

FIRE NOTE

ISSUE 43 SEPTEMBER 2009

FITNESS FOR DUTY: LEGISLATIVE AND SCIENTIFIC CONSIDERATIONS

Selecting and deploying personnel who are 'fit for duty' assists fire and emergency services to preserve the health and safety of their personnel. At present, the selection criteria rural fire agencies should use is not known.

BACKGROUND

The devastation of the 2009 Victorian bushfires has led to unprecedented scrutiny on Australian fire agencies. One issue that is yet to be evaluated is the readiness of firefighters for deployment. In particular, the legislative responsibilities placed on fire agencies by the federal Occupational Health and Safety (OH&S) Act (2004). To comply, fire agencies must "reduce those risks so far as is reasonably practicable". This *Fire Note* will detail how Bushfire CRC research could help rural fire agencies meet their OH&S legislative responsibilities.

OCCUPATIONAL HEALTH & SAFETY

Injury records from rural fire agencies in south eastern Australia indicate that the major risks for firefighters are musculoskeletal strains and sprains, accounting for 11 to 41% of on-duty injuries (Aisbett et al., 2007). International research has demonstrated direct relationships between firefighters' fitness levels and their injury rates while on duty (Cady et al., 1979; Rodriguez & Eldridge, 2003). Less fit firefighters may fatigue more quickly, increasing the risk of poor decision making and unsafe behaviour, leading to injury (Budd et al., 1997). If Australian firefighters' risk of musculoskeletal injury also related to their fitness levels, then assessing firefighters' fitness for duty and only deploying firefighters who are 'fit for duty' could:

- Reduce firefighter injury rates
- Limit disruption to outside employment due to injury
- Preserve workforce capability, and
- Reduce injury compensation costs for fire agencies.

SUMMARY

This research project meets a critical information void faced by Australia's fire agencies: how to make pragmatic decisions about the deployment of personnel who are 'fit for duty', without infringing their Occupational Health and Safety and Equal Opportunity employment responsibilities.

It establishes a number of Australian 'firsts' by: identifying critical bushfire suppression tasks; assessing the physical demands of these tasks; and verifying the data by comparing the physical demands during simulated testing of the critical tasks to firefighters' work rate during emergency bushfires.

It then examines the 'on the ground' implications of the research by making recommendations for the future design of a scientifically valid, legally defensible fitness-for-duty screening tool. The findings and lessons learned will help fire agencies to meet their moral and OH&S legal responsibilities to preserve the health and safety of their firefighters.



▲ Figure 1: Rural firefighters repositioning hose during bushfire suppression duties.

► **Figure 2:** Rural firefighter (right) using a manual tool during blacking out activity.

Using fitness to select between potential employees or volunteers must comply with Australian anti-discrimination legislation. Australian employment law allows for discrimination against an individual, employee or volunteer worker on the basis of impairment or physical features if the discrimination is reasonable necessary to protect the health or safety of any individual, members of the public or property (e.g. NSW Anti-Discrimination Act, 1977; Victorian Equal Opportunity Act, 1995). The direct relationships between injury and fitness identified in overseas firefighting cohorts may constitute grounds for lawful discrimination. Disability discrimination legislation also states that lawful discrimination is permitted when the selection procedure reflects the inherent requirements of the job (Disability Discrimination Act, 1992) essential for job performance (Cosma v Qantas Airways Limited, 2002).

BUSHFIRE CRC RESEARCH

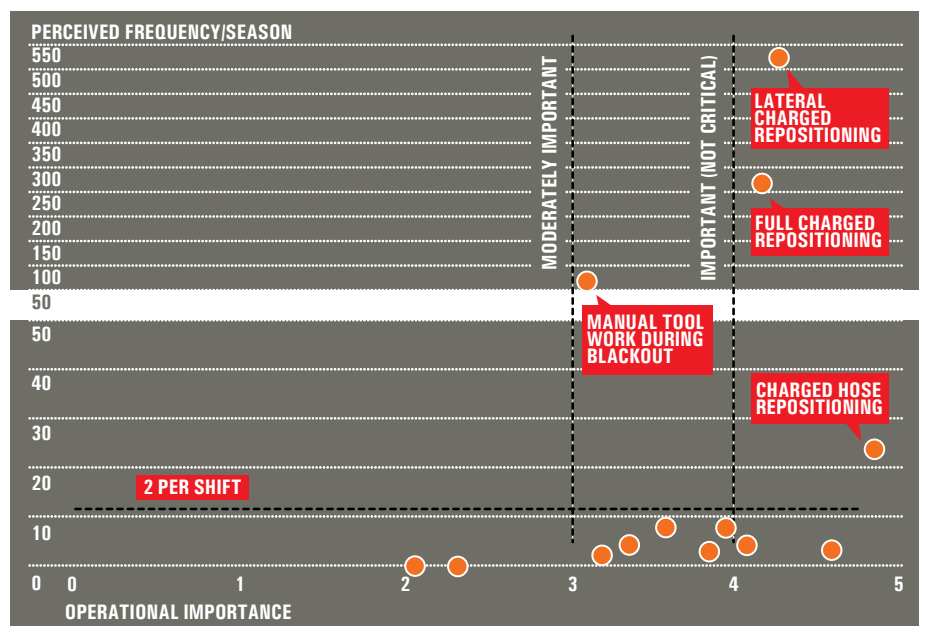
The inherent fitness requirements of tanker-based bushfire suppression are not known, so the aims of the current research were to:

1. Identify critical bushfire suppression tasks
2. Assess the physical demand of these tasks
3. Compare the physical demands of the critical tasks to firefighters' work rate during emergency bushfires to verify simulated testing results.

Comparisons between simulated work tasks and those performed during emergency bushfire shifts (Aim 3) is a novel step forward. Fitness duty literature usually relies exclusively on simulated work practices.

Study 1 – What are critical bushfire suppression tasks?

Thirty six incumbent volunteer firefighters (21 ± 12 years' experience) identified the perceived physical demand, frequency, and operational importance of 55 job tasks performed during tanker-based bushfire suppression. The most physically demanding tasks included advancing and repositioning 38-millimetre charged hoses (Figure 1, page 1) and using manual or 'hand' tools (Figure 2, above right) to create firebreaks



▲ **Figure 3:** Frequency and importance of physically demanding bushfire suppression tasks.

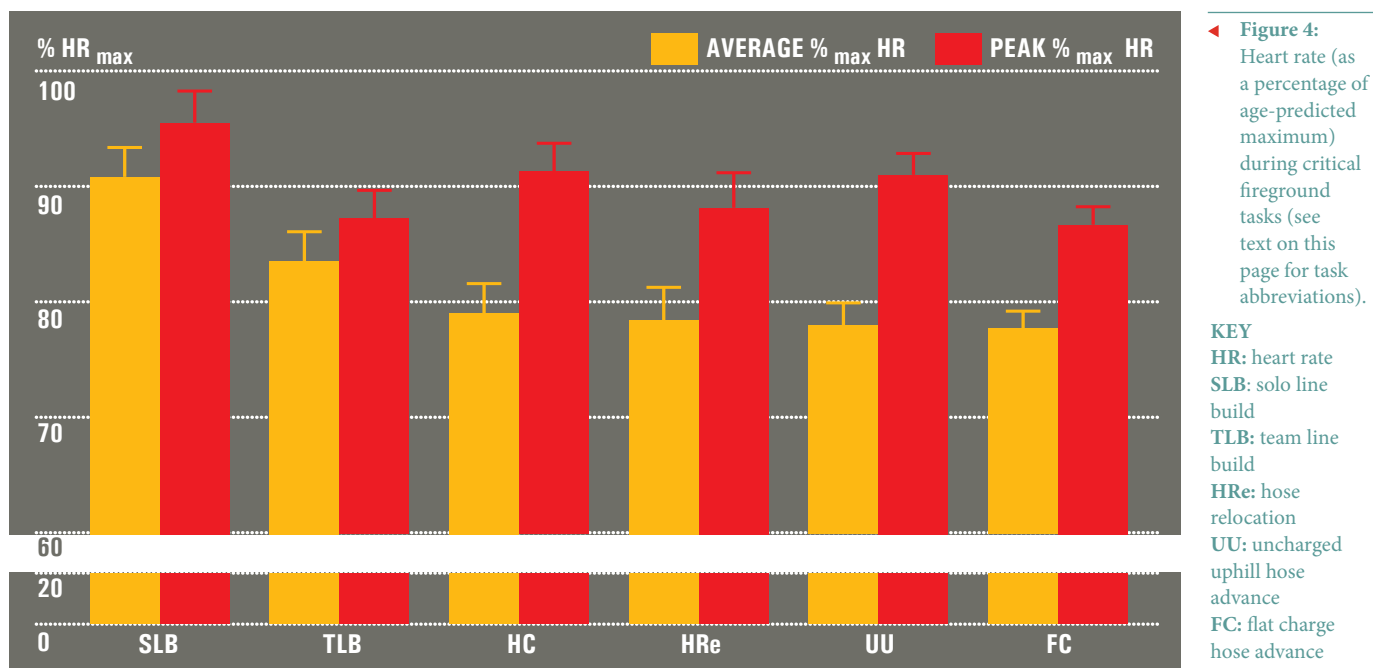


Figure 4: Heart rate (as a percentage of age-predicted maximum) during critical fireground tasks (see text on this page for task abbreviations).

ABOUT THE PROJECT

Project D2.1 Firefighter Health, Safety, and Well-being on the Fireground is part of Bushfire CRC Program D: Protection of People and Property.

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or during blacking out activities. Figure 3 (page 2) shows that repositioning a charged 38-millimetre hose and using a manual tool during blacking out activities were the most frequent and operationally important of the physically demanding tasks. The four tasks were, accordingly, identified as critical (Taylor & Groeller, 2003) for bushfire suppression work. Hose repositioning and manual tool work were characterised by carry, drag, and dig actions and challenged firefighters' strength-endurance capabilities.

Study 2 – What are the physical demands of critical bushfire suppression tasks?

Twenty six incumbent volunteer firefighters, wearing full personal protective equipment, performed critical fireground tasks in bushland under the supervision of experienced training officers and brigade captains. Figure 4 shows

that firefighters' peak heart rates during critical fireground tasks exceed 90% of their age-predicted maximal heart rate. Firefighters' averaged heart rate during each task was at least 70% of their age-predicted maximal heart rate. There were no meaningful differences between the work-rate (i.e., heart rate) across the critical tasks of solo line build (SLB), team line build (TLB), hose relocation (HRe), uncharged uphill hose advance (UU) or flat charge hose advance (FC). The results indicate that the inherent work-rate for critical fireground tasks lies between 70% and 95% of firefighters' maximal heart rate. Such work rates are considered 'hard' to 'very hard' work, according to the American College of Sports Medicine (Balady et al., 1998).

Study 3 - What are firefighters' work rates during emergency bushfire duties?

Thirty six volunteer firefighters wore portable heart rate, activity, and global positioning system monitors during fireground shifts across six bushfires. Firefighters worked for 10 ± 2.1 hour (mean \pm standard deviation) in each shift, with $21.7 \pm 18.4\%$ of that time spent travelling in the tanker. On the fireground, they covered 16 ± 5.5 kilometres on foot at an average speed of 1.7 ± 1.0 kilometres per hour. During their shift, the firefighters' average heart rate was 101.2 ± 12.6 beats per minute, while their peak heart rate was 169.0 ± 17.8 beats per minute. Expressed relative to their age-predicted maximal heart rate, firefighters' average and peak fireground heart rates were $54.0 \pm 5.0\%$ and $92.0 \pm 9.2\%$, respectively. Firefighters' peak heart rates are consistent with their work-rates during simulated critical fireground tasks (Study 2, Figure 4, this page). Figure 5 (page 4) shows that firefighters spend ~ 20% of their shift working at 'hard' and 'very

hard' work rates (Balady et al., 1998), with longer periods of low level labour or rest.

RESEARCH OUTCOMES

The collective results demonstrate that moving fire hoses and clearing debris are inherent to tanker-based bushfire suppression work. During these tasks, firefighters work at heart-rates close to between 70 and 90% of their age-predicted maximum.

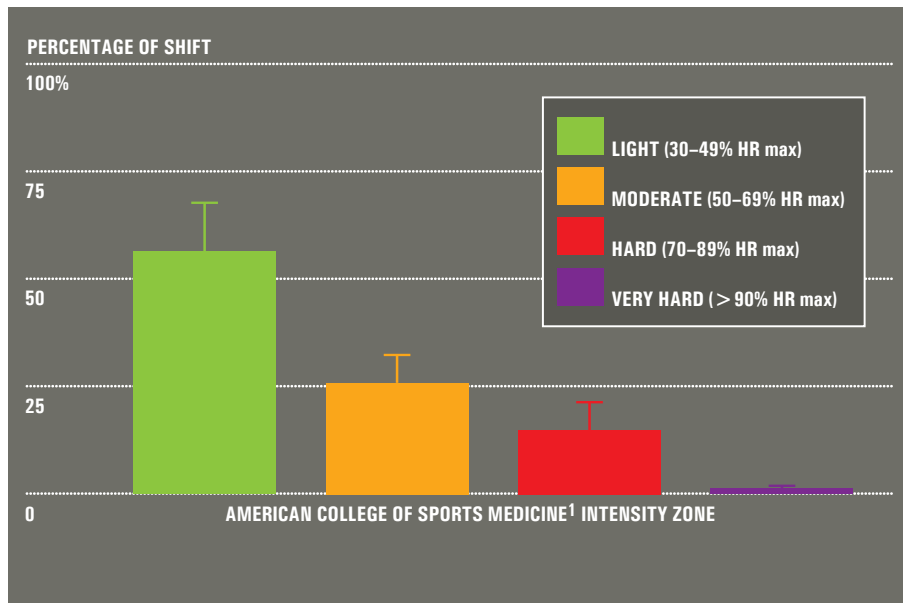
Future design of a scientifically valid, legally defensible fitness-for-duty screening tool should incorporate:

- Drag, carry, and dig actions to mimic critical hose and hand tool work tasks
- Short, hard to very-hard intensity work efforts performed repeatedly to challenge candidates' strength endurance capabilities.

CRC RESEARCH BEING USED

The Australian Capital Territory Rural Fire Service (ACT RFS) is using the above research and working with Project D2.1 researchers to validate their fitness-for-duty selection procedures. At present, ACT RFS volunteer firefighters are required, every two years, to walk 3.2 kilometres in less than 30 minutes while carrying 11 kilograms. Despite widespread use by land management agencies in Australia and the United States Forestry Service, there is little published evidence that the field walk test reflects the inherent requirements of bushfire suppression work or is able to predict firefighters' 'performance' on the fireground.

Twenty-five incumbent firefighters' performances in four inherent fireground tasks (i.e., hose advance, hose blacking out, handtool blacking out, and handtool fireline construction) were correlated with firefighters' performances on the field walk test. This approach, known as 'criterion



▲ Figure 5: Percentage of fireground shift at different work intensity zones ('HR' denotes heart rate).

validity testing', can determine whether the field walk test measures 'essential elements to job performance' (Cosma v Qantas Airways Limited, 2002). Criterion validation is advocated by the United States Department of Labour through their Uniform Guidelines for Employee Selection Procedures – the seminal guide on fitness for duty testing. Preliminary evidence indicates that firefighters' field walk test performance was predictive of their ability to complete core fireground tasks.

Firefighter's work rates and subjective responses during the fireground tasks were also compared with those recorded during the field walk test. Here, researchers evaluated whether the field walk test includes the inherent work-rate requirements of bushfire suppression, even if the test does not resemble core fireground actions or movements. Analyses are ongoing with final results due for publication in the coming months.

CONCLUSIONS

Australia's firefighters safeguard our nation from the annual threat of bushfire. Preserving the health and safety of Australia's firefighters is a moral and legislative responsibility. The findings from and lessons learned during the above

END USER STATEMENT

"This research breaks new ground in Australia by providing information to enable agencies to assess the legal and practical implications of firefighter fitness for duty. The research is robust as it is backed up by practical investigation into what 'fit for duty' means on the fireground. This high-calibre, evidence-based information is helping fire agencies to meet their obligations in such core areas as protecting the community, complying with occupational health and safety regulations, and – importantly – preserving the welfare of our firefighters."

– Robyn Pearce
 Director Human Services
 Tasmania Fire Service

research activities uniquely positions Project D2.1 researchers to assist Australia's fire and emergency services to deploy personnel who are fit for duty. The procedures outlined will allow agencies to meet their occupational health and safety responsibilities, without inadvertently breaching Australian employment law.

FURTHER READING

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Fire Note is published jointly by the Bushfire Cooperative Research Centre (Bushfire CRC) and the Australasian Fire and Emergency Service Authorities Council (AFAC).

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 AFAC is the peak representative body for fire, emergency services and land management agencies in the Australasia region. It was established in 1993 and has 26 full and 10 affiliate members.