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Fatigue risk management by volunteer fire-fighters: Use of informal strategies to augment formal policy

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ABSTRACT

An increasing number and intensity of catastrophic fire events in Australia has led to increasing demands on a mainly volunteer fire-fighting workforce. Despite the increasing likelihood of fatigue in the emergency services environment, there is not yet a systematic, unified approach to fatigue management in fire agencies across Australia. Accordingly, the aim of this study was to identify informal strategies used in volunteer fire-fighting and examine how these strategies are transmitted across the workforce. Thirty experienced Australian volunteer fire-fighters were interviewed in August 2010. The study identified informal fatigue-management behaviours at the individual, team and brigade level that have evolved in fire-fighting environments and are regularly implemented. However, their purpose was not explicitly recognized as such. This apparent paradox – that fatigue proofing behaviours exist but that they are not openly understood as such – may well resolve a potential conflict between a culture of indefatigability in the emergency services sector and the frequent need to operate safely while fatigued. However, formal controls require fire-fighters and their organisations to acknowledge and accept their vulnerability. This suggests two important areas in which to improve formal fatigue risk management in the emergency services sector: (1) identifying and formalising tacit or informal fatigue coping strategies as legitimate elements of the fatigue risk management system; and (2) developing culturally appropriate techniques for systematically communicating fatigue levels to self and others.

1. Introduction

1.1. Bushfires in the Australian context

Australia is particularly susceptible to fire due to climatic conditions typified by high temperatures, low humidity, and vast lands of dry vegetation following years of drought. These environmental factors, coupled with the increasing frequency and intensity of bushfires associated with climate change, has led Australia to experience several catastrophic bushfires over the last few decades. These catastrophic fire events have resulted in significant loss of life, property and other assets. In February 2009, Australia experienced one of the most devastating fires on record. Over three days, 173 people died. The economic costs to date have been estimated at over $4.4 billion dollars (Teague et al., 2010).

An increasing number and intensity of catastrophic fire events in Australia has led to increasing demands on a mainly volunteer fire-fighting workforce (Lucas et al., 2007). Within this context, there is a significant risk to safety posed by fatigued workers being present on the fire ground. This is primarily due to a combination of two factors; (1) the longer working hours associated with more frequent and longer fires and (2) ever-diminishing volunteer numbers (McLennan and Birch, 2005). Despite the increasing likelihood of fatigue in the emergency services environment, there is not yet a systematic, unified approach to fatigue management in fire agencies across Australia.

1.2. Fatigue-related risk in volunteer fire-fighting

Increasingly, research suggests that fatigue contributes significantly to accidents and injuries in the workplace. Specifically, fatigue impairs mental performance and decision-making as a consequence of generalised cognitive slowing (Dorrian et al., 2006; Williamson et al., 2011). This slowing and subsequent compensatory behaviour results in a range of cognitive changes including delayed response times, reduced situational awareness, attentional tunnelling, memory impairment and changes in affect and motivation (Brown, 1994; Harrison and Horne, 2000).

Not surprisingly, fire-fighting is an activity that is both physically and cognitively demanding and there is clear evidence

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of the fact that fatigue can impair firefighter performance (Aisbett et al., 2012; Ferguson et al., 2011). Moreover, given the unpredictability in the timing and duration of bushfires, volunteer fire-fighters can often be required to work for long periods at any time of the day, with limited sleep opportunity, in an environment that is both physically and mentally demanding. This is especially important in volunteer firefighting forces where many volunteers are required to maintain their paid employment and to volunteer during periods normally allocated rest and recovery. This leads to the situation where fatigue-related risk is often elevated during times of bushfire suppression. In one US study, almost 10% of injured fire-fighters reported suffering from fatigue at the time they were injured (US Fire Administration, 2008).

1.3. Fatigue-risk management

In recent years fatigue has been highlighted as an identifiable workplace hazard, and as such organisations are required to do everything 'reasonably practicable' to minimise fatigue-related risk. This requirement is embedded in Work Health and Safety legislation in Australia, and requires organisations to ensure factors such as: (1) work schedules; (2) job demands; and (3) environmental conditions do not lead to elevated fatigue-related risk (Safe Work Australia, 2013). According to national Workplace Health and Safety (WHS) guidelines, working time arrangements are broadly limited to 12 h in any 24 h period and a sequence of shifts should not exceed a total of 48 h of work before a reset break of at least 48 h is required.

However, the organisations responsible for managing volunteer fire-fighters at times of emergency are faced with a complex dilemma, whereby the types of prescriptive control measures (such as limiting the length of an individual shift and specifying minimum break times) traditionally used to mitigate fatigue-related risk are impractical in times of local or national emergency. Within this context, it is generally accepted that the broad Australian Code of Practice for fatigue risk management will not be complied with by emergency organisations due to the unpredictable nature of emergency work and imminent threat to life and property that is to be balanced with fatigue of workers. More formally, in Australia, most volunteer fire-fighting agencies have (a) partial or full exemptions to regulations relating to hours of work driving heavy vehicles during bushfire incidents (as they are declared as "emergency events" and excluded from the limits via Ministerial exemption), and/or (b) little or no enforcement or review of working time arrangements during incidents. In short, there is no systematic, unified, formal approach to fatigue management in fire agencies across Australia. However, despite long hours and sometimes additional employment during bushfire incidents, the self-reported incidence of fatigue-related accidents and injuries is anecdotally low. Given the regulatory requirements to report workplace injuries, it is reasonable to suggest that this is not a function of under-reporting, at least for injuries that require medical treatment away from the fire ground. Accordingly, this low rate of fatigue-related injury suggests that some form of risk mitigation is being employed, albeit outside of the formal system.

Given the lack of formal approaches to fatigue-risk management in Australian volunteer fire-fighting agencies, it is hypothesised that individuals and teams may be relying heavily on informal strategies to reduce the risks associated with fatigue on the fire-ground. In other industries (e.g. aviation, marine transport, trucking, healthcare), research has highlighted the use of informal fatigue risk mitigation strategies, previously referred to as "fatigue-proofing" (for a detailed discussion of this topic, see Dawson et al., 2012). This term refers to adaptive coping behaviours used by fatigued individuals which (a) reduce the likelihood of fatigue-related error, and/or (b) ensure that such error is quickly identified and mitigated. However, to date there has been no published study reporting informal fatigue risk management practices amongst volunteer firefighters.

Accordingly, the aims of this research were to identify:

1. How volunteers recognise fatigue in self and others
2. Volunteer awareness of formal organizational strategies for reducing fatigue-related risk
3. Informal strategies for mitigating fatigue-related risk
4. How informal fatigue risk-mitigation strategies are communicated

2. Method

2.1. Design, materials and measures

A qualitative methodology was used to elicit fire-fighters' experiences, perceptions and understandings of working whilst fatigued. It was based on methodologies refined in studies of train driver experiences of fatigue (Rainbird et al., 2010; Thompson, 2013). This interview protocol was designed to elicit an overall perception based on cumulative experience, rather than refer to a single critical event. The interview protocol was subjected to a small pilot study and feedback from subject matter experts.

A minimum of five years fire-fighting experience was required to participate in interviews. To ensure this, a purposive sampling strategy was employed. A member of the research team approached individual volunteer brigades with an invitation to participate in one-on-one, face-to-face interviews. Approximately 30% of those approached agreed to participate in the research. Once a total of 30 participants had been recruited, no more interviews were conducted. Interviews lasted approximately 60 min and were conducted by a single interviewer. Open-ended questions addressed the participants' perceptions, opinions, attitudes and experience of safety and fatigue management systems within the organization. The sample size ($n = 30$) was more than sufficient to reach thematic saturation based on established guidelines (Guest et al., 2006).

Ethics approval for the project was obtained from the Human Research Ethics Committee at the University of South Australia and the research was conducted according to the National Statement on Ethical Conduct in Human Research.

2.2. Analysis

Audio recordings of interviews were transcribed and subject to three stages of qualitative data analysis. The first stage identified units of information that addressed the research aims. In the second stage, the researcher organized these units into four categories consistent with the research aims listed above. In the third stage, these categories were classified into meaningful subcategories that resonated with pre-established constructs derived from fatigue risk management theory and the Australian fire-fighting context.

Thematic analysis of the data was then carried out using NVivo (version 8). Specifically, data was coded in three stages:

1. Open Coding—the data was read line-by-line and substantive codes were identified. Substantive codes with similar contents (meaning) were grouped together to form categories that were more abstract.
2. Axial Coding—links between categories were sought and subcategories were identified.
3. Selective coding—the core themes were subsequently identified (Saldana, 2009).