**AI Plus ECG Data Determines Biological Heart Age and Health Risk**

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Biological age trumps chronological age when it comes to predicting risk of death and major cardiovascular risk, and now researchers have used AI and ECG data to estimate the heart’s biological age.

“Our research showed that when the biological age of the heart exceeded its chronological age by seven years, the risk of all-cause mortality and major adverse cardiovascular events increased sharply,” explained Yong-Soo Baek, associate professor at Inha University Hospital, in South Korea. “Conversely, if the algorithm estimated the biological heart as seven years younger than the chronological age, that reduced the risk of death and major adverse cardiovascular events.”

The study was presented at [EHRA 2025](https://www.escardio.org/Congresses-Events/EHRA-Congress/Registration?utm_source=google&utm_medium=ppc&utm_campaign=ehra2025&gad_source=1&gclid=Cj0KCQjwna6_BhCbARIsALId2Z0VkqOnSZeBgVg5VvjRFDKkkb8UwUu0oN-x3OyCJtuiNJTB7g1Zv1QaAroxEALw_wcB), a scientific congress of the European Society of Cardiology (ESC). It demonstrated that by using AI to analyze standard 12-lead electrocardiograph (ECG) data taken from almost half a million cases, they were able to create an algorithm to predict the biological age of the heart. This algorithm could be used to identify those most at risk of cardiovascular events and mortality.

Their work, they believe, shows that the integration of AI into clinical diagnostics presents novel opportunities for enhancing predictive accuracy in cardiology. “Using AI to develop algorithms in this way introduces a potential paradigm shift in cardiovascular risk assessment,” said Baek.

Cardiac events are difficult to predict but are a major risk of death. According to the [Cardiac Arrest Foundation](https://www.sca-aware.org/about-sudden-cardiac-arrest/latest-statistics" \t "_blank), there are about 356,000 out-of-hospital cardiac arrests annually in the United States, nearly 90% of them fatal.

For this study, a deep neural network was developed and trained on a dataset of 425,051 12-lead ECGs collected over fifteen years, with subsequent validation and testing on an independent cohort of 97,058 ECGs. Comparative analyses were conducted among age and sex-matched patients differentiated by ejection fraction.

After looking at this data in statistical models, the researchers found that an AI-ECG estimated heart age exceeding the heart’s chronological age by seven years was associated with an increased risk of all-cause mortality by 62% and of major cardiovascular events (MACE) by 92%. In contrast, an AI ECG heart age that was seven years younger than its chronological age reduced the risk of all-cause mortality by 14% and MACE by 27%.

Additionally, subjects with reduced ejection fraction consistently exhibited increased AI ECG heart ages along with prolonged QRS durations, which is the time taken for the heart’s electrical signal to travel through the ventricles, causing contraction.

The authors explained the significance of the observed correlation between reduced ejection fraction and increased AI ECG heart ages, alongside prolonged QRS durations and corrected QT intervals. They said this suggests that AI ECG heart age effectively reflects various cardiac depolarization and repolarization processes. These indicators of electrical remodeling within the heart may signify underlying cardiac health conditions and their association with ejection fraction.

While the study is promising, Baek said, “It is crucial to obtain a statistically sufficient sample size in future studies to substantiate these findings further. This approach will enhance the robustness and applicability of AI ECG in clinical assessments of cardiac function and health.”

He added, “Biological heart age estimated by artificial intelligence from 12-lead electrocardiograms is strongly associated with increased mortality and cardiovascular events, underscoring its utility in enhancing early detection and preventive strategies in cardiovascular healthcare. This study confirms the transformative potential of AI in refining clinical assessments and improving patient outcomes.”