Effectiveness of cardiovascular risk assessment in Australian professional aviators
a cohort study

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Background: Framingham

- Considers
  - Age
  - Gender
  - High density lipoproteins (HDL)
  - Total cholesterol
  - Systolic blood pressure
  - Smoking status
  - Diabetes
  - Presence of left ventricular hypertrophy (1,2)
- Not considered
  - Family history (3,4,5)
  - Socio-economic status (6)
  - Ethnicity (7,8)
  - Newer markers such as coronary artery calcium (9,10,11)

Current system in Australia

- Risk calculated at initial application
- 5 yearly until aged 60
- Annually from 60, or if diabetes or impaired fasting glucose
- Further investigation if considered high risk
- 1 % rule (12)

Current system in Australia

Coronary Heart Disease Risk Factor Prediction Chart (CRI)

1 ***Find Points for each Risk Factor***

FEMALE		MALE		HDL Cholesterol		Total Cholesterol		Systolic BP		Other	
Age	Pts	Age	Pts	HDL-C	Pts	Total-C	Pts	SBP	Pts	Others	Pts
30	-12	30	-2	0.65-0.68	7	3.60-3.99	-3	98-104	-2	Cigarettes	4
31	-11	31	-1	0.69-0.76	6	4.00-4.30	-2	105-112	-1	Diabetic (M)	3
32	-10	32-33	0	0.77-0.84	5	4.31-4.69	-1	113-120	0	Diabetic (F)	6
33	-8	34	1	0.85-0.90	4	4.70-5.19	0	121-129	1	ECG-LVH	9
34	-6	35-36	2	0.91-0.99	3	5.20-5.69	1	130-139	2	(0 points assigned for each negative answer)	
35	-5	37-38	3	1.00-1.09	2	5.70-619	2	140-149	3		
36	-4	39	4	1.10-1.19	1	6.20-6.79	3	150-160	4	NOTE: IFG or IGT are counted as diabetes for this calculation	
37	-3	40-41	5	1.20-1.30	0	6.80-7.49	4	161-172	5		
38	-2	42-43	6	1.31-1.43	-1	7.50-8.19	5	173-185	6		
39	-1	44-45	7	1.44-1.56	-2	8.20-8.55	6				
40	0	46-47	8	1.57-1.70	-3						
41	1	48-49	9	1.71-1.89	-4						
42-43	2	50-51	10	1.90-2.07	-5						
44	3	52-54	11	2.08-2.25	-6						
45-46	4	55-56	12	2.26-2.49	-7						
47-48	5	57-59	13								
49-50	6	60-61	14								
51-52	7	62-64	15								
53-55	8	65-67	16								
56-60	9	68-70	17								
61-67	10	71-73	18								
68-74	11	74	19								

Use this profile for professional pilots 5 yearly (or private pilots, if clinically indicated) and every year for pilots over 60 years of age

2 ***Sum Points for all Risk Factors***

Age ( ) + HDL-C ( ) + Total-C ( ) + SBP ( ) + Smoker ( ) + Diabetes ( ) + ECG-VVH ( ) = Point Total

NOTE: Minus points subtract from total

3 ***For Stress ECG if > 14 Pts***

Methodology

- A retrospective cohort study was conducted looking at professional pilots' cardiovascular risk index using the Framingham model, and examined to see if any were diagnosed with ischaemic heart disease (IHD) during the next five years.
- The initial selection criteria were pilots aged 55 or younger who held a class 1 medical certificate in 2011.

Methodology – inclusion criteria

Inclusion	Exclusion
Age Gender (any) Class 1 medical certificate in 2011 CRI calculated in 2011 Data available for cardiac status 31st December 2016	Pre-existing CASA audit IHD Previous IHD Data not available up to and including December 2016

Results

- 2754 had a CRI calculated in 2011
- 7 had pre-existing IHD
- 945 did not renew their licence
- 1802 were included in final study group

Reason for non-renewal	Number of pilots
Did not apply for new medical certificate in 2016	926
Died	2
Medical certificate suspended / cancelled for medical reasons	17

Results - cohort

	Medical certificate current at 5 years	**Pilots did not renew medical certificate**
Number of pilots	1802	945
Age range	16-55	15-55
Average age	35.5	32.1
CRI range	-24 to +23	-21 to +22
Average CRI	3.4	1.4
Male	1676 (93%)	861 (91%)
Female	127	84

Results

	IHD	No IHD	Total
CRI ≥ 15	4	90	94
CRI ≤ 14	2	1706	1708
Total	6	1796	1802

Results

		95% confidence interval	
		Lower limit	**Upper Limit**
Prevalence	0.003	0.001	0.008
Sensitivity	0.667	0.241	0.940
Specificity	0.95	0.938	0.959
PPV	0.043	0.014	0.113
NPV	0.999	0.995	1.000

Discussion : Limitations / future directions

- Small number of cases with IHD
  - Prevalence 0.33% (CI 0.14 – 0.76)
- Sample size approximately 20 % of all ongoing pilots
- Electronic records / limitations of optical character recognition
- A prospective study could be commenced now that records are entirely electronic
- Examination of further investigations for CRI ≥ 15

Conclusions

- As a preliminary study, this shows the usefulness of Framingham in this setting
- None of the identified cases presented with incapacitating symptoms in any setting
- Further study with larger numbers could show true validity of Framingham model of screening for cardiovascular disease in Australian professional pilots.

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References

1. Anderson, K. M., Odell, P.M., Wilson, P.W.F, & Kannel, W. B. (1991). Cardiovascular disease risk profiles. *American Heart Journal, Jan;121(1 Pt 2)*(0002-8703 (Print)), 293-298.
2. Anderson, M., Keaven , F.Wilson, W., Peter, Odell, M., Patricia , & Kannel, B., William. (1991). An Updated Coronary Risk Profile: A Statement for Health Professionals. *Circulation, Vol.83*(1), 356-357.
3. Andresdottir, M. B., Sigurdsson, G., Sigvaldason, H., & Gudnason, V. (2002). Fifteen percent of myocardial infarctions and coronary revascularizations explained by family history unrelated to conventional risk factors. The Reykjavik Cohort Study. *European Heart Journal, 23*(21), 1655-1663. doi:10.1053/euhj.2002.3235
4. Mulders, T. A., Barsom, E., Ayada, I., Sivapalaratnam, S., De Winter, R., Koch, K., . . . Pinto-Sietsma, S. J. (2013). Family history of premature cardiovascular disease as risk factor for recurrent coronary artery disease: a retrospective cohort study. *European Heart Journal, 34*(suppl_1), P2487-P2487. doi:10.1093/eurheartj/eht308.P2487
5. Sivapalaratnam, Suthesh, Boekholdt, S. Matthijs, Trip, Mieke D., Sandhu, Manjinder S., Luben, Robert, Kastelein, John J. P., . . . Khaw, Kay-Tee. (2010). Family history of premature coronary heart disease and risk prediction in the EPIC-Norfolk prospective population study. *Heart, 96*(24), 1985-1989.
6. Brindle, Peter M., McConnachie, Alex, Upton, Mark N., Hart, Carole L., Smith, George Davey, & Watt, Graham C. M. (2005). The accuracy of the Framingham risk-score in different socioeconomic groups: a prospective study. *The British Journal of General Practice, 55*(520), 838-845.

References cont.

7. Tillin, Therese, Hughes, Alun D., Whincup, Peter, Mayet, Jamil, Sattar, Naveed, McKeigue, Paul M., & Chaturvedi, Nish. (2014). Ethnicity and prediction of cardiovascular disease: performance of QRISK2 and Framingham scores in a UK tri-ethnic prospective cohort study (SABRE—Southall And Brent REvisited). *Heart, 100*(1), 60.

8. Wells, Sue, Riddell, Tania, Kerr, Andrew, Pylypchuk, Romana, Chelimo, Carol, Marshall, Roger, . . . Jackson, Rod. (2017). Cohort Profile: The PREDICT Cardiovascular Disease Cohort in New Zealand Primary Care (PREDICT-CVD 19). *International Journal of Epidemiology, 46*(1), 22-22. doi:10.1093/ije/dyv312

9. Mahabadi, Amir A., Möhlenkamp, Stefan, Lehmann, Nils, Kälsch, Hagen, Dykun, Iryna, Pundt, Noreen, . . . Investigators, on behalf of the Heinz Nixdorf Recall Study. (2017). CAC Score Improves Coronary and CV Risk Assessment Above Statin Indication by ESC and AHA/ACC Primary Prevention Guidelines. *JACC: Cardiovascular Imaging, 10*(2), 143-153.

10. Tota-Maharaj, Rajesh, Blaha, Michael J., McEvoy, John W., Blumenthal, Roger S., Muse, Evan D., Budoff, Matthew J., . . . Nasir, Khurram. (2012). Coronary artery calcium for the prediction of mortality in young adults <45 years old and elderly adults >75 years old. *European Heart Journal, 33*(33), 2955-2962.

11. Valenti, Valentina, Hartaigh, Bríain ó, Heo, Ran, Cho, Iksung, Schulman-Marcus, Joshua, Gransar, Heidi, . . . Min, James K. (2015). A 15-year warranty period for asymptomatic individuals without coronary artery calcium: a prospective follow-up of 9715 individuals. *JACC Cardiovascular Imaging, 8*(8), 900-909.

12. ICAO. (2012). *Manual of Civil Aviation Medicine*.