Secondary ASCVD Risk Prediction using Electronic Health Record Data

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Background

- New, expensive drugs make predicting future secondary events of atherosclerotic cardiovascular disease (ASCVD) more important.
- The electronic health record (EHR) could make risk prediction more effective and practical.
- We evaluated whether the VA EHR can help predict ASCVD for secondary prevention and compared to a traditional risk score (the TIMI 2°Pr Model).

Methods

- **Data sources:** VA CDW, Medicare, and National Death Index.
- **Outcome:** Fatal or nonfatal myocardial infarction or stroke over 5 years.
- **Population:** All VA ambulatory care patients aged 45-80 in 2009 who had a heart attack or stroke during the prior 5 years.
- **Analysis:**
  - Prediction used elastic net regression with 5-fold cross-validation.
  - Fit statistics were assessed with the testing dataset. Results of the VA Model were compared to the TIMI 2°Pr Model.

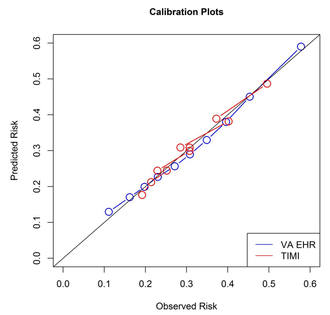
Risk Factors

Traditional Risk Factors	Age, sex, diabetes diagnosis, hypertension diagnosis, hyperlipidemia diagnosis, statin use, BP medication use (0/1), smoking status
Traditional risk factors, vital signs and labs	Blood pressure, total cholesterol:HDL ratio, LDL, atrial fibrillation
ASCVD history	MI, stroke, PAD, CHF, CABG, PCI, peripheral arterial surgery
Cardiovascular procedures	Type of prior procedure (bypass, stent, endarterectomy); location (peripheral, aortic, coronary, carotid); number of cardiac or neurological vessels intervened upon; number of procedures
Less common risk factors	Atrial fibrillation, CKD and eGFR, heart rate
Longitudinal variables	For blood pressure, heart rate, eGFR, and weight we will include longitudinal measures from the prior 5 years (e.g., mean, minimum, maximum, standard deviation, slope)
Other comorbidities	ESRD, Serious Mental Illness, Substance Abuse
Longitudinal changes	Time since last cardiovascular event
Medication use	BP, cholesterol, anticoagulant, diabetes, antidepressant, antipsychotic, antianginal

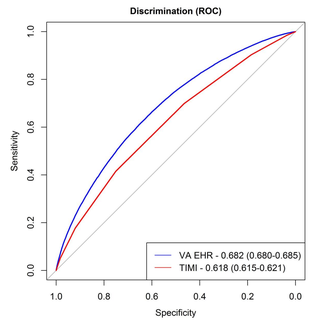
Results

- **Population**: 742,787 participants (726,588 Men and 16,199 Women)
  - 65% Men, 49% Women had prior MI
  - 47% Men, 61% Women had prior Stroke
- 30% Patients had a CV event during 5-year follow-up (30% Men; 24% Women).
- The VA EHR Risk Model had better discrimination and was better calibrated than the TIMI Model.

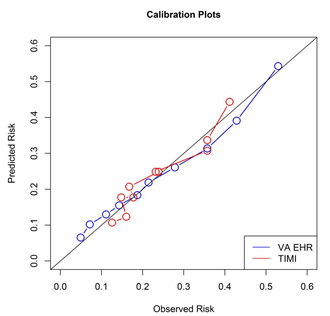
Results: Men



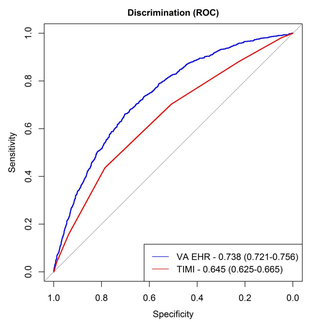
- **Important risk factors:** History of CHF, Afib, CABG, PAD, diabetes, diabetes medications, coronary endarterectomy counts.
- Compared to TIMI, the VA EHR model was slightly better calibrated and had better discrimination.
- The VA EHR had similar discrimination for subgroups (hx MI 0.68; hx Stroke 0.66).



Results: Women



- **Important risk factors:** History of MI, stroke, CHF, Afib, hypertension, number of prior carotid stents, other coronary procedures.
- Compared to TIMI, the VA EHR model was slightly better calibrated and had better discrimination.
- The VA EHR model had slightly worse discrimination for subgroups (hx MI 0.69; hx Stroke 0.70).



Conclusions

- The electronic health record can be used to predict secondary ASCVD events.
- We were able to identify patients with secondary event rates that varied widely, with 20-80th percentile 5-year event rates (18%-45% in men and 10%-36% in women).
- This technique can be calculated entirely within the electronic health record and could be used to stratify medicines for secondary prevention.