MANAGING FATIGUE-RISK DURING LONG DEPLOYMENTS: RATIONALE FOR A SUSTAINED OPERATIONS MODE

David Darwent,[1] Sally Ferguson[1] and Robyn Pearce[2]

[1] Centre for Sleep Research, University of South Australia

[2] Tasmania Fire Service

Background

Climate change fuelled by global warming is expected to increase the frequency, duration and severity of extreme weather events, including bushfires.[1] As a consequence, the length of firefighting campaigns and the demands placed on personnel are also likely to increase. Firefighting campaigns have traditionally been organised by rostering personnel to work 12-hour day or night shifts. This rostering system ensures that operations are staffed round-the-clock. However, it also requires some personnel to work continuous night shifts.

In Australia, firefighters working the 12-hour night during bushfire fighting campaigns report being awake for 24+ hours during the initial deployment (i.e. including the commute from home to the fireground and the first night shift) and then obtaining only 3-4 hours of sleep on subsequent days.[2] Any increase in the length of deployments is likely to be associated with an unsustainable rise in the fatigue levels experienced by personnel working this shift. This is because performance declines in association with severely restricted sleep (i.e. < 5 hours/day) become progressively worse in the absence of sustained recovery opportunities (i.e. 2×8-hour night-time sleeps in a row).

In practice, the benefits of permitting personnel to continue working under the influence of ever-increasing fatigue will at some point be outweighed by poorer productivity and higher accident-risk. When this occurs, workplace operations are likely to revert naturally to a more sustainable mode, but with reduced effectiveness as personnel are forced to take extended recovery sleeps.

The purpose of this project is to investigate the feasibility of a 'sustained operations mode' in which a sustainable rostering strategy would be implemented from the very start of deployments. This would apply for deployments that were projected to be of long duration (i.e. > 3-5 days).

Sustained operations mode

It envisaged that a sustained operations mode would be used to manage round-the-clock staffing demands when:

- operational demands are likely to go beyond the endurance capacity of personnel working a 12-hour shift system;
- there is minimal scope to source replacement personnel (e.g. inter-state emergency service deployments etc.); and
- where the number of personnel is too few for long recovery sleep opportunities to be scheduled.

The proposed rostering strategy would include shorter and faster shift rotations (e.g. 6 hours on 6 hours off, 8 hours on 8 hours off etc.). Faster rotations in combination with shorter shifts can provide the same 24-hour coverage as the 12-hour shift system, but can ensure that all personnel have rest periods that are scheduled at night.

In any sustained operations mode, shorter and faster shift rotations could be used to roster firefighters (or select groups of firefighters, e.g. incident controllers) either:

- in-place of the standard 12-hour shift system; or
- in conjunction with the standard 12-hour shift system.

The second of these options would employ targeted use of sustained operations shifts (i.e. short shifts) to mitigate acute safety risks, including:

- the start-up phase of deployments, i.e. getting personnel from home to the fireground and onto a shift rotation in a fit state;
- long stretches of consecutive 12-hour nights, i.e. transitioning personnel between 12-hour day and night shifts; and
- the closing phase of deployments, i.e. to ensure personnel are in a fit state prior to leaving for home (with a minimum of inconvenience).

Evidence in respect to sustained operations rosters is limited, but promising. Individuals working such rosters in industrial settings are reported to average 6 hours of sleep per day[3-5], but without apparent alertness and/or performance deficits;[3, 5-7] but not universally so.[4] To date, no basic scientific research has been conducted to establish the sleep and fatigue implications of sustained operations rosters. This is the main research objective of this project.

Research project

Two laboratory-based research protocols will be conducted. Briefly:

Protocol 1. Healthy young adults will be subjected to various sustained operations schedules and their sleep and performance measured. Data collected will be benchmarked against analogous data already collected from healthy young adults subjected to standard schedules. During this protocol, participants will be required to spend the equivalent of 8 hours of each 24-hour period in bed attempting to sleep, but in two equal-length bouts.

Protocol 2. Volunteer firefighters will be invited to participate in a simulated sustained operations study. Participants will be subjected to a specific sustained operations roster (selected on the basis of Protocol 1 results) and their performance on tasks relevant to firefighting measured. During this protocol, participants will be given the option to sleep during all non-work periods, but they may also choose to stay awake.

In combination, these two protocols will establish the fatigue and performance consequences of sustained operations rosters under ideal conditions (i.e. Protocol 1), and then under more realistic conditions using performance metrics relevant to firefighting (i.e. Protocol 2). *The outcomes will be used to develop best-practice principles for managing fatigue during long deployments, with a particular emphasis on the potential benefits associated with a sustained operations mode.*

References. 1. Hasson A et al. Climate Research, 2009. 39(2): 159-172. 2. Cater H et al. In The Joint AFAC-Bushfire CRC Conference, 2007. Tasmania, Australia: Australian Fire Authorities and Bushfire CRC. 3. Darwent D et al. Applied Ergonomics, 2008. 39(5): 614-622. 4. Eriksen CA et al. Chronobiology International, 2006. 23(6): 1193-1202. 5. Lamond N et al. Applied Ergonomics, 2005. 36(3): 313-318. 6. Hartley L. The Quarterly Journal of Experimental Psychology, 1974. 26(1): 8-14. 7. Nicholson A. Aviation, Space, and Environmental Medicine, 1985. 56(2): 105-114.

CRC

University of South Australia

DEAKIN UNIVERSITY