

*Editorial***Artificial Intelligence in Cardiology: How Close Are We to Routine Use**Ibrahim Antoun^{1,2,*}, Riyaz Somani^{1,2}, André Ng^{1,2,3,4,*}¹Department of Cardiology, University Hospitals of Leicester NHS Trust, Glenfield Hospital, LE3 9QP Leicester, UK²Department of Cardiovascular Sciences, Clinical Science Wing, University of Leicester, Glenfield Hospital, LE3 9QP Leicester, UK³Leicester British Heart Foundation Centre of Research Excellence, University of Leicester, LE1 7RH Leicester, UK⁴Cardiovascular Theme, NIHR Leicester Biomedical Research Centre, LE5 4PW Leicester, UK*Correspondence: ia277@leicester.ac.uk (Ibrahim Antoun); andre.ng@leicester.ac.uk (André Ng)

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1. Introduction

Artificial intelligence (AI) is poised to revolutionise cardiology, promising faster diagnoses, predictive insights, personalised treatments, and streamlined workflows. AI algorithms can detect patterns invisible to human clinicians. Yet enthusiasm is tempered by real-world challenges; relatively few AI tools have, so far, entered routine practice [1]. This editorial examines how AI is being applied in clinical cardiology and what the future may hold, with a focus on diagnostics, predictive analytics, treatment planning, and workflow automation.

2. AI in Cardiovascular Diagnostics

AI has demonstrated a remarkable ability to analyse medical images and signals, potentially augmenting cardiac diagnostics. In imaging, deep learning algorithms can interpret echocardiograms, cardiac magnetic resonance (CMR), and computed tomography (CT) scans with speed and accuracy comparable to those of experts. A prime example is the AI-driven HeartFlow analysis for coronary CT angiography. This tool creates a three-dimensional (3D) model of a patient's coronary arteries from a CT scan and uses AI to assess blockages [2]. Notably, the AI analysis can even suggest optimal stent size and placement for a given lesion, aiding interventional planning. Beyond imaging, AI-enhanced electrocardiography is another diagnostic frontier in which algorithms can detect subtle electrocardiogram (ECG) abnormalities (e.g., early signs of cardiomyopathy or arrhythmia) that clinicians might overlook, thereby improving early disease detection [3–5].

3. AI in Predictive Analytics and Risk Stratification

One of AI's most powerful contributions is in predictive analytics, sifting through complex data to forecast outcomes. Machine learning (ML) models can improve cardiovascular risk stratification beyond traditional scores [6], identifying patients who might benefit from preventive treatment while avoiding needless intervention. For instance, researchers developed an AI model that analyses routine 12-lead ECGs to predict a patient's future risk of cardiovascular events and even all-cause mortality [7].

This model was able to accurately flag patients at high risk of developing new or worsening cardiac disease and those at risk of early death, outperforming standard assessments. Such AI-driven risk tools could allow clinicians to intervene earlier. For example, intensifying preventive therapies for a high-risk patient and prioritising the most urgent cases for specialist follow-up. Other predictive uses of AI include forecasting arrhythmias or heart failure decompensation from remote monitoring data, as discussed below. Over time, integrating AI with large-scale patient data (including labs, imaging, and genomics) may enable the creation of patient “digital twins” to simulate disease trajectories and personalise risk-reduction strategies.

4. AI in Treatment Planning and Personalised Care

AI has the potential to enhance clinical decision-making in cardiology by synthesising vast data into actionable insights for treatment planning. In the era of precision medicine, algorithms can integrate an individual's clinical profile, imaging results, and genetic markers to guide therapy tailored to that patient. Emerging research shows that AI systems excel at extracting complex patterns from multi-dimensional data—for example, identifying unique genetic biomarkers linked to cardiovascular disease—which can inform more precise predictive models and treatment plans [8]. In practical terms, this could mean using AI to determine which heart failure patients are most likely to respond to a specific drug, or to design personalised care pathways for post-myocardial infarction (post-MI) patients based on risk of complications. Early applications are already hinting at this potential. For instance, the HeartFlow CT analysis not only diagnoses coronary blockages noninvasively but also helps cardiologists plan interventions by indicating the likely hemodynamic significance of lesions and suggesting stent sizing for optimal outcomes. Likewise, AI decision-support tools are being developed to recommend therapy adjustments (such as medication titration in heart failure or anticoagulation in atrial fibrillation) by continuously learning from patient data and guidelines. As these tools evolve, they could help clinicians navigate complex guidelines and voluminous patient data to deliver truly individualised care.



However, rigorous evidence of improved patient outcomes will be essential.

5. AI in Workflow Automation and Remote Monitoring

Beyond diagnostics and decisions, AI can streamline clinical workflows and extend care beyond the hospital. In the National Health Service (NHS), one immediate impact area is the remote monitoring of patients with chronic cardiac conditions. AI algorithms embedded in cardiac devices and home sensors can continuously watch for early signs of deterioration, alerting clinicians and automating aspects of care. A recent example is the approval of two algorithm-based monitoring tools for heart failure (HeartLogic and TriageHF), which analyse data from patients' implanted pacemakers/defibrillators to detect worsening heart failure before symptoms escalate [9,10]. A study has found that using these AI-driven tools can reduce heart failure hospitalisations by over 70%, as timely alerts prompt clinicians to intervene (for example, adjusting diuretics) before a crisis [11]. In a recent British study (FOOT trial), this wall-mounted device alerted the care team an average of 13 days before a patient's hospital admission for heart failure by flagging increasing fluid in the lower limbs. In effect, it acts as a "virtual nurse", monitoring patients daily and notifying clinicians to take preemptive action [12]. Such AI-enabled remote monitoring systems, alongside wearable sensors (such as smartwatches that detect arrhythmias), could fundamentally shift care toward prevention and early intervention.

AI is also improving workflow efficiency within clinics and hospitals. Pilot programs suggest that "ambient" AI scribe tools can automate documentation (listening to doctor-patient interactions and drafting notes), reducing clerical burden. Similarly, NHS pilots have used AI to optimise administrative workflows—for example, intelligent algorithms to prioritise outpatient waiting lists and triage referrals based on urgency. By automating routine tasks and surveillance, AI can free up clinicians' time to focus on direct patient care, a critical benefit as workforce pressures mount.

6. Challenges and Ethical Considerations

While the promise of AI in cardiology is great, significant challenges and ethical issues must be addressed for widespread adoption. Validation and trust are major concerns as many AI models perform impressively in research settings but lack robust validation in diverse real-world populations [13]. Clinicians are understandably cautious about relying on "black box" algorithms whose reasoning is opaque. Indeed, algorithms that output recommendations without clear explanations can undermine doctors' trust and hinder clinical adoption. The NHS recognises that if we do not proactively ensure transparency, accountability, and fairness, data-driven technologies could even cause

unintended harm [14]. Issues of bias are paramount: AI systems trained on unrepresentative data might systematically underperform for certain groups (e.g., women, ethnic minorities), potentially widening health inequalities if not corrected. Promisingly, the UK's regulatory approach emphasises ethical AI, and the NHS code of conduct for data-driven tech explicitly demands consideration of equity, bias mitigation, and the "explainability" of algorithms. Researchers and developers are urged to be mindful of social context, data privacy, and health equality when designing AI solutions [15].

Data governance and privacy form another cornerstone. High-quality AI outcomes require large datasets, but patient consent and confidentiality must be safeguarded. The UK's strict data protection laws mandate careful handling of patient data, and NHS AI guidelines call for using the minimum necessary data and building privacy-by-design into AI systems [15]. Navigating these requirements can be challenging—for example, combining datasets across hospitals for an AI project requires robust anonymisation and agreements, which slow down development but are essential for public trust.

Another practical hurdle is integration with clinical workflows and electronic health record (EHR) systems. Frontline clinicians will only adopt AI tools that readily fit into their routine. Ideally, AI outputs should surface within the existing EHR interface or imaging software they use, not in a separate silo. Many hospitals have legacy information technology (IT) systems, and ensuring compatibility (interoperability standards, data format alignment) is non-trivial. NHS digital strategy highlights open standards and interoperability to enable new AI solutions to "communicate easily with existing national systems". Without seamless integration, even the best algorithm might sit unused. Relatedly, there is a need for training the workforce to use AI tools appropriately—clinicians must understand an AI's role and limitations (for instance, an AI risk score is a decision-support aid, not an infallible oracle). Developing a culture of human-AI collaboration will be key, wherein physicians oversee AI recommendations and retain ultimate responsibility for patient care. Importantly, clarifying legal liability is part of building trust: if an AI error contributes to a patient harm, clear frameworks are needed to determine accountability (clinician, hospital, or software provider). Regulators such as the Medicines and Healthcare products Regulatory Agency (MHRA) are updating approval processes for AI-based medical devices, and professional bodies are beginning to issue guidance on the responsible use of AI in practice. Although this editorial focuses on cardiology, similar progress and debates are unfolding across other specialities, including respiratory medicine, diabetes care, and oncology. Many challenges, such as algorithmic bias, explainability, data governance, regulatory oversight, and clinical integration, are common across disciplines. Clinicians and researchers should therefore learn collaboratively

from emerging experience across specialities, rather than developing solutions in isolated silos. Cross-speciality dialogue and shared governance frameworks will be critical to ensure safe, efficient, and equitable adoption of AI across healthcare.

7. Future Prospects and the UK Policy Landscape

Looking ahead, the potential for AI in cardiology is immense. We are entering an era in which routine care may include AI algorithms that continuously learn from vast NHS datasets and each patient's own health signals. The UK is positioning itself at the forefront of this transformation. The government's NHS Long-Term Plan and the new 10-Year Health Plan for England place digital and AI at the heart of healthcare reform. Such initiatives indicate strong top-down support for AI and align hospital incentives to implement technologies proven to add value.

In cardiology specifically, we can expect AI to become increasingly embedded in care pathways. Future cardiac imaging suites may routinely include AI "co-pilots" that pre-analyse scans (echocardiograms, CTs, magnetic resonance imagings (MRIs)) and provide initial reports or flag abnormalities for the cardiologist's review. General practitioners (GPs) and cardiologists may use AI risk calculators that update in real time as new patient data arrive, prompting earlier interventions for patients at risk. Wearable sensors and smart home devices, when paired with AI, will enable a shift to proactive management of chronic cardiac conditions, intervening with medication adjustments or virtual visits before a patient becomes acutely ill. Moreover, as AI helps integrate genomic profiling into cardiology, truly personalised cardiac care plans (e.g., tailoring a hypertension treatment regimen based on a patient's genetic metabolism profile and lifestyle data) could become a reality [8]. Importantly, these advances could help the NHS cope with rising demand by improving efficiency: AI might reduce unnecessary clinic visits (e.g., by monitoring patients remotely and bringing them in only when needed) and assist clinicians in managing larger caseloads by automating routine analyses. To ensure sustainable adoption of AI in cardiology, education must begin at the undergraduate level. Medical curricula should incorporate foundational concepts in data science, machine learning, and algorithmic decision support, alongside training in bias recognition, model limitations, and ethical governance. Early exposure will enable future clinicians to evaluate AI outputs critically, integrate decision-support tools into clinical reasoning, and maximise patient benefit while maintaining clinical accountability.

Key Points

- AI already supports cardiology diagnostics, ECG interpretation, imaging analysis, risk prediction, and remote monitoring.

- Machine learning improves risk stratification and enables more personalised treatment decisions.
- AI-driven automation and remote monitoring can reduce workload and prevent hospitalisations.
- Major barriers include limited real-world validation, bias, poor explainability, data governance, and workflow integration.
- Ethical regulation and clinician training are essential for safe routine adoption.

Availability of Data and Materials

Not applicable.

Author Contributions

IA, AN and RS designed the work. IA wrote the first draft. AN and RS revised the manuscript critically for important intellectual content. All authors approved the final version of the manuscript. All authors agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

Not applicable.

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Conflict of Interest

The authors declare no conflict of interest.

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