**Heart disease risk associated with electrocardiogram-estimated age**

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Honghuang Lin, PhD

A standard 12-lead electrocardiogram (ECG) can predict biological age and risk of death and cardiovascular disease, according to a new study led by Honghuang Lin, PhD, professor of medicine and co-director of the Program in Digital Medicine at UMass Chan Medical School. Biological age, measured by ECG (defined as ECG-age), looks at the relative health of a patient’s cardiovascular system rather than a patient’s chronological age.

The study was published online in *[Circulation: Cardiovascular Quality and Outcomes](https://www.ahajournals.org/doi/10.1161/CIRCOUTCOMES.122.009821" \o "Association Between Electrocardiographic Age and Cardiovascular Events in Community Settings: The Framingham Heart Study)*.

“When ECG-age is higher than chronological age, you can quantify how your lifestyle can change your risk,” said Dr. Lin. For example, if a person who is 55 years old has an ECG-age of 65, they might adopt a healthier lifestyle, like performing regular physical exercise or quitting smoking, to lower their ECG-age.

The new study expands what was previously known about how well deep neural network machine-learning models estimate age in large health care databases from diverse populations. However, existing studies were limited to relatively short observation periods in health care settings.

The current study tested the association between ECG-age and death and cardiovascular outcomes over 35 years in the community-based Framingham Heart Study. Nearly 35,000 ECG records from 9,877 Framingham Heart Study participants were included.

The Framingham Heart Study originally recruited participants in 1948. It includes three generations of participants. All participants since 1986 have routinely received computerized ECGs during research center visits every four to eight years, according to Lin.

The study found that having an ECG-age higher than chronological age was related to a higher risk of atrial fibrillation, myocardial infarction, heart failure and death, whereas having an ECG-age lower than chronological age was associated with decreased risk of adverse cardiac events and death.

With an average of 17 years of follow-up, it was found that every 10-year increase of ECG-age over chronological age was associated with an 18 percent increase in mortality from all causes; 23 percent increase in atrial fibrillation risk; 14 percent increase in myocardial infarction risk; and 40 percent increase in heart failure risk. On the other hand, participants with ECG-age younger than chronological age had a 16 percent decrease in all-cause mortality.

Lin said the study demonstrated that ECGs, which are low cost and widely available even in areas accessible only through telemedicine, have the potential to be used for determining biological age, a scalable marker of cardiovascular risk.

He said work is ongoing to assess other readily available technologies to monitor health and aging, including devices like smartwatches, fitness trackers and even [toilet seats](https://www.umassmed.edu/news/news-archives/2023/06/umass-chan-digital-medicine-study-uses-smart-toilet-seat-to-monitor-heart-health/" \o "UMass Chan digital medicine study uses smart toilet seat to monitor heart health ) with special sensors.

“We hope we can use digital technology to have better health, so you don’t have to go to a doctor for everything. You can monitor your health at home,” said Lin.