Cardiovascular Risk Screening and Stratification of Victorian Volunteer Firefighters

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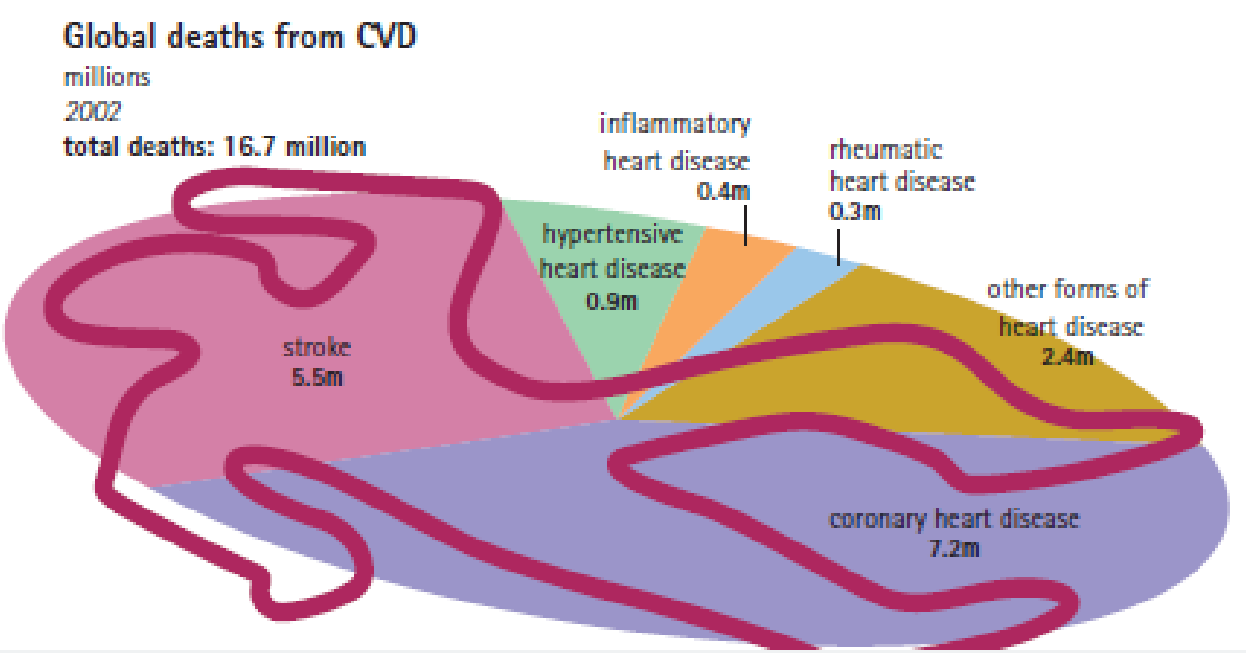
Cardiovascular Disease (CVD)

CVD is the leading cause of death and disability worldwide (WHO 2005;AIHW 2006)

CVD affects the heart and blood vessels (AIHW 2008;Nieman 2007)



CVD Risk Factors

Positive Risk Factors	**Risk Factor Classification**
Age	Men ≥ 45 years; Women ≥ 55 years
Family History of CVD	Myocardial infarction, coronary revascularization, or sudden death before 55 yr of age in father or other male first-degree relative, or before 65 yr of age in mother or other female first-degree relative
Hypertension	SBP ≥ 140 mm Hg and/or DBP ≥ 90 mm Hg confirmed on at least two separate occasions or taking antihypertensive medication
Dyslipidemia	LDL-C ≥ 3.37 mmol·L^{-1} (130 mg·dL^{-1}) or HDL-C < 1.04 mmol·L^{-1} (40 mg·dL^{-1}) or on lipid-lowering medication
Impaired Fasting Glucose (Diabetes)	Fasting blood glucose ≥ 5.50 mmol·L^{-1} (100 mg·dL^{-1}) but < 6.93 mmol·L^{-1} (126 mg·dL^{-1}) or Impaired glucose tolerance (i.e. two hour values in oral glucose tolerance test ≥ 7.70 mmol·L^{-1} but < 11.0 mmol·L^{-1}) confirmed on at least two separate occasions
Obesity	BMI ≥ 30 kg·m^{-2} *or* WC > 102 cm (40 inches) for men and > 88.0 cm (35 inches) for women
Exercise/Sedentary Lifestyle	Not participating in at least 30 min of moderate intensity (40%-60% VO_2R) physical activity on at least three days of the week for at least three months
Smoking	Current cigarette smoker or has quit in the last six months
Negative Risk Factors	**Risk Factor Classification Criteria**
High HDL-C	HDL-C ≥ 1.55 mmol·L^{-1} (60mg·dL^{-1})

(American college of Sports Medicine 2009)

Cardiovascular Disease (CVD) and Firefighters

- CVD related deaths are the leading cause of on-duty death among firefighters in USA (50%) (Fahy et al. 2012; Kales et al. 2007)
- CVD related deaths occur among individuals with ↑ prevalence of CVD risk factors (Kales et al. 2007)
- Intense physical work in potentially hazardous environments
- Significant strain on the cardiovascular system

Intense work + Hazardous environment + CVD risk factors = Cardiac events

Australian Fire Services

No national CVD-related mortality data

Country Fire Authority (CFA) volunteer firefighters

- Similar prevalence of CVD risk factors to Australian population (Wolkow et al. In second review)
- Compared to overseas emergency services, CFA firefighters have a greater CVD risk (Wolkow et al. in second review)
- Volunteer and career firefighters share similar demands and on-duty CVD risks (Kales et al. 2007)
- May not be subject to same stringent health-related employment procedures as their paid counterparts

CVD Risk Factor Screening & Stratification

Mandatory medical screening standards in USA based firefighting & emergency service agencies

CVD risk screening and stratification research

- Accurately identify emergency service personnel at high CVD risk (Gaetano et al. 2007)
- Rural volunteer firefighters & emergency medical service personnel (n = 315) (Gaetano et al. 2007)
- Soldiers (n = 76) (Foder et al. 1998)

Currently no mandatory risk screening standards for volunteer CFA firefighters

Without screening, volunteer firefighters with ↑ CVD risk factors and ↑ risk of on-duty CVD-related events are less likely to be identified

CVD Risk Screening & Stratification Tools

bushfire CRC

Typical risk screening and stratification involves:

- Questionnaires
- Blood samples
- Blood pressure
- Body composition assessment
- Graded exercise task

To be effective:

- Time and cost-efficient
- Suited for large scale application
- High level of accuracy
- Prevent false positive results
- Minimal financial costs

CVD Risk Screening Tools

Implementing CVD risk screening in Firefighting:

- 'Moderate' to 'very-hard' physical activity intensity
  e.g. vigorous weightlifting and circuit training
- Firefighting and intense physical activity share similar CVD risks
- Pre-participation Fitness Screening Questionnaire appropriate e.g. the AHA/ACSM Health and Fitness Pre-participation Fitness Screening Questionnaire
  - Widely used and recognised for low to high-intensity exercise
  - CVD history, symptoms and risk factors → Low, Moderate or High Risk
  - Uses evidence-based CVD risk factor guidelines
  - Time-efficient and easily applied to large populations

Aim

- To evaluate the consequences of applying a time and cost-efficient CVD risk screening tool to a volunteer firefighter population.

Methods

Major CVD risk factors collected from:

- n = 3777 CFA volunteer firefighters
  - 80% Males
  - 20% Females

- Between 18-75 years old

- Undergoing the Emergency Services Volunteer (ESV) Healthwatch health assessment program

- Data collection: Individual brigades and non-emergency firefighting events across Victoria (e.g. Rural and Urban firefighting games)

Methods

Questionnaire

- Each participant completed an online questionnaire to assess the main CVD risk factors

Body composition

- Height, weight and waist circumference

Resting blood pressure (BP) measurement

Finger-prick blood sample

- Total cholesterol
- Low-density lipoprotein cholesterol
- High-density lipoprotein cholesterol
- Triglyceride
- Blood glucose

Methods

Risk factor data entered into AHA/ACSM pre-participation CVD risk stratification

Risk stratify individuals according to a certain level of CVD risk

Low Risk: ≤ 1 CVD risk factor

- No medical clearance required

Moderate Risk: ≥ 2 CVD risk factors

- Medical clearance + graded exercise test prior to high intensity exercise

High Risk: Diagnosed diabetes (type 1 or type 2)

- Medical clearance recommended prior to low, moderate or high intensity exercise

Results

Demographic Results:

- Males: 80% (n = 3011); 46 ±15 yr
- Females: 20% (n = 766); 43 ±15 yr

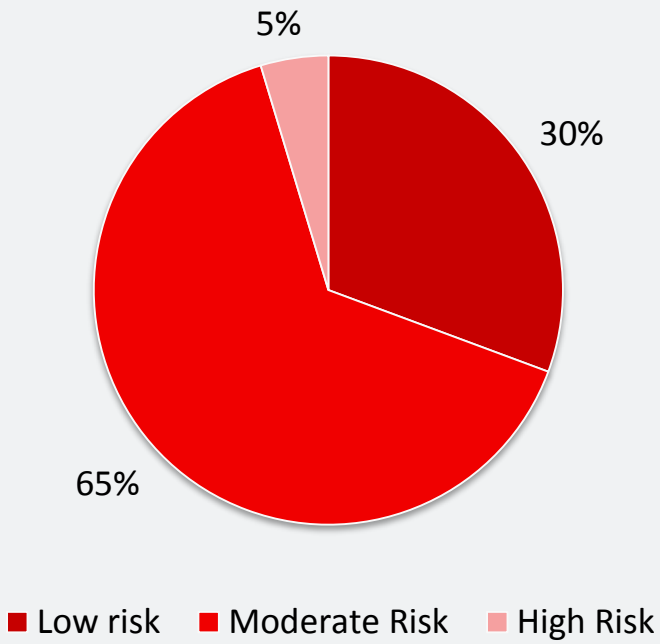


Figure I. Percentage of CFA firefighters with low, moderate and high risk stratification

Results

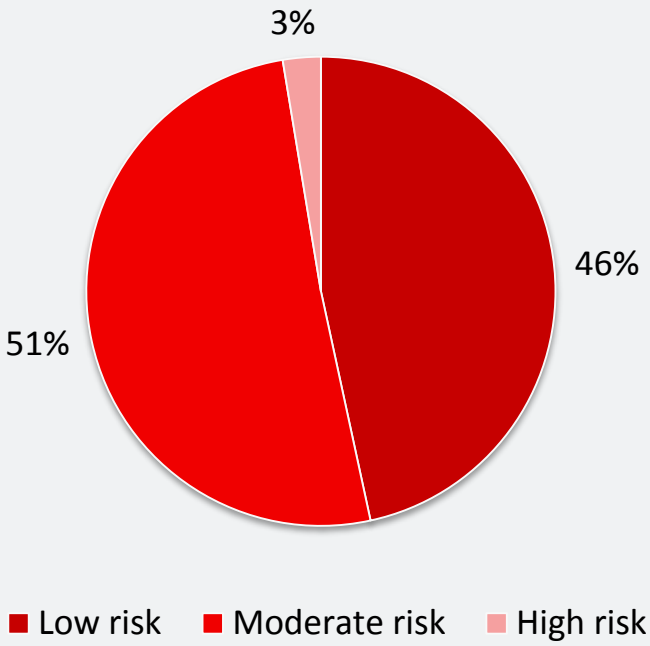


Figure II. Percentage of female CFA firefighters with low, moderate and high risk stratification

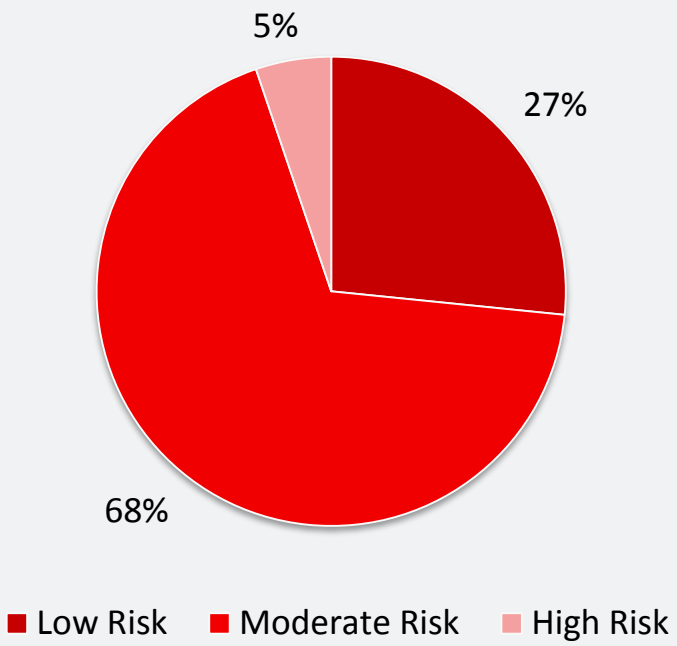


Figure III. Percentage of male CFA firefighters with low, moderate and high risk stratification

Research Implications

- Large % of CFA firefighters stratified as moderate risk
- ↑ risk of CVD related event during moderate to vigorous intensity activity
- % at moderate risk is higher than USA firefighting and emergency medical service personnel (Gaetano et al. 2007)
- Moderate and high risk personnel require medical examination + Graded exercise test (GXT)
  - Cost $280 AUD per person
  - Skilled staff
  - Large financial cost to CFA / Australian Agencies ~$45,500,000
  - Reduce volunteer firefighter numbers → Reduce fire agency response

Research Implications

Points for consideration:

- Fire agencies should invest in screening and stratification for high risk personnel
- When recruiting, consider combining risk factor screening + Job-specific physical capacity tests
    - More comprehensive and accurate assessment
    - Reduce inappropriate exclusion of firefighters
- Possibility that the ACSM tool may not be the best screening and stratification method for this population
    - Places a large emphasis on any one risk factor
    - Ageing firefighting population
    - No distinction between individuals with two or nine risk factors
    - Potential financial and practical implications
    - Therefore, need to explore other screening options

Research Implications

Recommendations:

- Introduce agency wide health education
- Implement regular health monitoring of personnel
- Reducing the number of personnel at CVD risk
- Increases healthy volunteer firefighter numbers
- Increases fire agency response capacity

Summary

- First study to investigate AHA/ACSM pre-participation screening questionnaire in firefighters
- Large % of CFA firefighters at moderate risk
- Focus screening and stratification of high CVD risk personnel
- Screening combined with physical capacity to perform job requirements
- Agency wide CVD health interventions