.gov.sg.