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Brief Report

BEAT to Treat: Artificial Intelligence–Enabled Point-of-Care Diagnostics for Community-Based Detection and Immediate Management of Heart Failure in a Socioeconomically Deprived UK Population

RAJIV SANKARANARAYANAN, MBBS, FRCP (Lon), FESC, FHFA, PhD[1,2]
NICK HARTSHORNE-EVANS, BEM[3] KATE HORNBY[3] AMY CLARK[4] GAYLE ROOKE, BSc[5]
SHANE KNOTT, MPH[6] FRANCES WATKINS, MBBS[4]
MATTHEW ASHTON, FFPH, FRSPH, FRCP[6] and CAROLYN S.P. LAM, MBBS, PhD[7]

Liverpool and Preston, United Kingdom; and Singapore

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Introduction

Heart failure (HF) affects more than 64 million people globally and remains a leading cause of hospitalization and mortality.[1] Delayed diagnosis is common, and many patients first receive a diagnosis during an emergency hospital admission, by which time opportunities for earlier initiation of guideline-directed medical therapy (GDMT) may already have been missed. These challenges often are amplified in socioeconomically deprived populations, in whom barriers to access, lower health literacy, and competing social needs may delay presentation and investigation.[2]

Early diagnosis of HF in the community often is limited by lack of timely access to specialized diagnostic tools such as point-of-care testing natriuretic peptide testing and echocardiography. Recent studies suggest that point-of-care testing and artificial intelligence (AI)-enabled mobile echocardiographic pathways may facilitate task-sharing and accelerate the detection of cardiac dysfunction outside conventional specialist settings.[3–6] However, the integration of AI-enabled point-of-care testing into community-based HF care pathways remains limited.

We have previously demonstrated the benefits of BEAT-HF (Breathlessness Exhaustion Ankle swelling Time to check NTproBNP for Heart Failure) healthy heart mass testing events in terms of detecting hypertension, atrial fibrillation (AF), and HF.[7] Here, we report a real-world, neighborhood-based intervention combining AI-assisted echocardiography (US2.AI, Singapore), point-of-care biomarker testing, and immediate treatment initiation ("BEAT to Treat"[8]) in a high-risk population. The aim was to assess feasibility, immediate clinical yield, and the potential relevance of this model in reducing cardiovascular health inequalities.

Methods

Setting and Population

A community cardiovascular testing event was conducted on March 6, 2026, in Speke, South Liverpool, United

From the [1]University of Liverpool, University Hospitals of Liverpool Group, Heart Failure Lead Cheshire & Merseyside ICB, Aintree University Hospital, Liverpool, United Kingdom; [2]Liverpool Centre for Cardiovascular Sciences, University of Liverpool, Liverpool, United Kingdom; [3]Evans BEM Honorary Doctorate Glasgow Caledonian University, Patient Expert and CEO The Pumping Marvellous Foundation, Preston, United Kingdom; [4]SWAGGA Primary Care Network, Liverpool, United Kingdom; [5]Cheshire and Merseyside ICB, Liverpool, United Kingdom; [6]Liverpool City Council, Liverpool, United Kingdom and [7]National Heart Centre Singapore and Duke-National University of Singapore, Singapore.

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Reprint requests: Rajiv Sankaranarayanan, MBBS, FRCP (Lon), FESC, FHFA, PhD, University of Liverpool, University Hospitals of Liverpool Group, Heart Failure Lead Cheshire & Merseyside ICB, Aintree University Hospital, Lower Lane, Liverpool L9 7AL, UK. Tel: +44 7525826672; Fax: +441515292724. E-mail: Rajiv.Sankaranarayanan@liverpoolft.nhs.uk

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Kingdom, by UK's HF patient charity The Pumping Marvellous Foundation in collaboration with primary and secondary care clinicians, volunteers (nursing students from Liverpool John Moore's University), the Liverpool City Council, long-term conditions department of the integrated care board, and preventive health services. Speke is an area located within the top 10% most deprived communities in England. Adults were invited through digital outreach (text messages, social media) and community engagement, with a focus on individuals aged 40 years or older or those with known cardiovascular risk factors such as hypertension or diabetes.

Intervention

The program was delivered through seamless integration of clinical care providers by a multidisciplinary team including primary care clinicians (general practitioner [GP], pharmacist) and secondary care (consultant cardiologist, HF specialist nurses), trained volunteers (20 nursing students from Liverpool John Moore's University, pharmacists), and preventive services (smoking cessation, diabetes teams, lifestyle advice, and social prescribing). The BEAT to Treat community clinical pathway is illustrated in Figure 1.[9] While this pathway is currently being implemented in several centers in the United Kingdom through community outpatient clinics, this work describes the outcomes of the first implementation of the pathway in a one-stop community mass testing event. We have also developed an implementation playbook[9] to enable easy implementation by other health care systems. Participants underwent the following:

- BEAT (Breathlessness, Exhaustion, Ankle swelling, Time for N-terminal pro B-type natriuretic peptide [NT-proBNP]) symptom assessment by trained nursing students[7];
- Blood pressure measurement, pulse rhythm assessment for AF via 30-second 6-lead electrocardiography (AliveCor; Kardia, Mountain View, CA); red-flag symptoms or signs prompting immediate escalation to a cardiologist and consideration of referral to the emergency department included ongoing chest pain, syncope, symptomatic significant hypotension (systolic blood pressure <90 mm Hg), symptomatic bradycardia (heart rate <40 beats/min), or tachycardia (heart rate >130 beats/min)
- Point-of-care NT-proBNP testing (LumiraDx, London, UK);
- AI-assisted echocardiography (Us2.ai), which enabled rapid acquisition and interpretation of images, with specialist oversight by a consultant cardiologist;
- Clinical review and GDMT initiation by an HF specialist nurse with clinical oversight by a GP, pharmacist, and consultant cardiologist; and
- Lifestyle modification advice and social prescribing.

A diagnosis of HF was made in symptomatic attendees on the basis of the National Institute for Health and Care Excellence NTproBNP diagnostic thresholds and the European Society of Cardiology 2021 HF classification of heart failure with reduced ejection fraction, heart failure with preserved ejection fraction (HFpEF), and heart failure with mildly reduced ejection fraction. People with elevated finger-stick (LumiraDx) NT-proBNP (≥400 ng/L as per UK's National Institute for Health and Care Excellence HF diagnostic guidelines) underwent clinical examinations and point-of-care AI-assisted echocardiography (Vscan Air [GE Healthcare, Chicago, IL]; AI reporting by Us2.ai) performed by a trained HF specialist nurse or GP, with images also vetted by the consultant cardiologist who was available during the event. The AI-enabled echocardiographic protocol included AI-automated assessment of chamber dimensions, left and right ventricular structure, systolic and diastolic function, including left atrial size and US2. AI's deep learning pattern recognition for cardiac amyloidosis along with incorporating the conventional echocardiographic red flags. Follow-up was arranged with the cardiology team.

Outcomes

Primary outcomes included (1) new HF diagnoses (classified by phenotype) and (2) new AF diagnoses. Secondary outcomes included (1) immediate initiation of GDMT, (2) escalation to greater levels of care, (3) detection of cardiovascular risk factors (eg, hypertension and diabetes), and (4) engagement with preventive services.

Results

The event was attended by 376 participants. The median age was 67 years (range, 24–92 years; 47% women), 11% were aged 80 years or older, and approximately 10% were from non-White ethnic backgrounds. Elevated blood pressure was identified in 43% of attendees, underscoring a high burden of previously undetected or suboptimally controlled cardiovascular risk.

Seven new cases of AF were identified of 376 participants (1.9%). Anticoagulation was initiated immediately in all eligible participants, with communication to each participant's usual primary care team through the electronic clinical record.

Twenty-four participants underwent point-of-care NT-proBNP testing, and 12 underwent AI-assisted echocardiography. Ten new HF diagnoses were made (10/376 = 2.7%): 7 with HFpEF, 2 with HF with reduced ejection fraction, and 1 with HF with mildly reduced ejection fraction. Two participants with HFpEF had features that raised suspicion for transthyretin cardiac amyloidosis on the basis of AI pattern recognition (US2.AI) for cardiac amyloidosis and were referred for further specialist

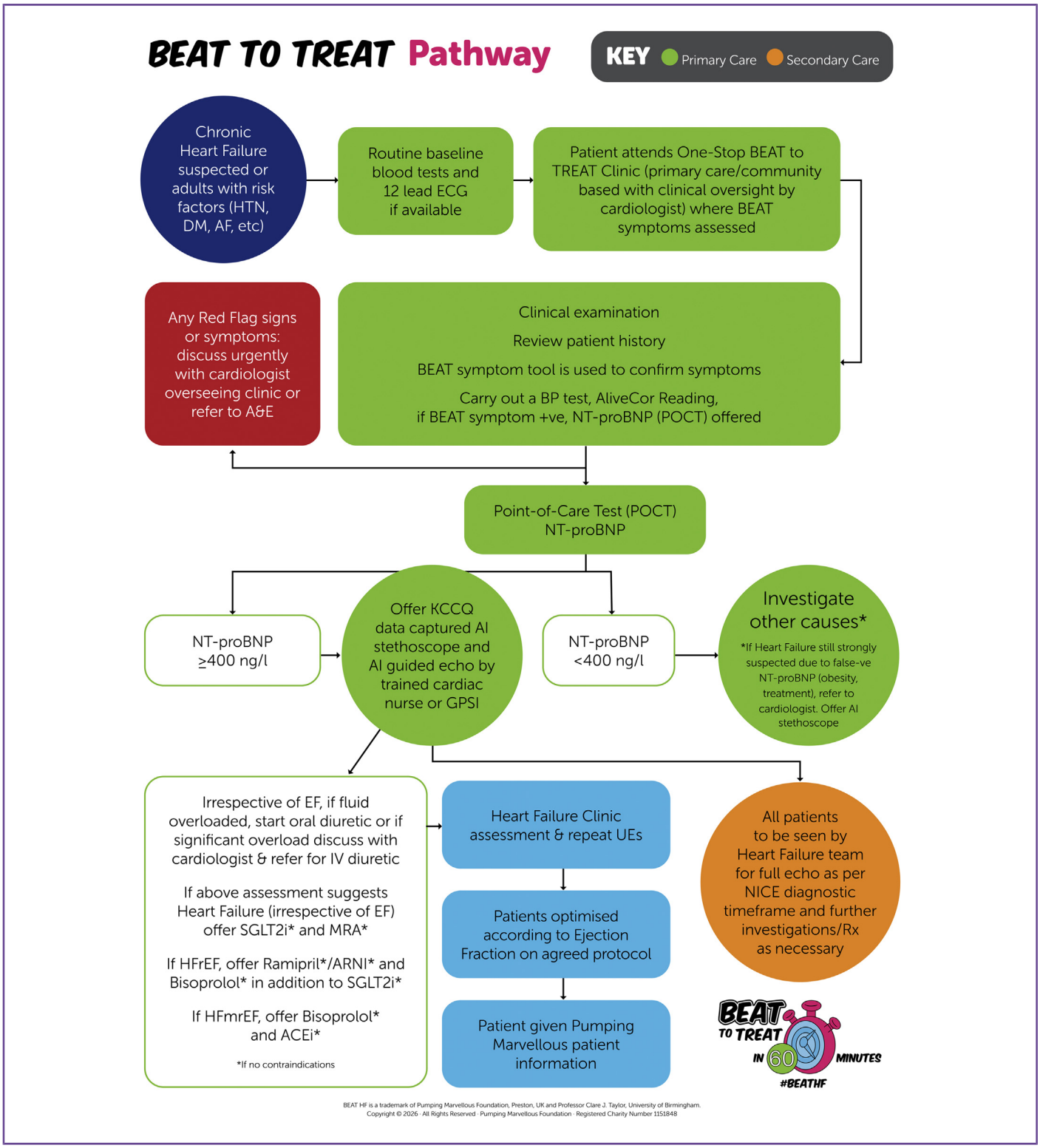


Fig 1. Flowchart illustrating the BEAT to Treat clinical pathway.[9] A&E, accident and emergency department; ACEi, angiotensin-converting enzyme inhibitor; AF, atrial fibrillation; AI, artificial intelligence; ARNI, angiotensin receptor/neprilysin inhibitor; BP, blood pressure; DM, diabetes mellitus, ECG, electrocardiogram; EF, ejection fraction; GPSI, general practitioner with special interest; HFmrEF, heart failure with mildly reduced ejection fraction; HFrEF, heart failure with reduced ejection fraction; HTN, hypertension; IV, intravenous; KCCQ, Kansas City Cardiomyopathy Questionnaire; MRA, mineralocorticoid receptor antagonist; NICE, National Institute for Health and Care Excellence; NT-proBNP, N-terminal pro B-type natriuretic peptide; POCT, point-of-care testing; SGLT2i, sodium-glucose cotransporter-2 inhibitor; UE, Urea, creatinine and electrolytes.

evaluation. GDMT was initiated at the point of diagnosis, and arrangements were made for subsequent specialist follow-up, treatment optimization, and additional investigations according to the standard clinical pathway. One participant with New York Heart Association class III symptoms, marked fluid overload, NT-proBNP of 2800 ng/L, and newly detected AF was escalated on the same day to a telehealth remote monitored acute HF virtual ward for home intravenous diuretic administration, an intervention that likely prevented emergency admission to the hospital. Information was communicated to the patient's usual primary care team using electronic case records. Further follow-up and treatment optimization was also arranged by the HF team including investigations as indicated by the standard clinical pathway.

Preventive Care Integration

Participants were connected to co-located services, including smoking cessation, diabetes prevention, and social prescribing, demonstrating high engagement across multiple health domains. These included the following:

- Smokefree Liverpool: 86 engagements
- The Life Rooms (mental and physical health): 47 engagements
- National Health Service (NHS) Diabetes Prevention Programme: 15 referrals
- NHS Abdominal Aortic Aneurysm Screening Programme: 16 engagements
- NHS Type 2 Diabetes Path to Remission Programme: 11 referrals

This demonstrates the power of co-located neighborhood services to address multiple determinants of cardiovascular health simultaneously.

Discussion

This brief report shows that AI-enabled point-of-care cardiovascular diagnostics can be deployed within a multidisciplinary community event to support early detection and immediate management of HF. A distinguishing feature of the "BEAT to Treat" model is the integration of diagnosis and GDMT within a single encounter in a community setting through a proactive testing model. Delays between symptom onset, diagnosis, and treatment initiation are well documented in HF care and are associated with worse outcomes.[2] Prompt initiation of GDMT has the potential to improve quality of life, prevent hospitalizations, reduce mortality, and yield health care system efficiencies.

AI-assisted echocardiography was central to this model because it enabled timely imaging in a nonhospital environment, with specialist-supported interpretation. In communities where access to formal echocardiography may be constrained by geography, deprivation, or service capacity, this approach may help shift diagnostic capability closer to patients' homes. The model also aligned diagnostic activity with preventive services, showcasing the potential value of neighborhood-based, co-located service delivery in addressing multiple determinants of cardiovascular health within a single encounter and supporting a broader public health approach rather than a narrow disease-specific intervention.

The intervention was intentionally delivered in a socioeconomically deprived neighborhood, where unmet cardiovascular need may be particularly high and conventional care pathways may be less accessible. The findings therefore have relevance beyond feasibility alone: they suggest a possible mechanism by which AI-enabled, community-based cardiovascular services could contribute to reducing inequities in diagnosis and treatment.

Limitations

This was a single-event observational report with a modest sample size, no control group, and no formal assessment of long-term clinical outcomes, treatment persistence, patient-reported outcomes, or cost-effectiveness. In addition, follow-up data remain incomplete, and the extent to which these findings are generalizable to other health systems or community settings is uncertain.

Conclusions

The BEAT to Treat model demonstrates the feasibility of combining AI-assisted echocardiography, point-of-care biomarker testing, and specialist-led treatment decisions within a community cardiovascular screening event. This approach identified previously undiagnosed HF and AF, enabled same-day initiation of prognostic therapy, and linked participants to preventive and supportive services. Larger prospective studies should evaluate clinical outcomes, sustainability, economic impact, and scalability.



Rajiv Sankaranarayanan

Disclosures

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CRediT authorship contribution statement

RAJIV SANKARANARAYANAN: Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **NICK HARTSHORNE-EVANS:** Writing – review & editing, Project administration, Funding acquisition, Conceptualization. **KATE HORNBY:** Writing – review & editing, Project administration, Data curation. **AMY CLARK:** Writing – review & editing, Project administration. **GAYLE ROOKE:** Writing – review & editing, Project administration. **SHANE KNOTT:** Writing – review & editing, Project administration. **FRANCES WATKINS:** Writing – review & editing, Supervision, Project administration. **MATTHEW ASHTON:** Writing – review & editing, Methodology. **CAROLYN S.P. LAM:** Writing – review & editing, Supervision, Software, Resources, Methodology.

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Patient consent

The research reported adhered to the relevant ethical guidelines, and patient consent was obtained.

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