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## Low-Cost Office-Based Cardiovascular Risk Stratification Using Machine Learning and Focused Carotid Ultrasound in an Asian-Indian Cohort

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### Abstract

This study developed an office-based cardiovascular risk calculator using a machine learning (ML) algorithm that utilized a focused carotid ultrasound. The design of this study was divided into three steps. The first step involved collecting 18 office-based biomarkers consisting of six clinical risk factors (age, sex, body mass index, systolic blood pressure, diastolic blood pressure, and smoking) and 12 carotid ultrasound image-based phenotypes. The second step consisted of the design of an ML-based cardiovascular risk calculator-called "AtheroEdge Composite Risk Score 2.0" (AECRS2.0<sub>ML</sub>) for risk stratification, considering chronic kidney disease (CKD) as the surrogate endpoint of cardiovascular disease. The last step consisted of comparing AECRS2.0<sub>ML</sub> against the currently utilized office-based CVD calculators, namely the Framingham risk score (FRS) and the World Health Organization (WHO) risk scores. A cohort of 379 Asian-Indian patients with type-2 diabetes mellitus, hypertension, and chronic kidney disease (stage 1 to 5) were recruited for this cross-sectional study. From this retrospective cohort, 758 ultrasound scan images were acquired from the far walls of the left and right common carotid arteries [mean age = 55 ± 10.8 years, 67.28% males, 91.82% diabetic, 86.54% hypertensive, and 83.11% with CKD]. The mean office-based cardiovascular risk estimates using FRS and WHO calculators were 26% and 19%, respectively. AECRS2.0<sub>ML</sub> demonstrated a better risk stratification ability having a higher area-under-the-curve against FRS and WHO by ~30% (0.871 vs. 0.669) and ~20% (0.871 vs. 0.727), respectively. The office-based machine-learning cardiovascular risk-stratification tool (AECRS2.0<sub>ML</sub>) shows superior performance compared to currently available conventional cardiovascular risk calculators.

**Keywords:** Cardiovascular disease; Machine learning; Non-laboratory biomarkers; Office-based; Risk assessment; Stroke; and artificial intelligence, "AtheroEdge composite risk score 2.0".

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