Comparative Study of Artificial Intelligence-Driven Diagnostic Models and Traditional Risk Scores in Predicting Cardiovascular Events

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Abstract:

Background: Cardiovascular diseases (CVDs) remain the leading cause of mortality globally. Traditional risk scores such as the Framingham Risk Score (FRS) and ASCVD estimator have been widely used to predict cardiovascular events. However, advancements in artificial intelligence (AI) offer the potential for enhanced prediction accuracy by integrating large datasets and identifying complex patterns. This study aimed to compare the predictive performance of AI-based diagnostic models with conventional risk scoring methods in forecasting cardiovascular events.

Materials and Methods: A retrospective cohort of 2,000 patients aged 30–75 years, with no prior history of cardiovascular events, was selected from a tertiary care database. Demographic, clinical, and biochemical data were collected. Three AI models—random forest (RF), support vector machine (SVM), and deep neural networks (DNN)—were developed and trained using 70% of the dataset and tested on the remaining 30%. Performance was compared against the FRS and ASCVD scores. Metrics evaluated included sensitivity, specificity, accuracy, and the area under the receiver operating characteristic curve (AUC).

Results: The DNN model demonstrated the highest predictive performance with an AUC of 0.91, sensitivity of 88.5%, and specificity of 85.2%. The RF model achieved an AUC of 0.87, while SVM reached 0.84. In comparison, the FRS and ASCVD scores yielded AUCs of 0.76 and 0.74, respectively. AI models consistently outperformed traditional scores in correctly identifying high-risk individuals who experienced cardiovascular events over a five-year follow-up period.

Conclusion: AI-driven diagnostic models, particularly deep learning algorithms, significantly surpass traditional risk scores in predicting cardiovascular events. These findings support the integration of AI tools into clinical decision-making to enhance early risk identification and preventive strategies.

Keywords:

Artificial Intelligence, Cardiovascular Risk Prediction, Deep Learning, Framingham Risk Score, ASCVD, Machine Learning, Predictive Modeling.