

## Supplementary material

### 1. Overview of the Search

The systematic literature search was conducted independently by two reviewers (A.P. and S.S.) across three electronic databases: PubMed, the Cochrane Library (CENTRAL), and ScienceDirect. The search was conducted from database inception through March 2025. All searches were executed on the same day and results were exported to a reference management tool (Zotero) for deduplication and screening.

### 2. PICOS Framework

PICOS Element	Definition
Population (P)	Patients with confirmed cardiovascular diseases (CVDs), including acute coronary syndrome, acute myocardial infarction, coronary artery disease, atrial fibrillation, essential hypertension, and pulmonary arterial hypertension.
Intervention (I)	Application of machine learning (ML) or artificial intelligence (AI) models integrated with microRNA (miRNA) expression profiles for diagnostic purposes.
Comparison (C)	Traditional (non-ML) methods for miRNA analysis, or no comparator intervention.
Outcomes (O)	Diagnostic performance metrics of ML-based miRNA models (accuracy, sensitivity, specificity, AUC-ROC) in diagnosing or differentiating CVDs.
Study Design (S)	Primary studies: randomised controlled

	trials, experimental studies, and observational studies with original data.
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**3. Core Search String**

The following conceptual search string was used across all databases and adapted to each database’s specific syntax:

("Machine Learning" OR "Artificial Intelligence" OR "Deep Learning" OR "Neural Network") AND ("MicroRNA" OR "miRNA" OR "micro-RNA" OR "miR") AND ("Cardiovascular Disease" OR "Hypertension" OR "Heart Failure" OR "Atherosclerosis" OR "Acute Coronary Syndrome" OR "Myocardial Infarction" OR "Coronary Artery Disease" OR "Atrial Fibrillation" OR "Pulmonary Hypertension")

**4. Database-Specific Search Strategies**

**4.1 PubMed**

((("Machine Learning"[MeSH Terms] OR "Machine Learning"[tiab] OR "Artificial Intelligence"[MeSH Terms] OR "Artificial Intelligence"[tiab] OR "Deep Learning"[tiab] OR "Neural Networks, Computer"[MeSH Terms] OR "Neural Network"[tiab]) AND ("MicroRNAs"[MeSH Terms] OR "miRNA"[tiab] OR "microRNA"[tiab] OR "miR"[tiab] OR "micro-RNA"[tiab]) AND ("Cardiovascular Diseases"[MeSH Terms] OR "cardiovascular disease"[tiab] OR "Myocardial Infarction"[MeSH Terms] OR "myocardial infarction"[tiab] OR "Acute Coronary Syndrome"[MeSH Terms] OR "acute coronary syndrome"[tiab] OR "Coronary Artery Disease"[MeSH Terms] OR "coronary artery disease"[tiab] OR "Hypertension"[MeSH Terms] OR "hypertension"[tiab] OR "Heart Failure"[MeSH Terms] OR "heart failure"[tiab] OR "Atrial Fibrillation"[MeSH Terms] OR "atrial fibrillation"[tiab] OR "Pulmonary Hypertension"[MeSH Terms] OR "pulmonary hypertension"[tiab] OR "Atherosclerosis"[MeSH Terms] OR "atherosclerosis"[tiab]))

**4.2 Cochrane Library (CENTRAL)**

((("Machine Learning" OR "Artificial Intelligence" OR "Deep Learning" OR "Neural Network") AND ("microRNA" OR "miRNA" OR "miR" OR "micro-RNA") AND ("cardiovascular disease" OR "myocardial infarction" OR "acute coronary syndrome" OR

"coronary artery disease" OR "hypertension" OR "heart failure" OR "atrial fibrillation" OR "pulmonary hypertension" OR "atherosclerosis")) in Title, Abstract, Keywords

#### **4.3 ScienceDirect**

Title, abstract, keywords: (machine learning OR artificial intelligence OR deep learning) AND (microRNA OR miRNA OR miR) AND (cardiovascular disease OR myocardial infarction OR acute coronary syndrome OR coronary artery disease OR hypertension OR heart failure OR atrial fibrillation OR pulmonary hypertension)