Correlates of Cardiovascular Risk Prediction Calculators in a HIV+ Population

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Introduction

CVD risk functions enable physicians to obtain an prognostic estimate for a future CHD/CVD related incident. HIV has been reported to be associated with higher risk of CVD. Three well-known risk calculators have been critical to elucidate one's susceptibility in obtaining CVD. Blood pressure, cholesterol, BMI, etc. were used to estimate individual risk for CVD. These factors often are not accurate in estimating the risk associated in HIV+ individuals due to variable constraints[1]. Previous readings have explored and focused on Framingham functions for a 5 year risk score analysis with incidences of Coronary Heart Disease (CHD). We seek to compare theses three risk calculators at predicting variables pertaining to an HIV+ population – Global Deficit Scores (GDS), Volumetric Data, CD4, and nadir CD4 Data.

Background

Study Criteria

- Male and Female participants ≥ 30 years old
- Confirmed HIV+ and on cART (combination Antiretroviral Treatment)
- Virologically well controlled (viral load < 400 copies/ mL)

Demographics	All (N=223)
Age (yrs) - mean ± SD	53.7 ± 10.4 (223)
Race/ethnicity - %(n)	
African American	61% (136/223)
Caucasian	37.2% (83/223)
Other	1.8% (4/223)
Sex - %(n)	
Male	75.8% (169/223)
Female	24.2% (54/223)
Education - mean ± SD	13.3 ± 2.7 (221)
CD4 Count - median (Q1, Q3)	556 (404, 802.5)
CD4 Count < 200 cells/mm3 - %(n/N)	7.3% (16/219)
Nadir CD4 Count - median (Q1, Q3)	78 (9, 242.2)
Nadir CD4 Count < 200 cells/mm3 - %(n/N)	66.3% (138/208)
HIV Viral Load < 400 copies/mL - % (n/N)	94% (204/217)
Learning Memory - mean ± SD	1.4 ± 1.6 (218)
Psycho-Motor - mean ± SD	0.5 ± 1.2 (218)
Executive Function - mean ± SD	0.7 ± 1.2 (218)
Global Defict Score - mean ± SD	0.7 ± 1.1 (218)

Table 1: Demographics table denoting age, race, sex, education, lab results, and cognitive scores

Methodology

Cognitive Domains

- **Learning Memory (LM):** Hopkins Verbal Learning Test (HVLT) and HVLT Delayed Recall
- **Executive Function (EF):** Trail-Making Test, Letter Numbering Sequence, Letter and Verb Fluency
- **Psycho-Motor (PM):** Grooved Pegboard dominant and non-dominant hand tests, Trail-Making Test A, Digit Symbol
- **Global Deficit Score (GDS):** Cognition score range from 0 (cognitively normal) to 5 (severe cognitive impairment)

Risk Factors	Risk Calculator Table		
	Framingham CHD	Framingham ASCVD	ACC/AHA ASCVD
Age	✓	✓	✓
Sex	✓	✓	✓
Race	✓	✓	✓
Total Cholesterol (mg/dL)	✓	✓	✓
HDL Cholesterol (mg/dL)	✓	✓	✓
LDL Cholesterol (mg/dL)	✗	✓	✗
Systolic Blood Pressure (mm/Hg)	✓	✓	✓
Diastolic Blood Pressure (mm/Hg)	✗	✓	✓
BMI	✓	✗	✗
Diabetes	✓	✓	✓
Hypertension Medication	✓	✓	✓
Smoking	✓	✓	✓

Table 2: Risk calculator table denoting differences in the variables each functions for

Results

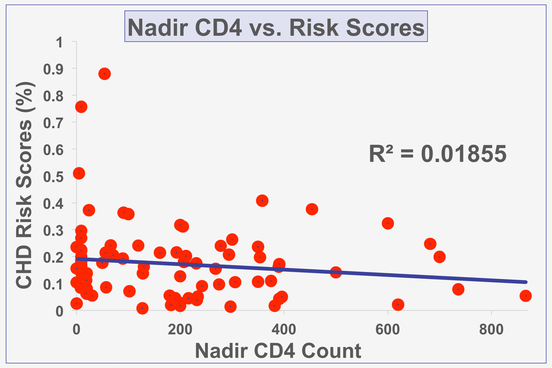

Figure 1: R^2 Analysis of Nadir CD4 Values vs. Framingham CD4 Risk Scores

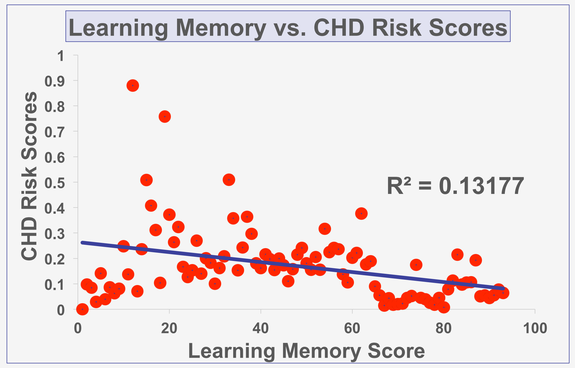

Figure 2: R^2 Analysis of Learning Memory Values vs. Framingham CHD Risk Scores

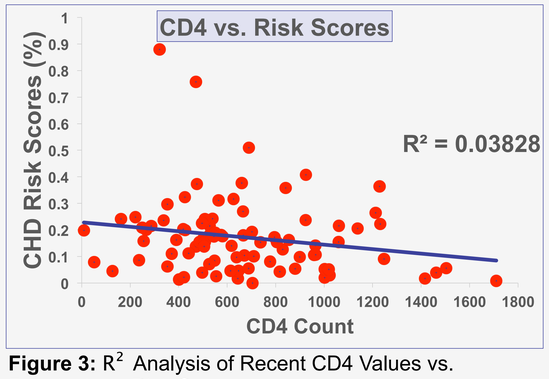

Figure 3: R^2 Analysis of Recent CD4 Values vs. Framingham Risk Scores

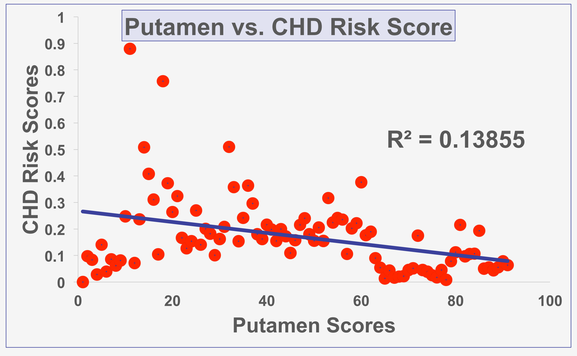

Figure 3: R^2 Analysis of Total Caudate Values vs. Framingham Risk Scores

	Framingham CHD	Framingham ASCVD	ACC/AHA ASCVD
Predicted risk scores based on established functions	17.4% (7.6%, 21.8%)	9.9% (3.6%, 11.8%)	9.9% (3.6%, 11.8%)

Table 3: Percent average risk score(s) from Framingham CHD, Framingham ASCVD, and ACC/AHA ASCVD calculators

Summary & Conclusions

The following conclusions were made:

- Observed risk factors are shown to not be associated with cognitive performance, CD4 values, or volumetric measures.
- CVD may capture independent measures not obtained in typical functions

Limitations:

- Few individuals with significant cognitive impairment
- Limited sample size of 223 participants
- Low variability

Future directions of this study include:

- Accounting for further variables such as depression and stress
- Obtaining a more exhaustive list of already established variables from our cohort
- Increasing the presence of female participants to the dataset
- Evaluating CVD imaging markers i.e. white matter hyper intensities

Acknowledgments

I would like to thank **Dr. Sarah Cooley**, **Dr. Jeremy Strain, Dr. Beau Ances, Elizabeth Westerhaus , and Dr. Dedric Carter** - research scientists at Washington University School of Medicine in St. Louis - for sharing their pearls of wisdom with me during the course of this research by suggesting comments and edits to this poster. Finally, I would like to gratefully acknowledge the financial and professional support of the National Science Foundation under the Missouri Louis Stokes Alliance for Minority Participation, Award No. 1619639.

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Key Terms

CHD denotes Coronary Heart Disease; **ASCVD**, Atherosclerotic Cardiovascular disease; **ACC**, American College of Cardiology; **AHA**, American Heart Association

	Framminghan CHD	Framminghan ASCVD	ACC/AHA ASCVD
Age	✅	✅	✅
Sex	✅	✅	✅
Race	✅	✅	✅
Total Cholesterol (mg/dL)	✅	✅	✅
HDL Cholesterol (mg/dL)	✅	✅	✅
LDL Cholesterol (mg/dL)	❌	✅	❌
Systolic Blood Pressure (mm/Hg)	✅	✅	✅
Diastolic Blood Pressure (mm/Hg)	❌	✅	✅
BMI	✅	❌	❌
Diabetes	✅	✅	✅
Hypertension Medication	✅	✅	✅
Smoking	✅	✅	✅

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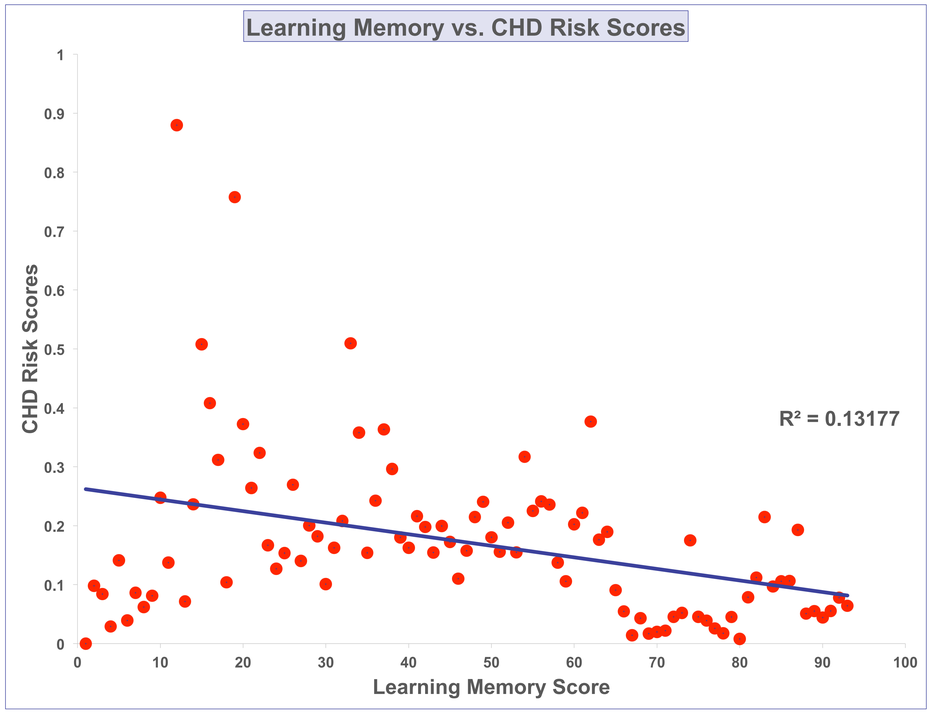
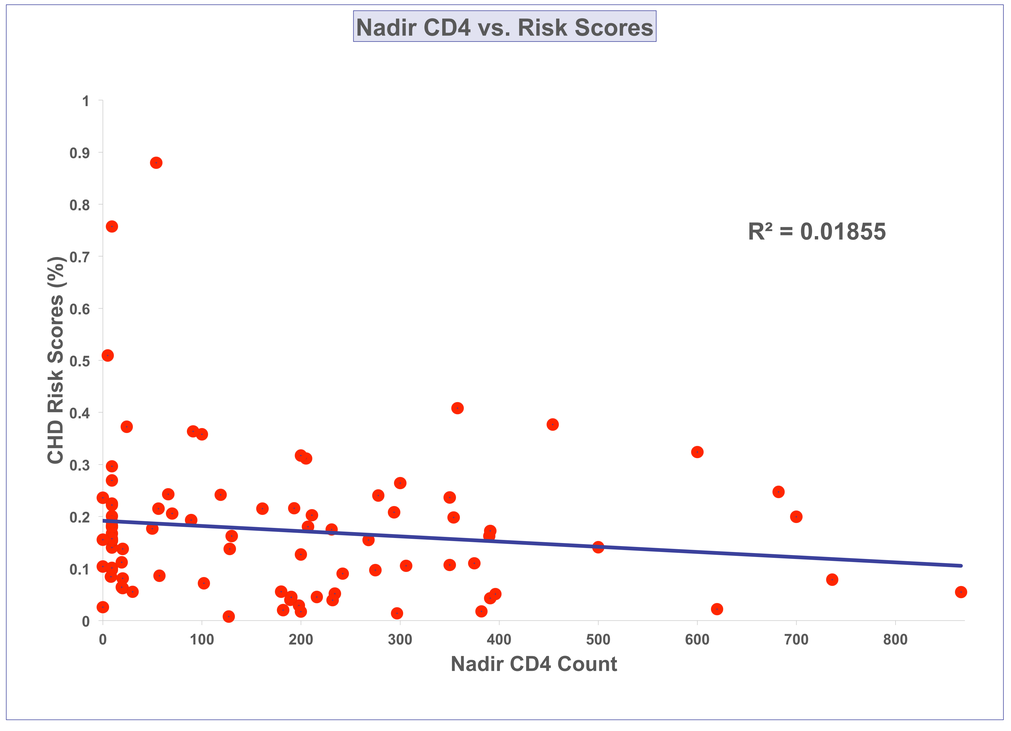
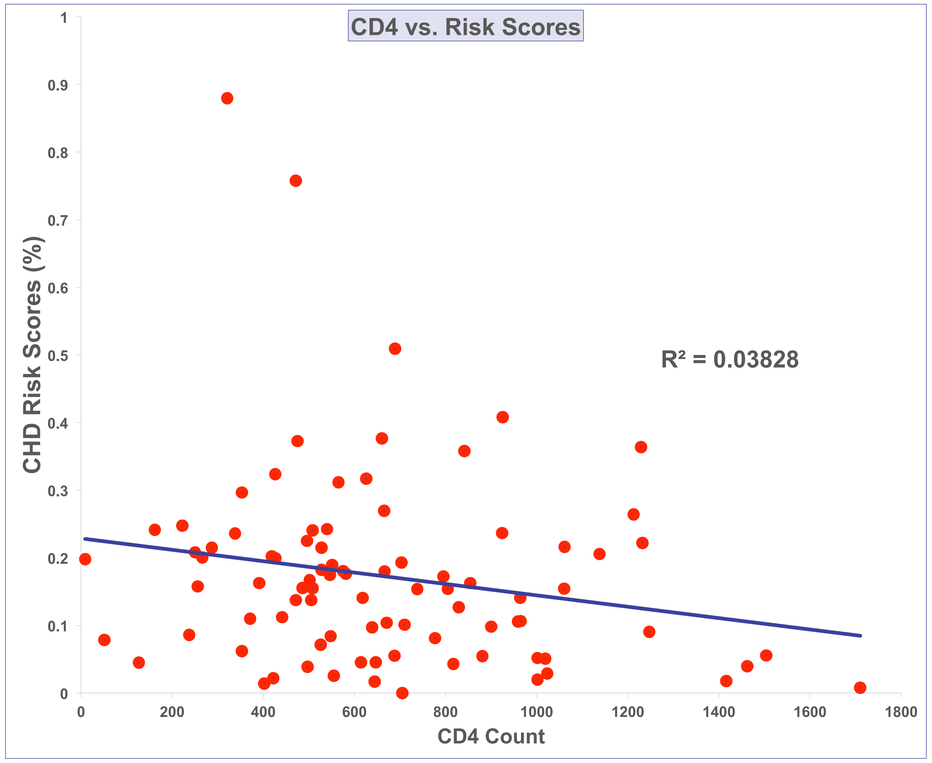
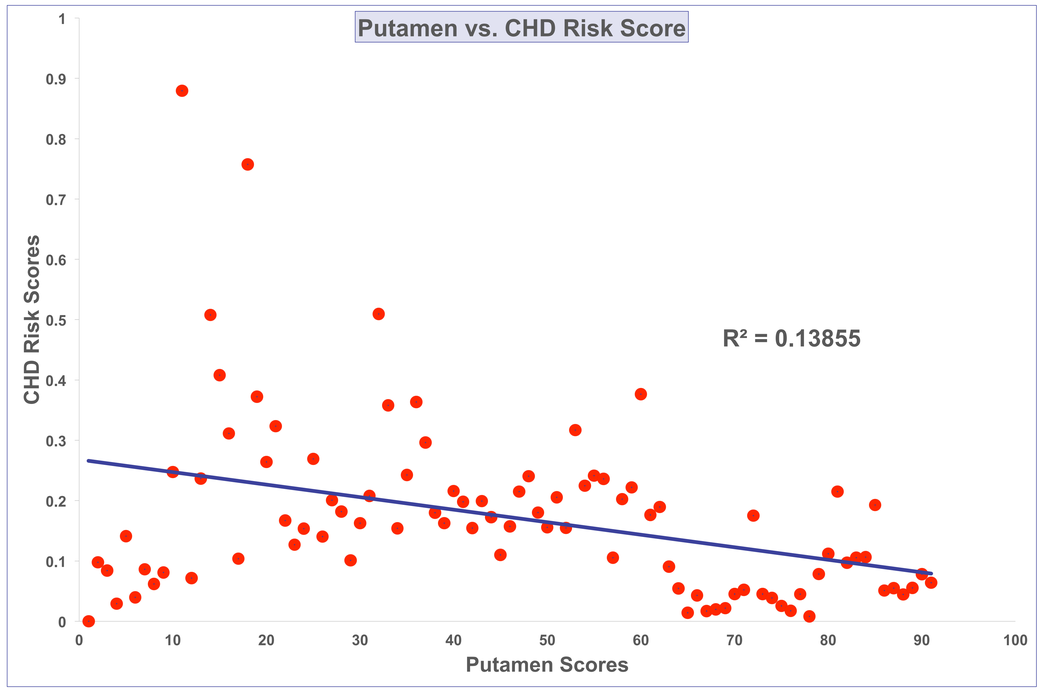
HDL Cholesterol (mg/dL)	✅	✅	✅
LDL Cholesterol (mg/dL)	❌	✅	❌
Systolic Blood Pressure (mm/Hg)	✅	✅	✅
Diastolic Blood Pressure (mm/Hg)	❌	✅	✅
BMI	✅	❌	❌
Diabetes	✅	✅	✅
Hypertension Medication	✅	✅	✅
Smoking	✅	✅	✅


Learning Memory vs. CHD Risk Scores
CHD Risk Scores
Learning Memory Score
R² = 0.13177
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
10
20
30
40
50
60
70
80
90
100


Nadir CD4 vs. Risk Scores
CHD Risk Scores (%)
Nadir CD4 Count
R² = 0.01855
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
100
200
300
400
500
600
700
800


CD4 vs. Risk Scores
CHD Risk Scores (%)
CD4 Count
R² = 0.03828
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
200
400
600
800
1000
1200
1400
1600
1800


Putamen vs. CHD Risk Score
CHD Risk Scores
Putamen Scores
R² = 0.13855
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
10
20
30
40
50
60
70
80
90
100