ECG tests may someday be used by AI model to detect premature aging and cognitive decline

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Research Highlights:

An artificial intelligence (AI) model designed to predict a person’s biological age (age of body cells and tissues) based on electrocardiogram (ECG) data found a strong association between ECG-age and cognitive performance.

In an analysis of more than 63,000 people in the United Kingdom, those with accelerated ECG aging had lower cognitive test scores than those with normal aging.

Note: The study featured in this news release is a research abstract. Abstracts presented at the American Heart Association’s scientific meetings are not peer-reviewed, and the findings are considered preliminary until published as full manuscripts in a peer-reviewed scientific journal.

Embargoed until 4 a.m. CT/5 a.m. ET, Thursday, Jan. 30, 2025

DALLAS, Jan. 30, 2025 — Electrocardiogram tests may someday be used with an artificial intelligence (AI) model to detect premature aging and cognitive decline, according to a preliminary study to be presented at the American Stroke Association’s International Stroke Conference 2025. The meeting is in Los Angeles, Feb. 5-7, 2025, and is a world premier meeting for researchers and clinicians dedicated to the science of stroke and brain health.

Stroke can contribute to age-related cognitive decline, affecting quality of life and functioning. An electrocardiogram (ECG) measures the electrical activity of the heartbeat. With each beat, an electrical impulse (or “wave”) travels through the heart. Researchers designed an AI model, termed deep neural network (DNN), to predict people’s biological age (age of body cells and tissues) from their ECG data.

“Unlike chronological age, which is based on years lived, ECG-age reflects the functional status of the heart and potentially the entire organism at the tissue level, providing insights into aging and health status,” said Bernard Ofosuhene, B.A., lead author of the study and clinical research coordinator in the department of medicine at the UMass Chan Medical School in Worcester, Massachusetts.

Previous research has found that ECG-age can help predict heart disease and death. Before this new study, little was known about ECG-age’s relationship to cognitive impairment.

Researchers analyzed data from more than 63,000 participants in the UK Biobank, a large and ongoing study of more than 500,000 volunteers from the United Kingdom who enrolled when they were between 40 and 69 years old. Participants underwent a battery of cognitive tests. Cognitive performance was analyzed during assessment visits to align with the timing of ECG testing and the artificial intelligence model was used to determine their ECG-age. This approach ensured that the cognitive data accurately captured the participants’ cognitive status at the same time their ECG age was estimated.

Based on the ECG-age results in comparison to their actual ages, participants were divided into three groups: normal aging, accelerated ECG-aging (older than their chronological age), and decelerated ECG-aging (younger than their chronological age).

The analysis found that compared with the normal aging group, based on ECG-age, those:

younger than their chronological age group performed better on 6 of 8 cognitive tests.

older than their chronological age group performed worse on 6 of 8 cognitive tests.

“There is a lot of ECG-data available for stroke treatment and I encourage health care professionals to use this data to look for signs of cognitive decline. Doing so may help with early diagnosis and timely intervention,” Ofosuhene said.

The study has several limitations. Because the analysis was conducted on people between the ages of 43 and 85 (ages of the UK Biobank subset analyzed), it is unclear whether the findings apply to other ages. This cross-sectional study, with all measures taken at the same time, does not provide information about changes in cognitive function over time. Results from this study on UK Biobank participants may not be generalizable to other populations.

“In future research, we aim to investigate whether gender differences affect the relationship between ECG-age and cognitive performance. Additionally, considering that most of UK Biobank participants are of European ancestry, we are interested in determining if our findings can be replicated in more diverse populations,” Ofosuhene said.

“Researchers increasingly recognize the strong connection between heart and brain health. This study shows that when AI analyzes ECG data, a higher biological age is linked to poorer cognitive performance. Using ECG data to assess cognitive ability seems like a futuristic idea. If this study is validated, it could have several important outcomes. For instance, ECG data collected in a doctor's office or remotely with wearables could help assess cognition at home or in rural areas lacking neuropsychiatric specialists. Additionally, using ECG data and AI might be quicker and more objective than traditional neuropsychological assessments. However, one important question remains: can ECG data predict future cognitive decline? Answering this could lead to valuable treatments since some ECG issues can be fixed,” said Fernando D. Testai, M.D., Ph.D., FAHA, chair of the October 2024 American Heart Association scientific statement Cardiac Contributions to Brain Health and professor of neurology and rehabilitation at the University of Illinois College of Medicine in Chicago. Testai was not involved in the study.

Study details, background or design:

Researchers analyzed 63,800 participants (average age 65, 52% women) from August 2023 to July 2024. Most participants were of white European descent in the UK Biobank, a large and ongoing study of more than 500,000 volunteers in the United Kingdom who enrolled between 2006 and 2010.

Biobank participants were excluded from this study if ECG or cognitive data were missing or invalid.

There were 15,563 adults in the normal aging group, 24,671 participants in the accelerated aging group and 23,566 people in the decelerated aging group.

Eight cognitive tests were analyzed for this study. Some participants in the UK Biobank underwent more testing. Results of the cognitive tests were compared between the three groups after adjusting for chronological age, sex and education level.

Co-authors, disclosures and funding sources are listed in the manuscript.

Statements and conclusions of studies that are presented at the American Heart Association’s scientific meetings are solely those of the study authors and do not necessarily reflect the Association’s policy or position. The Association makes no representation or guarantee as to their accuracy or reliability. Abstracts presented at the Association’s scientific meetings are not peer-reviewed; rather, they are curated by independent review panels and are considered based on the potential to add to the diversity of scientific issues and views discussed at the meeting. The findings are considered preliminary until published as a full manuscript in a peer-reviewed scientific journal.

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Additional Resources:

Multimedia is available on the right column of the release link

Link to poster abstract WMP15; and ASA International Stroke Conference 2025 Online Program Planner

AHA news release: Heart healthy behaviors may help reverse rapid cell aging (May, 2024)

AHA news release: Following “Life’s Essential 8” checklist may slow biological aging by 6 years (Nov., 2023)

AHA news release: Higher cardiovascular health may partially offset increased genetic risk for stroke (July 2022)

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