Artificial intelligence/machine learning (AI/ML) techniques for risk/outcomes prediction in patients with myocardial infarction (MI) – A targeted literature review (TLR)

Abstract ID#: 121792

Rawat C[1], Gutta D[1], **Rai MK[2]**, Gautam R[1]
[1]EVERSANA, Mumbai, India, [2]EVERSANA, Singapore, Singapore

Background

AI/ML and its subtypes are being rapidly developed in cardiovascular diseases (CVDs) research to predict disease risk, incidence, imaging and outcomes.

Application of AI/ML techniques has been suggested to improve the performance of prediction models.

This partnership of AI/ML techniques and humans can improve decisions making accuracy, thus leading to improved patient outcomes.

Objective

This TLR investigated the use of AI/ML techniques to understand the types of AI/ML learning methods as well as outcomes prediction among MI patients in comparison with conventional statistical methods (CSMs).

Methodology

The literature search was conducted using OVID platform to identify studies reporting AI/ML techniques and/or CSMs in patients with MI published from January 2017 to 9th June 2022.

Inclusion criteria were patients with MI or suspected-MI, risk-factor prediction and published as full manuscripts.

Exclusion criteria were population other than MI or mixed population, outcomes other than risk prediction, conference abstracts and non-English articles.

Results

A total of 1755 studies were identified, of which 38 full texts were included for analysis (Fig. 1).

Included studies comprised of patients with MI or suspected-MI aged approx. >40 years. Patients had several comorbidities, commonly being hypertension, diabetes, CKD, CVD, angina and stroke.

In 15 studies (40%), patients were found to be current smokers. Input data in most of the studies was hospital records followed by registry, ECG, CMR images and OMICS (Fig. 2).

The use of AI/ML techniques was reported by nine studies (24%) and CSMs by three (8%), whereas 26 studies (68%) reported both AI/ML and CSM methods.

About 87% of studies reported supervised learning method followed by unsupervised and unspecified methods (Fig. 3).

Risk-prediction models for CVDs was identified as the most common outcome, followed by all-cause mortality, CVD-related mortality, readmission, MACE, non-CVDs and hospitalization. (Fig. 4)

In majority of the studies, AI/ML-based models were reported as superior to CSMs. The best performing supervised learning methods were random forest, boosting, neural network (Table. 1)

Figure 1. PRISMA flow chart

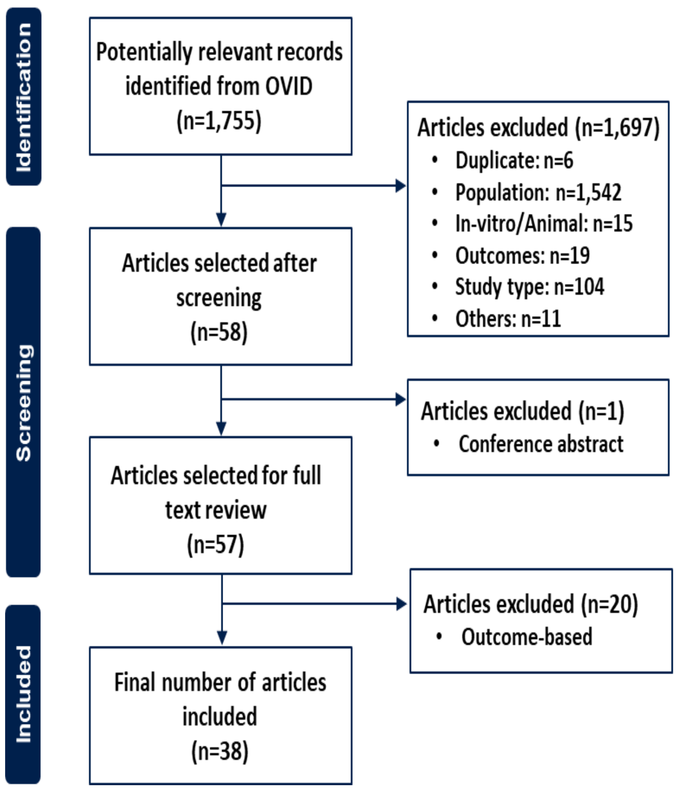


Figure 2. Baseline characteristics

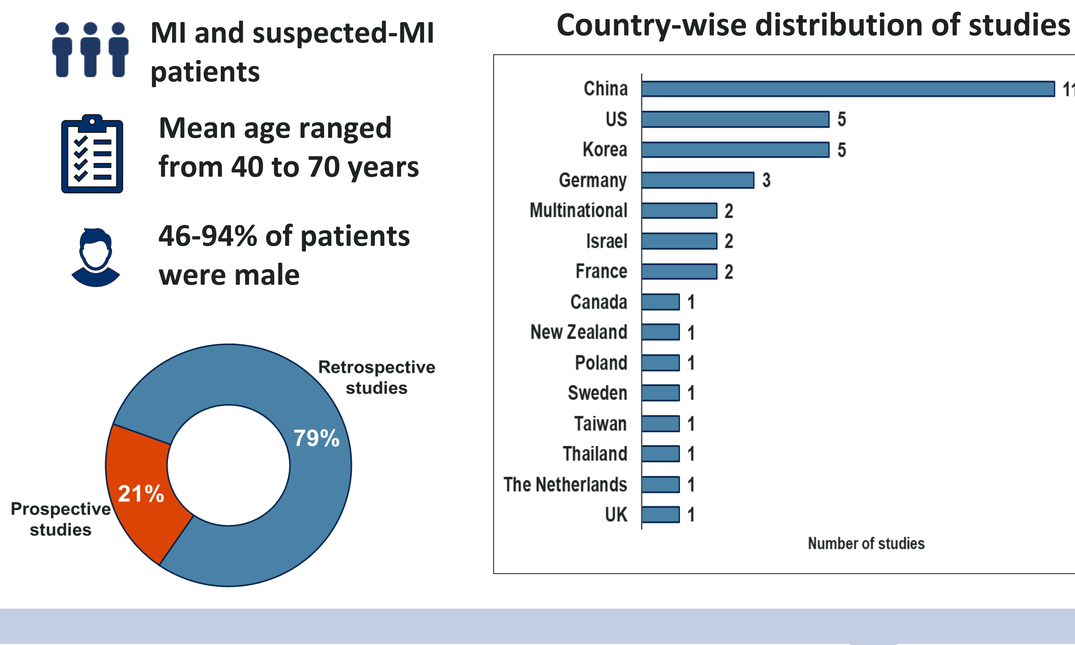
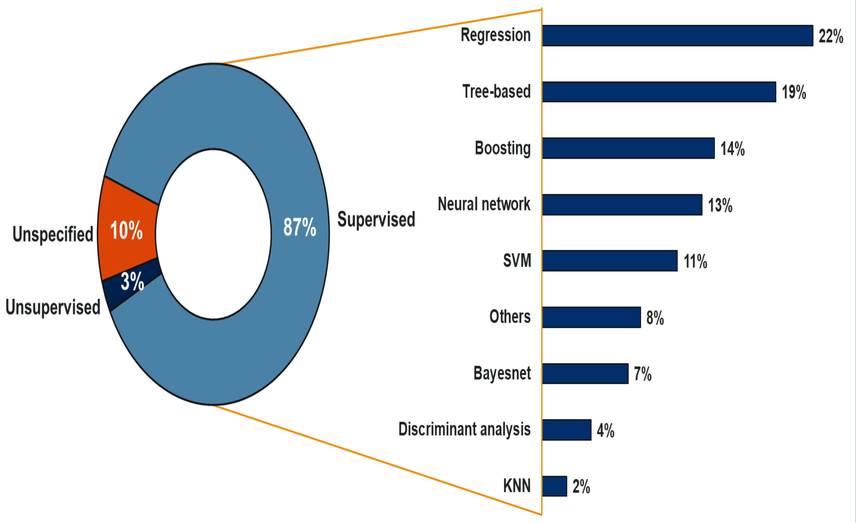


Figure 3. AI/ML learning methods and subtypes of supervised method



*33 studies reported 109 supervised learning methods

Figure 4. Outcomes identified in the included studies

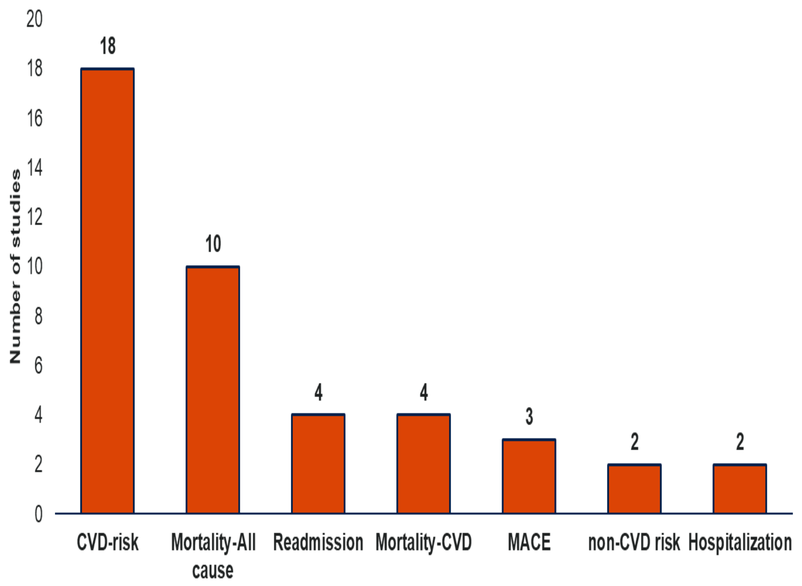


Table 1. Best performing AI/ML supervised learning models based on outcomes

Outcomes/ supervised models	Boosting	LASSO	Regression	Neural Network	Random forest	SVM	Tree-based	Bayesnet
CVD risk	✓✓	✓	✓	✓✓✓✓✓✓✓	✓✓✓✓			
Non-CVD risk					✓	✓		
Mortality-CVD	✓				✓	✓		
Mortality-All cause	✓✓✓				✓✓✓✓✓		✓✓	✓
MACE			✓		✓			
Hospitalization	✓	✓						
Readmission	✓	✓		✓				

✓ = 1 study (the studies are overlapping)

Conclusion

AI/ML is a transformative technology and has immense potential in healthcare domain. Based on this review, we observed that AI/ML-based models demonstrated better performance over CSMs in MI patients.

Given the disparity observed across studies, there is need for reporting standards for AI/ML studies.

Conflict of interest

Rawat C, Gutta D, Rai MK and Gautam R are employees of EVERSANA India.

Abbreviation

Bayesnet, Bayes network; CMR, cardiovascular magnetic resonance; CVD, cardiovascular disease; ECG, electrocardiogram; HER, electronic health record; KNN, k-nearest neighbors ; LASSO, Least Absolute Shrinkage and Selection Operator; MACE, major adverse cardiovascular event; SVM, support vector machine

Reference

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