



Cardiovascular Disease Risk Model Comparison and Development in HIV-infected Veterans

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Introduction

- Persons infected with HIV have a higher risk of cardiovascular disease (CVD) after adjustment for traditional risk factors.^{1,2}
- Despite this increased risk, HIV is not accounted for in traditional CVD risk calculations or cholesterol guidelines.³

Objective

To evaluate the Pooled Cohort Equations (PCE)³ and the Data Collection on Adverse Events of Anti-HIV Drugs (D:A:D)⁴ model in HIV-infected veterans, and discover a new cardiovascular disease risk prediction model specific to the HIV-infected veteran population.

Methods

- 5-year CVD events in HIV-infected veterans were assessed using the Veterans Affairs (VA) Clinical Case Registry (CCR) from 2005-2010.
- Baseline (1998-2004) laboratory, comorbidity, and medication data were used to determine patient risk scores according to both the PCE and the D:A:D models.
- Exclusion Criteria:
 - Prior history of CVD
 - Already receiving statin
 - Women
- CVD outcomes included myocardial infarction [MI], stroke, death from coronary heart disease, and fatal stroke.
- Kaplan-Meier analyses and ROC curves were used to compare PCE and D:A:D risk models.
- We developed a new model specific to the HIV-infected veteran population using proportional hazards modeling and PCE event definitions.
- Backwards selection was performed using a value of 0.2 for entry; variables with $p \leq 0.05$ were kept.

Table 1: Baseline Characteristics for HIV-Infected Veterans (n=10233)

	Median (IQR) or Count (%)
Age (2004)	49.5 (43.6-55.5)
Black race	4556 (49.3%)
SBP (mm Hg)	128 (118-139)
DBP (mm Hg)	78 (70-85)
Total Cholesterol (mg/dl)	178 (151-207)
HDL-C (mg/dl)	39 (31-49)
LDL-C (mg/dl)	101 (78-126)
Smoking	2329 (22.8%)
CD4 (cells/mm ³)	408 (244-602)
CD4 nadir (cells/mm ³)	202 (97-367)
CDB (cells/mm ³)	885 (611-124)
CD4/CDB ratio	0.44 (0.26-0.72)
HIV Viral Load (log)	2.60 (1.70-3.81)
HCV Coinfection	3604 (39.0%)

Abbreviations: TC: total cholesterol, HDL-C: high density lipoprotein, LDL-C: low density lipoprotein, SBP: systolic blood pressure, DBP: diastolic blood pressure, VL: viral load, HCV: Hepatitis C Virus

Results

Table 2. Univariate and Adjusted Proportional Hazard Models for Cardiovascular Disease Outcomes

	Univariate Analysis			Multivariable Analysis		
	HR	95% CI	p-value	HR	95% CI	p-value
Age (2004)	1.720	(1.535-1.925)	<0.001	1.788	(1.584-2.016)	<0.001
Black race	1.069	(0.852-1.341)	0.563			
SBP	1.195	(1.124-1.268)	<0.001	1.154	(1.087-1.224)	<0.001
DBP	1.057	(1.009-1.086)	0.002			
TC	1.023	(1.000-1.045)	0.043	1.042	(1.018-1.063)	0.001
HDL-C	0.994	(0.987-1.001)	0.125	0.992	(0.985-0.999)	0.036
LDL-C	1.002	(0.999-1.005)	0.135			
Smoking	1.289	(0.999-1.648)	0.047	1.366	(1.055-1.754)	<0.001
CD4	0.973	(0.934-1.013)	0.192			
CD4 nadir	0.941	(0.887-0.996)	0.040	0.944	(0.888-1.000)	0.056
CDB	1.000	(0.980-1.020)	0.967			
CD4/CDB	0.985	(0.766-1.195)	0.895			
HIV VL (log)	1.116	(1.022-1.218)	0.014	1.210	(1.104-1.324)	<0.001
HCV	1.379	(1.102-1.723)	0.005	1.405	(1.114-1.769)	0.004

Summary of Results

- 10,233 male HIV-infected veterans
- 312 (3.05%) five-year CVD events observed
- As shown in Figure 1 (by quintiles of risk score), the PCE and D:A:D models performed similarly for risk of outcome.
- In the new VA model
 - traditional risk factors including age, blood pressure, cholesterol and smoking were associated with increased risk of CVD event.
 - HCV coinfection was associated with 40% increased hazard of CVD event.
 - HIV viral load and lower CD4 nadir were also significantly associated with risk of outcome.
- PCE, D:A:D, and VA models had similar discrimination by ROC curve.

Conclusions

- The PCE and D:A:D models performed similarly for predicting risk of CVD outcome.
- The new VA model takes into account HIV viral load, CD4 nadir, and HCV coinfection, which were significant risk factors for predicting CVD events.
- Yet the new VA model did not demonstrate improvement in discrimination above the PCE or D:A:D models.
- In the veteran population, traditional risk factors and HIV specific risk factors predict CVD events.
- HCV co-infection carries the greatest risk of CVD events; this finding requires further investigation in light of new direct acting antiviral therapies.

Figure 1: Kaplan-Meier survival probabilities by quintile of risk score for PCE, D:A:D, and new VA model

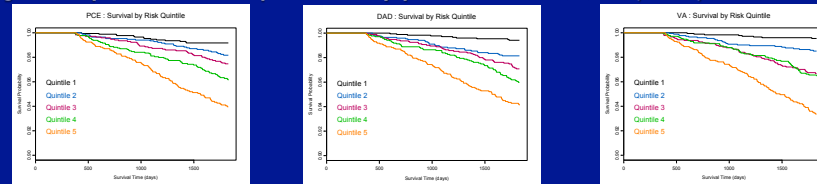
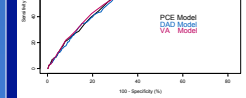


Figure 2: Receiver operating characteristic (ROC) curve for PCE, D:A:D, and new VA models



Limitations

- The D:A:D model incorporates anti-retroviral therapy (ART) as a risk predictor, but we were unable to include ART in our analysis.
- Only male veterans were included in the analysis and thus results may not be generalizable.

References

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