CHARACTERIZATION OF THE PHYSICAL DEMANDS & FITNESS FOR PURPOSE IN AUSTRALIAN TANKER BASED BUSHFIRE FIGHTERS

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Fire ground Stress and Strain

What is the best way to identify individuals at risk on the fire ground?

Fitness for purpose (operational readiness) testing
Project Outline

Program D2.1 Firefighter health, safety, and wellbeing on the fireground

Project Goals

1. Identify the physical demands of common bushfire tasks
2. Quantify the hardest fire fighting tasks
3. Validate a method to ensure bushfire fighters are operationally fit for purpose

Deliverables for Agencies

1. Quantified data on simulated bushfire suppression tasks
2. A reliable and valid fit for purpose protocol for tanker based bushfire fighting

PART 1: Physical demands of fire fighting?

- Simulated Vs Real
  - Operational assistance
  - Compared to real time bushfire data
  - Reproducible

- Variety of physiological measures:
  - Heart rate
  - Physical activity
  - GPS (speed, elevation & distance)
  - Task Duration
  - Expired air (gold standard)
Subject Characteristics

Physical demands of tanker based fire fighting

- Greendale and Blackwood brigades (Region 15)
- Multiple participations May - September 07
- Temp ranges between 4.5 & 16.9°C

<table>
<thead>
<tr>
<th></th>
<th>Value ± SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>25</td>
<td>19M, 6F</td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>43.8 ± 14.5</td>
<td>16 - 67</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>170.0 ± 8.6</td>
<td>151.3 - 183.6</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>81.0 ± 14</td>
<td>51.2 - 103.9</td>
</tr>
<tr>
<td>BMI</td>
<td>28.1 ± 3.4</td>
<td>20.3 - 31.1</td>
</tr>
<tr>
<td>Years of Service</td>
<td>10 ± 9.2</td>
<td>0.5 - 30</td>
</tr>
</tbody>
</table>

Individual task demands

Ten major tasks included with positional, gradient & operational variations

<table>
<thead>
<tr>
<th>Fireground task</th>
<th>Position</th>
<th>Oxygen Consumption (L/min)</th>
<th>Duration (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static hose spray (n = 7)</td>
<td>Solo</td>
<td>0.81 ± 0.26</td>
<td>120.20 ± 0.26</td>
</tr>
<tr>
<td>Blacking out with hose (n = 14)</td>
<td>Lead position</td>
<td>1.57 ± 0.33</td>
<td>127.45 ± 30.42</td>
</tr>
<tr>
<td>Charged hose advance on flat ground (n = 9)</td>
<td>Lead position</td>
<td>1.88 ± 0.69</td>
<td>46.06 ± 6.81</td>
</tr>
<tr>
<td>Spot fire rake hoe work (n = 14)</td>
<td>Solo (75 strokes)</td>
<td>2.32 ± 0.56</td>
<td>100.75 ± 16.48</td>
</tr>
<tr>
<td>Hose advance uphill (n = 9)</td>
<td>Second position</td>
<td>2.55 ± 0.48</td>
<td>68.65 ± 14.44</td>
</tr>
<tr>
<td>Prolonged rake hoe work (n = 10)</td>
<td>Solo</td>
<td>2.56 ± 0.31</td>
<td>121.06 ± 12.51</td>
</tr>
</tbody>
</table>

* 40-49 year old Australian men have an average maximum oxygen consumption of 2.88 L/min OR 89% of max for hose advance uphill

### Task demand: Intensity Vs. Duration


#### Men

<table>
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<tr>
<th>Task Demand</th>
<th>Light (≤50 sec)</th>
<th>Moderate (50-100 sec)</th>
<th>Heavy (100+ sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task</td>
<td>Static hose spray</td>
<td>Hose advance 85m flat</td>
<td>Quickfill pump trailer set up</td>
</tr>
<tr>
<td>Intensity</td>
<td>Light</td>
<td>Moderate</td>
<td>Heavy</td>
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<td>Duration</td>
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#### Women

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#### PART 2: Developing a fit for purpose test

Developing a fit for purpose standard

![Graph showing oxygen consumption (L/min) for various tasks.](image)
## The Fit for Purpose Test

1. **Hose Advance**
   - Obstacle negotiation
   - Weighed branch

2. **Arm Cranking**

3. **Repeat numerous ‘laps’ in set time at an intensity matched to metabolic level**

“Designed for firefighters, developed with firefighters, and tested by firefighters”
This time next year.....

1. ‘Fit for purpose’ prototype:
   - Speed
   - Weighted branch
   - Duration
   - Reliability
   - Sensitivity

2. Extensive fire fighter data on:
   - Fitness
   - Health
   - Operation job test performance

3. The standard
   - Validated screening protocol for bushfire fighters

Important considerations for fire agencies:

- Implementation of a fit for purpose standard
  - Safety standard Vs Productivity standard
    - Safety reserves
  - Retention
  - Redistribution into specific roles
  - Campaign fire deployment
  - Who administers the test?

- Increased agency participation in development of standard
  - Standard most valid to states that participate
Acknowledgements

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CFA, RFS & DSE participants Summer 06-07

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