Tenth International Conference on Managing Fatigue: Abstract for Review

A review of countermeasures to drowsy driving on the commute home from nightshift

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Problem

Sleep-related vehicle accidents (SRVAs) account for 16–20% of all road accidents (1). The probability of an SRVA occurring at 07:00h, when workers typically commute home from nightshift, is five times greater than at 19:00h (1). Nightshift workers report that commute sleepiness, falling asleep at the wheel, and being involved in near misses/incidents is a common problem (2). Australian statistics indicate that accident risk is 4–7 times greater for workers driving post-nightshift compared to other drivers (3). Such statistics point to the need for effective countermeasures to reduce driver sleepiness at this time.

Method

This review discusses strategies that may be applied to counteract drowsy driving on the commute home from night shift. Evidence gaps and future research directions, which focus on building an evidence-base for effective countermeasures to sleepiness on this commute, are identified throughout. Several studies have investigated countermeasures to minimise the detrimental effects of sleep loss and circadian timing on driving performance. Studies of driving countermeasures such as turning on the cold air or turning up the radio, or simply taking a break without sleep, have found these strategies ineffective or only briefly beneficial (4, 5). The majority of studies investigating effective commute countermeasures have focused on caffeine and/or napping.

This review consists of five sections: (i) a general overview of the evidence for the detrimental effects of sleepiness during the post-nightshift commute; (ii) a brief review of common countermeasures for drowsy driving in general; (iii) current evidence for effectiveness of napping as a pre-commute strategy; (iv) current evidence for the effectiveness of caffeine as a pre-commute strategy; and (v) consideration of the operational viability of these strategies, in addition to the weight of current scientific evidence.

In this abstract, we focus on points (iii) and (iv), that is, napping and caffeine as potential strategies for maintaining safe driving performance during the commute home from nightshift. Table 1 provides key references from this abstract.

Results & Discussion

Despite the high incidence of SRVAs in the morning hours and anecdotal evidence of post-nightshift fatigue, there are very few studies that have specifically investigated the efficacy of countermeasures to improve post-nightshift driving performance. Several studies have demonstrated short-term benefits of on-shift naps in the early hours of the morning, but these effects do not appear to extend beyond the nightshift. A nap taken closer to commute time may be of more benefit. However, there is very little research on naps so late in a shift. One study investigated a 10-min nap taken at the end of a simulated night shift, but did not report any benefits for subsequent driving performance (6).

Research assessing the efficacy of longer nap durations under these conditions should consider a number of cost/benefit trade-offs. For example, the nap needs to be long enough to allow for sufficient sleep and benefits to sustain performance throughout the commute. Nap duration must also be balanced, however, with: a) whether workers will adopt the new behaviour (e.g. a longer nap length will delay the worker returning home to their own bed and their family); b) the potential for sleep inertia following the nap (7); and c) the potential for the nap to negatively impact on daytime sleep at home (8). Further research is needed to determine the shortest nap length required to provide observable benefits to driving performance following a night of sleep deprivation.

Caffeine is an alternative countermeasure for minimising sleepiness and performance impairment during the post-nightshift commute. Caffeine ingested after a night of sleep loss has been shown to improve subsequent driving performance (9). However, as caffeine has a half-life of approximately 5 hours (10), it may have an impact on nightshift workers' daytime recovery sleep. This recovery sleep period is already difficult due to the high circadian rhythm in alertness during the day. More research is needed to determine the most advantageous timing of caffeine consumption (e.g. how long before the end of a shift) to minimise the impact on daytime sleep quality, while still conferring performance benefits during the commute.

The combined administration of a nap and caffeine shortly before a driving task in the afternoon has been shown to be effective in minimising the impact of prior sleep restriction on driving performance (11). However, the effectiveness of this combined-countermeasure has never been tested at different times of day (e.g. at night or the early morning), or under different homeostatic sleep pressure conditions (e.g. after extended wakefulness following a

night shift). Since the combination of caffeine and a nap has been recommended in government and industry road safety campaigns, this research is of key interest. Further studies of this promising countermeasure are, therefore, necessary to determine the effectiveness of combining napping and caffeine under conditions common to nightshift workers on their commute home.

Summary

Research on how to best employ post-nightshift commute countermeasures for maximum efficacy is needed to inform public safety campaigns. Short naps on nightshift may only provide short-lasting benefits that do not extend past the end of the shift. Longer naps may offer performance benefits, although the associated costs of sleep inertia and delayed commute may be unavoidable. Caffeine consumed towards the end of a nightshift appears to improve driving performance and has the benefit of not delaying the commute home. However, caffeine may be detrimental to daytime sleep. Combined countermeasures (e.g. caffeine followed by a nap) may offer a solution. Future research should focus on the costs (e.g. sleep inertia, impact on daytime sleep), benefits (e.g. impact on sleepiness and driving performance), and viability (e.g. ease of implementation) of countermeasures to drowsy driving following a nightshift.

Table 1. References

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