
Artificial Intelligence–Enabled Prediction of Heart Failure Risk



Despite the availability of effective treatments, accessible strategies for [heart failure](#) (HF) risk stratification remain limited. Current clinical risk scores (e.g., PCP-HF, PREVENT, Health ABC) require comprehensive clinical evaluation, which can exclude individuals without access to healthcare. Similarly, biomarker testing (e.g., NT-proBNP, troponins) is often inaccessible due to the need for lab resources.

Given the widespread availability of portable devices capable of recording single-lead ECGs, researchers are exploring their use in cardiovascular screening. Artificial intelligence (AI) has enhanced the ability of single-lead ECGs to detect hidden signs of heart disease, including subclinical left ventricular systolic dysfunction (LVSD).

A novel AI model incorporating noise during training has shown reliable diagnostic performance even with real-world ECG noise. This model, initially developed to detect reduced left ventricular ejection fraction (LVEF), may also identify other signs of dysfunction in patients with preserved LVEF.

A recent study assessed whether an AI algorithm can predict HF risk using noisy single-lead ECGs. Study researchers tested the model in patients undergoing outpatient ECGs in a diverse U.S. health system and in two large population-based cohorts from the U.K. and Brazil.

In the study, lead I ECGs were extracted, and a noise-adapted AI-ECG model—designed to mimic signals from wearable devices and trained to detect LVSD—was applied. Researchers evaluated the association between the model's output and the risk of new-onset HF, defined as the first HF hospitalisation. The model's performance in predicting HF was compared to two established risk scores (PCP-HF and PREVENT) using the Harrell C statistic, integrated discrimination improvement (IDI), and net reclassification improvement (NRI).

The study included 192,667 patients from YNHHS, 42,141 participants from the U.K. Biobank, and 13,454 from ELSA-Brasil, all with baseline ECGs. Over follow-up periods ranging from 3.1 to 4.6 years, HF developed in 1.9% of YNHHS patients, 0.1% of UKB participants, and 0.2% of ELSA-Brasil participants. A positive AI-ECG result for LVSD was linked to a 3–7 times higher risk of developing HF, with each 0.1 increase in the AI model's probability associated with a 27%–65% higher hazard, independent of other risk factors.

Higher AI-ECG probabilities corresponded with progressively greater risk, and the model consistently outperformed traditional risk scores (PCP-HF and PREVENT) in discrimination, reclassification, and net benefit, though performance varied by cohort.

The growing accessibility of portable ECG devices and the model's compatibility with noisy, wearable-device data suggest feasibility for large-scale, community-based HF screening programmes. This approach may be particularly beneficial in low- and middle-income countries, provided future prospective studies validate its clinical and cost-effectiveness.

Source: [JAMA](#)

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