RISK OF CARDIOVASCULAR DISEASE AMONG OSTEOARTHRITIS PATIENTS

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Background

- The present study explores the compelling connection between osteoarthritis (OA) and cardiovascular disease (CVD), providing evidence that OA is indeed a significant risk factor for CVD.
- OA commonly referred to as degenerative joint disease or "wear and tear" arthritis.
- CVD encompasses any illness affecting the heart or blood vessels.
- Dataset from the Canadian Community Health Survey (CCHS) Cycle 2.1, comprising 134,072 records and 23 relevant variables is utilized.

Research Questions

- Is having osteoarthritis associated with developing heart disease?
- What might be the highest risk factor that influences this association?
- Is there any survival factor that affects the rate of change of having osteoarthritis with heart disease?

Methods

- 23 variables were cleaned and preprocessed from a sample of over 130,000. No variables or samples were excluded.
- Using the method developed by Sullivan et al. (2004), a risk score was derived using the multivariable logistic regression model and the variables retained following LASSO selection. A point system was created for the risk score.
- Cross-validation was used to optimize the regularization parameter.
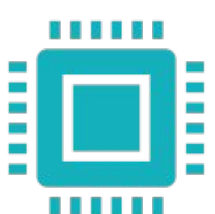
Data Pre-processing step. Fitting Logistic Regression to the Training set. Predicting the test result.

Test accuracy of the result Generating Summary outputs Calculation of Risk core

Results

Table 1. Baseline Patient

Variable	**N**	**Disease**, N = 929	**Healthy**, N = 10,452	**p-value**
__Age__	10,290			<0.001
35-39		10 (1.1%)	1,230 (13%)	
40-44		11 (1.2%)	1,072 (11%)	
45-49		21 (2.3%)	925 (9.9%)	
50-54		42 (4.5%)	1,113 (12%)	
55-59		86 (9.3%)	1,212 (13%)	
60-64		104 (11%)	953 (10%)	
65-69		115 (12%)	923 (9.9%)	
70-74		145 (16%)	718 (7.7%)	
75-79		203 (22%)	690 (7.4%)	
>80		191 (21%)	526 (5.6%)	
__Sex__	11,381			0.003
Male		479 (52%)	4,865 (47%)	
Female		450 (48%)	5,587 (53%)	
__Marital_Status__	11,381			<0.001
Married		493 (53%)	6,591 (63%)	
Common-law		14 (1.5%)	369 (3.55%)	
Widow/Sep/Div		386 (42%)	2,373 (23%)	
Single/Never Married		36 (3.9%)	1,119 (11%)	
__Diabetes__	11,381	170 (18%)	691 (6.6%)	<0.001
__Immigrant_status__	11,381	929 (100%)	10,452 (100%)	>0.9
__PAI__	11,381			<0.001
Active		171 (18%)	2,423 (23%)	
Moderate		212 (23%)	2,654 (25%)	
Inactive		546 (59%)	5,375 (51%)	
__Doctor__	11,381	898 (97%)	9,368 (90%)	<0.001
__Smoker__	11,381			<0.001
Daily		81 (8.7%)	1,336 (13%)	
Occasionally		12 (1.3%)	252 (2.4%)	
Always occasion		5 (0.5%)	141 (1.3%)	
Former daily		385 (41%)	2,778 (27%)	
Former occasion		123 (13%)	1,577 (15%)	
Never smoked		323 (35%)	4,368 (42%)	
__Drinker__	11,381			<0.001
Regular		469 (50%)	5,929 (57%)	
Occasional		158 (17%)	1,886 (18%)	
Former		209 (22%)	1,486 (14%)	
Never		93 (10%)	1,151 (11%)	
__High_blood_pressure__	11,381	527 (57%)	2,291 (22%)	<0.001

Univariate analysis

Variable	**N**	**Disease**, N = 929	**Healthy**, N = 10,452	**p-value**
__Daily_consumption__	11,381	5.10 (3.70, 6.60)	4.70 (3.40, 6.30)	<0.001
__Sampling_weight__	11,381	136 (72, 249)	192 (95, 366)	<0.001
__Emphysema_COPD__	11,381	55 (5.9%)	94 (0.9%)	<0.001
__Stress__	11,381			0.001
Not at all		188 (20%)	1,608 (15%)	
Not very		235 (25%)	2,669 (26%)	
A bit		328 (35%)	4,007 (38%)	
Quite a bit		139 (15%)	1,799 (17%)	
Extremely		39 (4.2%)	369 (3.5%)	
__Province__	11,381			
NFLD & LAB		2 (0.2%)	27 (0.3%)	
PEI		0 (0%)	31 (0.3%)	
NOVA SCOTIA		18 (1.9%)	121 (1.2%)	
NEW BRUNSWICK		6 (0.6%)	92 (0.9%)	
QUEBEC		58 (6.2%)	869 (8.3%)	
ONTARIO		523 (56%)	5,403 (52%)	
MANITOBA		37 (4.0%)	390 (3.7%)	
SASKATCHEWAN		22 (2.4%)	182 (1.7%)	
ALBERTA		81 (8.7%)	978 (9.4%)	
BRITISH COLUMBIA		172 (19%)	2,220 (21%)	
YUKON/NWT/NUNA		10 (1.1%)	139 (1.3%)	
__Time_in_Canada__	11,381			<0.001
0-9 Years		21 (2.3%)	1,486 (14%)	
>=10 Years		908 (98%)	8,966 (86%)	
__Cultural__	11,381			<0.001
White		785 (84%)	6,931 (66%)	
Visible minority		144 (16%)	3,521 (34%)	
__Education__	11,381			<0.001
< Than secondary		303 (33%)	1,845 (18%)	
Secondary grad		169 (18%)	1,834 (18%)	
Other post-sec		56 (6.0%)	555 (5.3%)	
Post-sec grad		401 (43%)	6,218 (59%)	
__Income__	11,381			<0.001
No income		157 (17%)	1,036 (9.9%)	
$15,000-$29,999		303 (33%)	2,113 (20%)	
$30,000-$49,999		226 (24%)	2,440 (23%)	
$50,000-$79,999		148 (16%)	2,533 (24%)	
>$80,000		95 (10%)	2,330 (22%)	
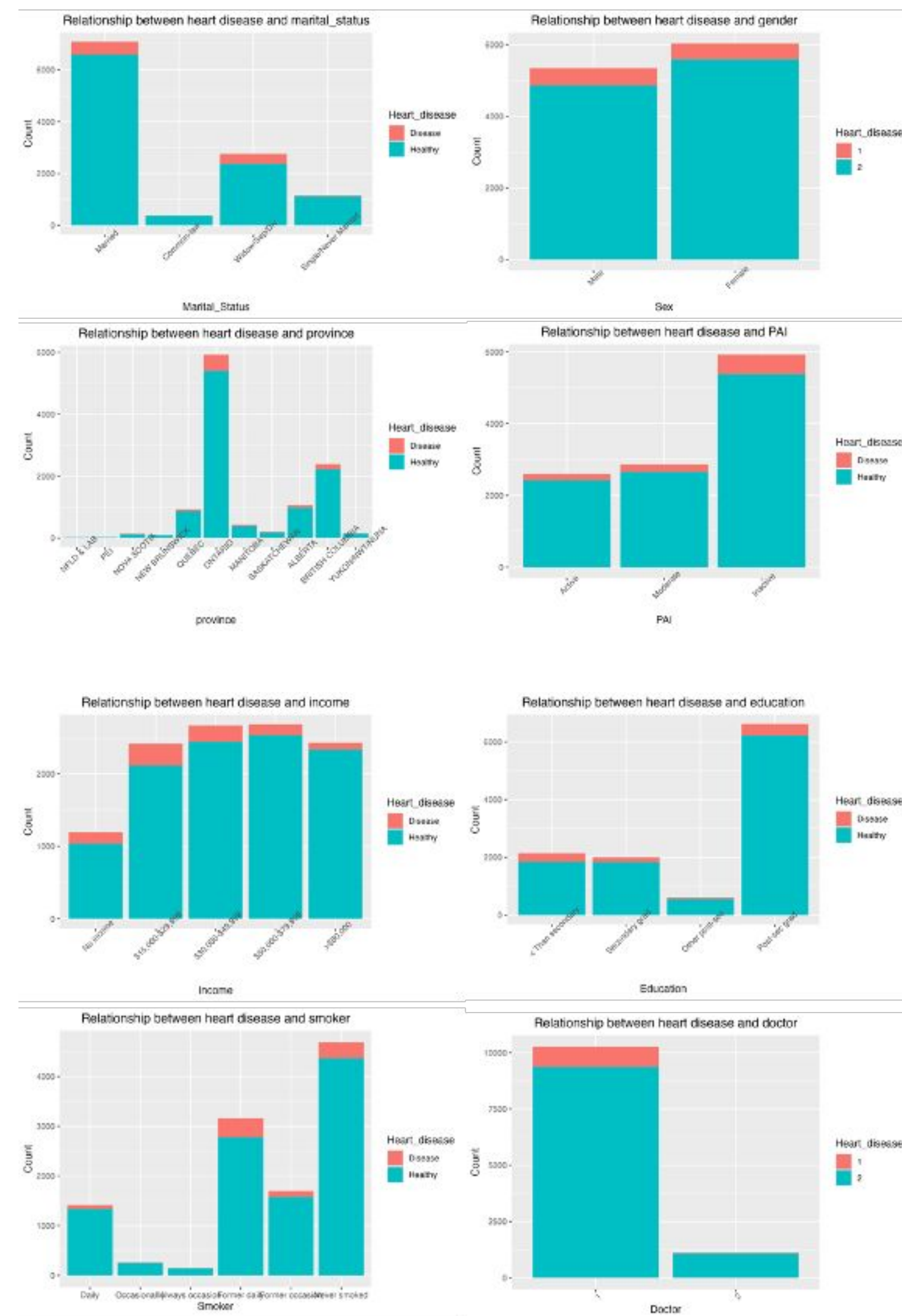
Risk Score for Cardiovascular Disease

Factor		Points		Total Point Score	Estimated Risk of Cardiovascular Disease
Sex	Female	1			
	Male	0		-7	44%
Age	35-39	0		-6	56%
	40-44	-2		-5	67%
	45-49	-3		-4	76%
	50-54	-4		-3	84%
	55-59	-5		-2	89%
	60-64	-5		-1	93%
	65-69	-6		0	95%
	70-74	-6		1	97%
	75-79	-7		2	98%
	>80	-7		3	98%
Has a Primary Care Physician/ Family Doctor	Yes	1		4	99%
	No	0			
High Blood Pressure	Yes	2			
	No	0			
Diabetes	Yes	1			
	No	0			
Total Point Score					

Receiver Operating Characteristic (ROC) Curve

AUC: 0.8203
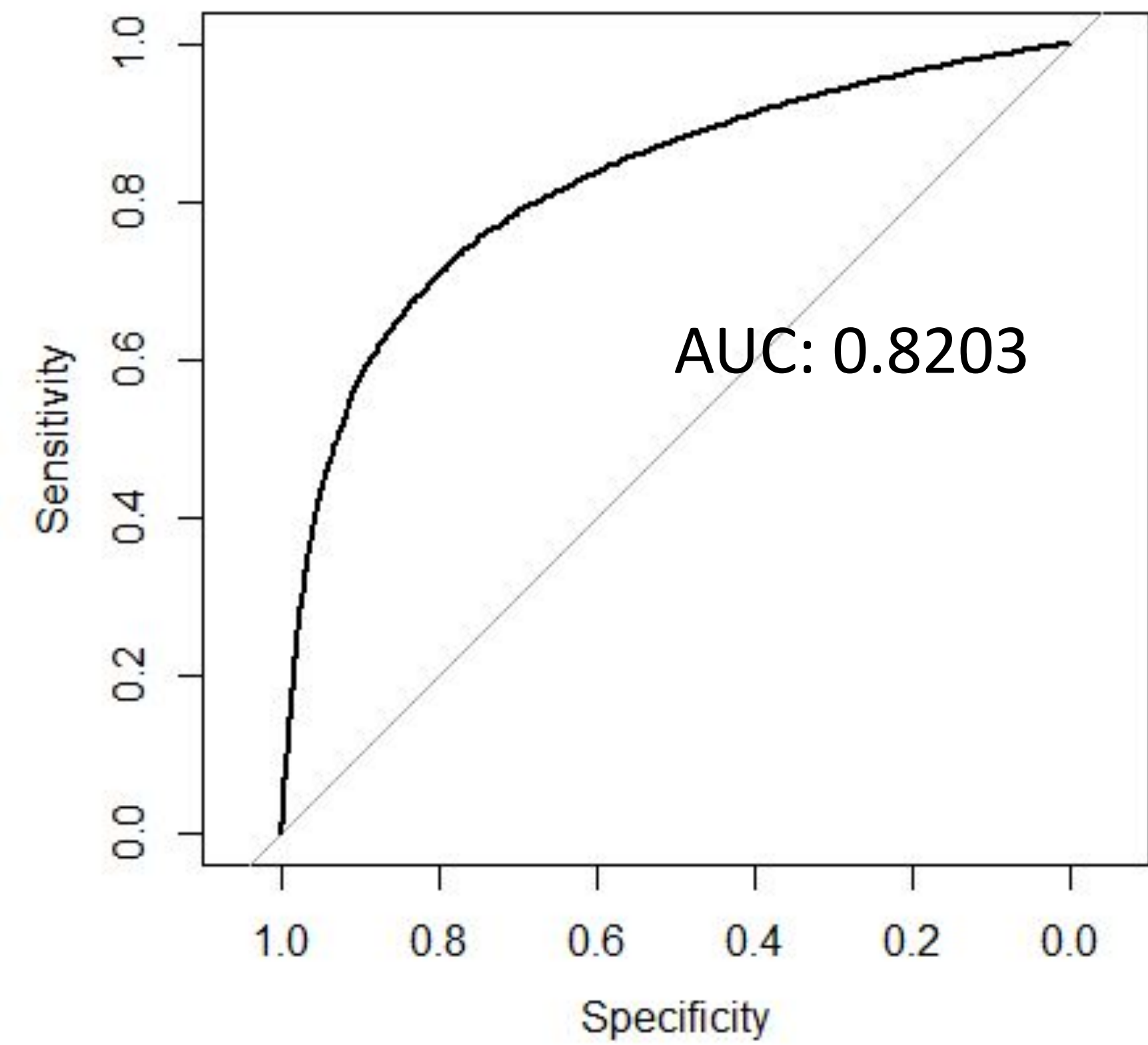
Summary

- 17 of the 23 variables were statistically significant in contributing to prediction of the presence of cardiovascular disease.
- On average, married individuals, Ontarians, and inactive patients on average have a higher rates of CVD.
- ROC curve had a value of 0.82 suggesting that model can distinguish between the presence of CVD well.

Future Research

- Further studies can be done to test and train different regularized models such as lasso and ridge regression to identify models with strongest predictive power.
- Additional variables can be considered to test for CVD, when utilizing regularized regression.

References

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Acknowledgments