Machine Learning vs. ACC/AHA Pooled Cohort Equation Risk Calculator for Detection of High-Risk Asymptomatic Individuals and Recommending Treatment for Prevention of Cardiovascular Events

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Background: Studies have shown that the status quo for atherosclerotic cardiovascular disease (CVD) prediction in the US, using AHA/ACC Pooled Cohort Equation Risk Calculator is inaccurate and results in overtreatment. We used Machine Learning to tackle this problem.

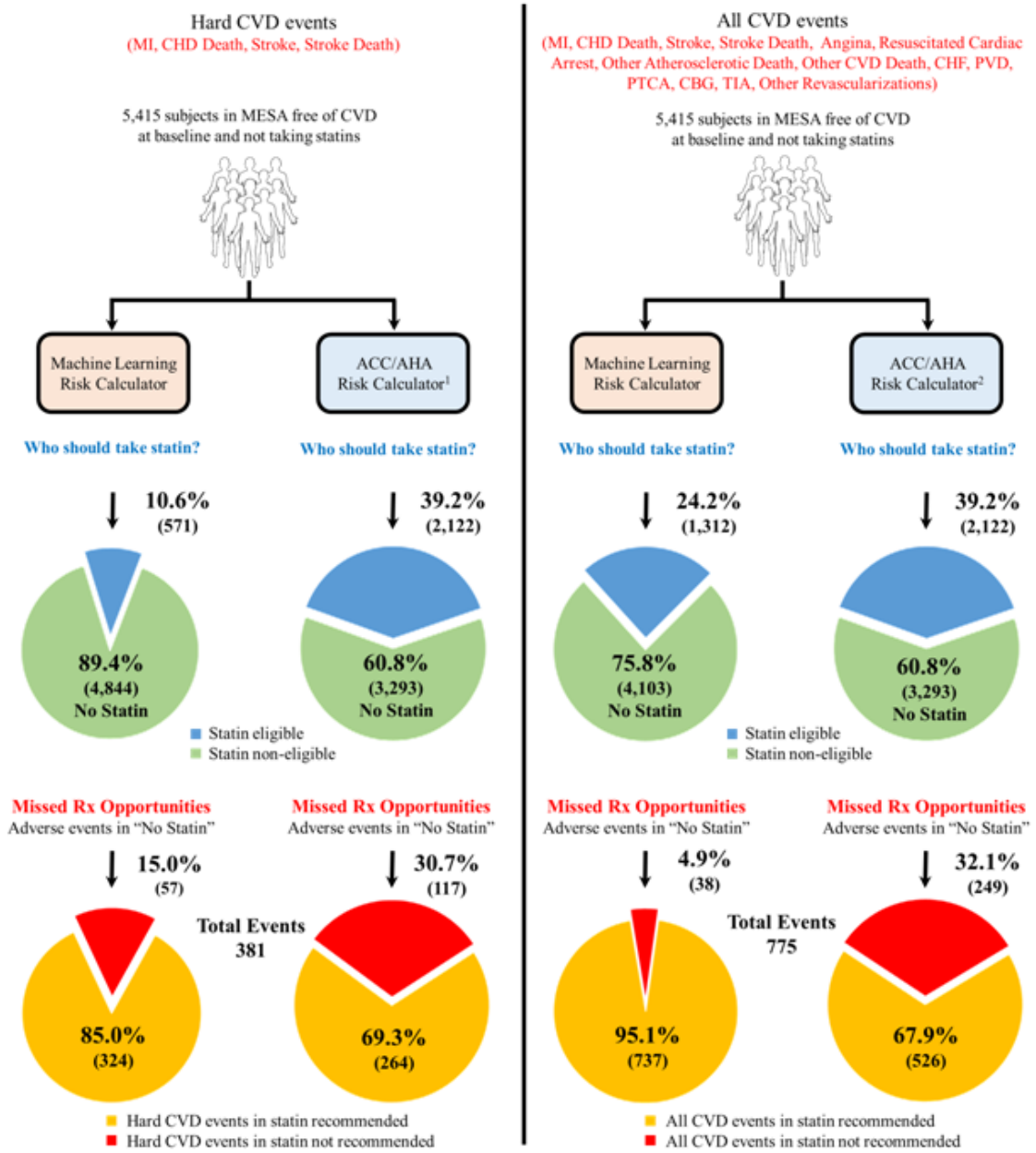
Methods: We developed a ML Risk Calculator using the latest 13-year follow up dataset from MESA (Multi-Ethnic Study of Atherosclerosis) of 6,814 participants who were CVD-free at baseline. We gave identical input to both calculators and then compared their accuracy for recommending statin. We examined 5,415 subjects (age 60.6 ± 9.7 years; 47.3% males) who were not on statin therapy on baseline.

Results: Over 13 years, 775 (14.3%) "All CVD" and 381 (7.0%) "Hard CVD" events occurred. According to ACC/AHA Risk Calculator and a 7.5% 10-year risk threshold for treatment, 39.2% would be recommended to take statin. Despite massive treatment, 30.7% of "Hard CVD" and 32.1% of "All CVD" events occurred in those not recommended statin, resulting in sensitivity (Sn) 0.69, specificity (Sp) 0.63, and AUC 0.72 for "Hard CVD" and Sn 0.68, Sp 0.66, and AUC 0.72 for "All CVD". In contrast, Machine Learning recommended only 10.6% to take statin, and only 15.0% of "Hard CVD" and 4.9% of "All CVD" events occurred in those not recommended statin, resulting in Sn 0.84, Sp 0.95, and AUC 0.92 for "Hard CVD" and Sn 0.95, Sp 0.88, and AUC 0.95 for "All CVD".

Conclusions: Machine Learning outperformed AHA/ACC Pooled Cohort Equation Risk Calculator, recommended less drug therapy and missed fewer events. Further studies are underway to validate these findings in other cohorts. As ML learns more cases and variables including biomarkers and imaging, short-term risk prediction will be within reach.

Who Should Take Statin?

Machine Learning vs. ACC/AHA Pooled Cohort Equation Risk Calculator



1 Statin eligibility threshold ≥ 7.5% 10-year risk

2 AHA/ACC Pooled Cohort Equation Risk Calculator was created for Hard CVD events only

	ΔSn	ΔSp	NRI
Machine Learning vs. ACC/AHA Risk Calculator (Hard CVD Events)	0.15	0.32	0.47
Machine Learning vs. ACC/AHA Risk Calculator (All CVD Events)	0.27	0.22	0.49