



PROGRAM D 2.1: Fire Fighter Health & Safety

→ **THE BUSHFIRE FIGHTING TEST:**
Quantifying a safe standard of fitness and health in CFA volunteers.

Matthew Phillips, Brad Aisbett and Glenn McConell
Department of Physiology, The University of Melbourne, Vic

David Nichols
Country Fire Authority, Vic

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A potential problem



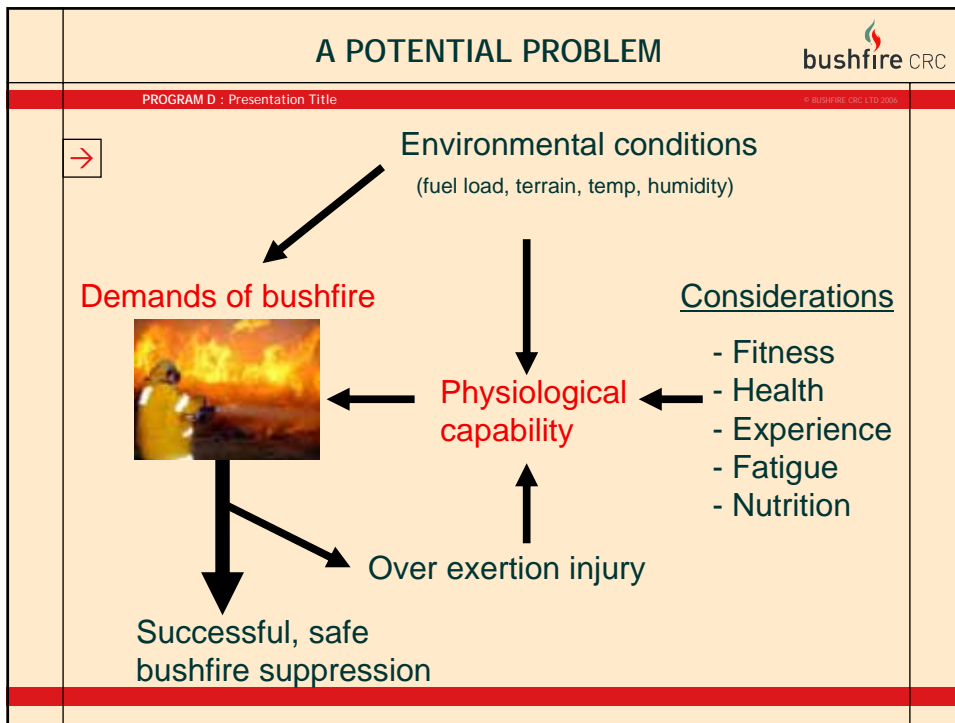
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→ In Victoria alone:

- 58,000 volunteer fire fighters
- 400 career fire fighters
- Mandatory testing for career fire fighters in recruit course
- Minimum fitness for entry
- No mandatory testing or standards for volunteer



Same fires



Overexertion related injury

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→ Fire ground injury caused by physical demands exceeding physical capability.

- Sudden cardiac death
- Heat illness
- Muscle strain/ tear

- Traditionally measured in

- lost man hours
- compensation costs
- mortality rate

> ?

- Overexertion injury risk unknown in Aus volunteer FF. Risk may be high.

- Risk mediated by operational readiness tests



Is this a good place to stand?

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Existing operational readiness tests

→ Predictive tests of productivity & safety during fire suppression

- USFS pack test
- Multistage 20m shuttle run (beep test)
- CFA challenge test

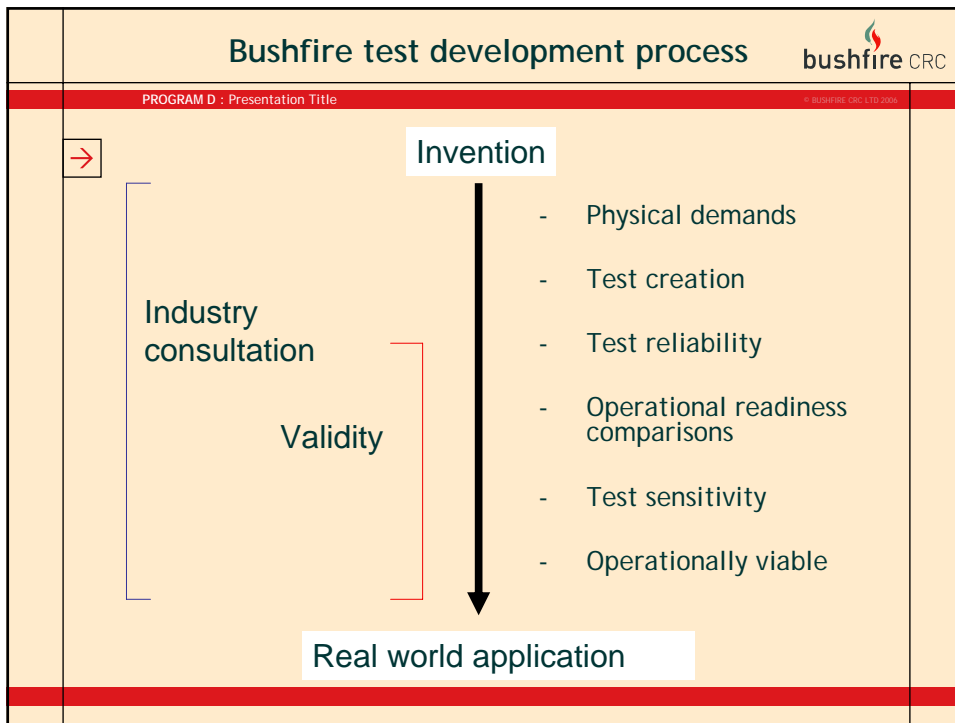


FUTURE

- Bushfire fighting test

→ Program D2.1 problems summarised

1. Physical demands of tanker based bushfire suppression unknown
2. Physical capabilities of volunteer bushfire fighters involved in tanker based bushfire suppression are unknown
3. Current operational readiness tests may not be appropriate for tanker based bushfire suppression



Industry consultation

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- Relevance through fire fighting literature
- Input of fire fighters, instructors and operational people
- Input of emergency services industry & other academics
- Test has to be valid, simple and useful to have real world application

Assessing Physical Demands



Prescribed burn job by job task analysis:

- Mucking up/ rake hoe
- Hose spraying
- Equipment carry
- Hose advance (through terrain)
- Fireline walking (varied terrain)



- Expired air sample analysis, HR, physical activity monitors
- Frequency & duration
- Maximal & stratified levels obtained

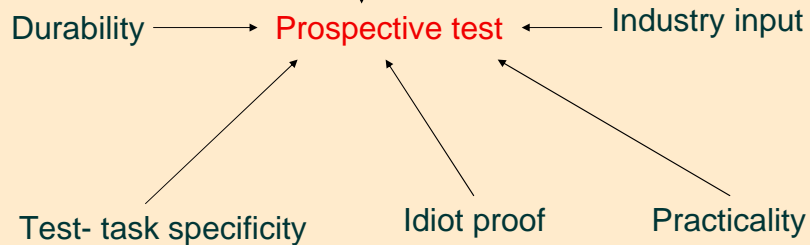


Test creation



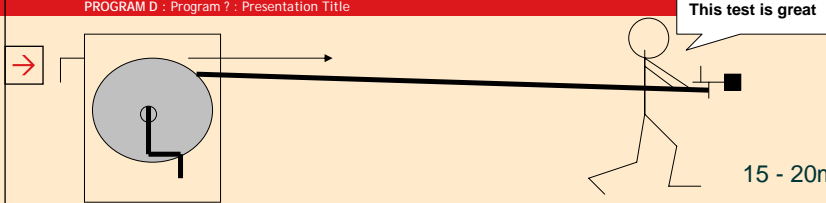
1. Relevance: literature, current tests - bushfire

2. Good science: robust, valid test



The proposed bushfire fighting test bushfire CRC

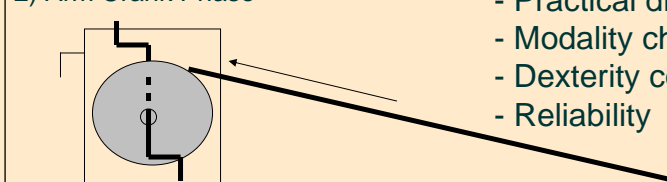
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1) Hose advance Phase

Factors to consider:

- Resistance mechanism
- Practical distance
- Modality changes
- Dexterity component
- Reliability



2) Arm Crank Phase

3) Repeat

Operational Readiness Comparison bushfire CRC

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<u>Operational readiness</u>	<u>Aerobic capacity</u>
Pack test	
Beep test	Treadmill VO_{2max}
CFA challenge test	(lab)
Bushfire fighting test	
<ul style="list-style-type: none"> - Correlation data between all tests - Importance of aerobic capacity in bushfire suppression - Additional health and fitness testing <ul style="list-style-type: none"> - Grip strength - Lung function - Health 	

The Importance of Health (Cardiovascular)

→ Association between BMI and health characteristics (indexed to age)

	BMI			
	Normal <25	Overweight 25>30	Obese 30>39	Morbidly Obese >39
VO _{2max}	48.6 ± 3.8	44.7 ± 5.8	41.7 ± 3.9	37.0 ± 2.8
Systolic	116.4 ± 10.1	122.6 ± 11.5	123.2 ± 10.0	128.0 ± 13.0
Diastolic	73.3 ± 8.4	76.2 ± 8.0	78.8 ± 7.3	88.8 ± 7.6

Associations in fire fighters with CVD risk factors:

- Systolic BP
- Diastolic BP
- Total cholesterol
- Cholesterol/ HDL ratio
- Triglycerides



Adapted from Clark et al., 2002

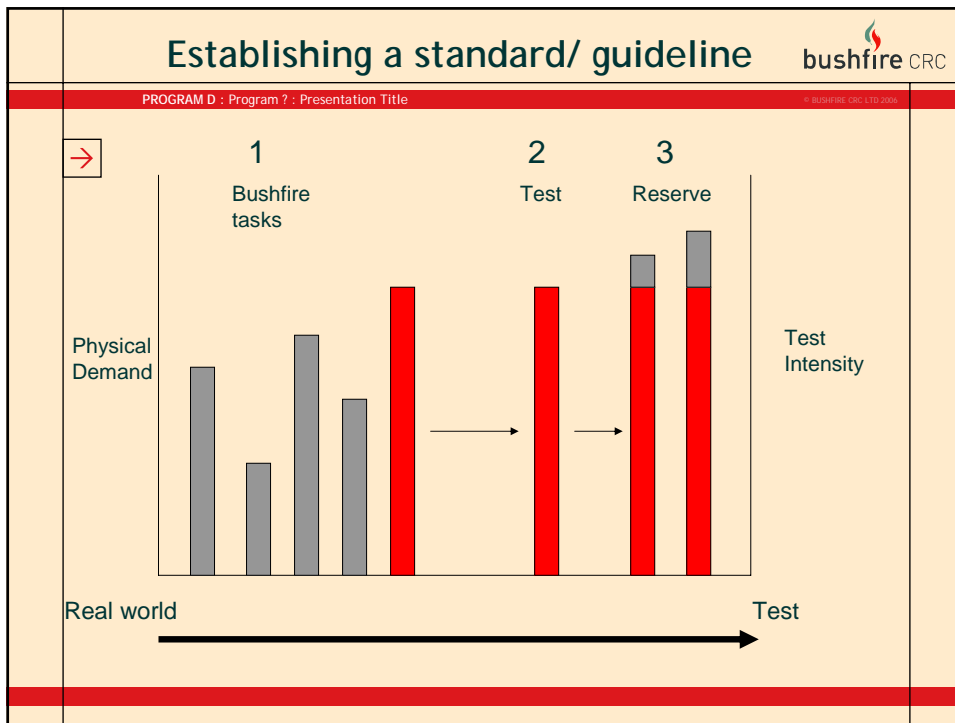
The Importance of Health (Respiratory)

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Age Group	Australian Population	American FF (Byrd & Collins)
	FEV ₁ / FVC ratio	FEV ₁ / FVC ratio
18-29	0.82	0.73
30-39	0.80	0.76
40-49	0.79	0.79
50-59	0.76	0.76
60-69	0.73	
70-78	0.72	

- ~30% of sample populations in literature are smokers
- Higher chance of respiratory damage
- Some acute changes in lung function in American Wildfire FF





Establishing a standard/ guideline

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Metabolic equivalent
of most arduous job
task

+

Reserve level
(%max)

=

Guideline

- Protocol design.... Time until exhaustion Vs level
- Durational component
- CFA HQ decision
 - People Vs productivity per person

Does the test detect skill?

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→ fire fighter training Recruit FF Bushfire Test = BFT

endurance training General public

No specific additional training Volunteer FF

BFT VO2max BFT VO2max BFT VO2max

Week 1 Week 8 Week 16

Time →

- Does the bushfire test detect fire fighting specific skill?
- Does the bushfire test pick up fire fighting performance increase independent of increased aerobic capacity?

Does the test detect fatigue?




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→ Day 1 Max Bushfire test

Day 2 Sub max simulated fire fighting bout + Max Bushfire test

- Conducted in CFA volunteer fire fighters
- Important as bushfire suppression is intermittently demanding over long durations
- Can the bushfire test be used to pick up common operational related fatigue?
- Model can also be used to test intervention strategies in the future

<h2>Outcomes</h2>		
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<p>→</p> <ol style="list-style-type: none"> 1. Understanding of the physiological demands and operational readiness needs of bushfire fighting in Australia 2. Understanding of the physiological capacity and operational readiness of Australian volunteer fire fighters 3. Validated and reliable operational readiness test for bushfire agencies 4. Some ability to mediate risk of overexertion injury in volunteer fire fighters 	 	

<h2>Acknowledgements</h2>		
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