



## CLINICAL REVIEW

## Sleeping at work: not all about location, location, location

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## SUMMARY

Working arrangements in industries that use non-standard hours sometimes necessitate an 'onsite' workforce where workers sleep in accommodation within or adjacent to the workplace. Of particular relevance to these workers is the widely held (and largely anecdotal) assumption that sleep at home is better than sleep away, particularly when away for work. This narrative review explores the idea that sleep outcomes in these unique work situations are the product of an interaction between numerous factors including timing and duration of breaks, commute length, sleeping environment (noise, movement, vibration, light), circadian phase, demographic factors and familiarity with the sleep location. Based on the data presented in this review, it is our contention that the location of sleep, whilst important, is secondary to other factors such as the timing and duration of sleep periods. We suggest that future research should include measures that allow conceptualisation of other critical factors such as familiarity with the sleeping environment.

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## Sleep at home and away

Global industry is now well established and in order to accommodate the 24 h society there has been a significant shift in the organisation of work hours. A growing percentage of the workforce no longer works a standard week. It is estimated that 16% of Australian [1], 18% of the USA [2] and 17% of the European Union [3] workforce are involved in some form of shift work. This shift in work patterns brings with it challenges for other aspects of life and of particular relevance to this review is sleep. The sleep and circadian disruption associated with shift work are well described [4] and inadequate sleep has adverse implications for numerous aspects of waking function [e.g., [5,6]] with ramifications for workplace performance and safety [7,8]. The quality and quantity of sleep that workers obtain between consecutive work shifts is therefore paramount for safety.

Working arrangements in many industries that use non-standard hours also necessitate an 'onsite' workforce where workers sleep in

accommodation within or adjacent to the workplace. This is the case in mobile workplaces such as aviation, road transport, the rail sector and maritime industry. Alternatively, the worksite may be in a remote area as in the case of oil rigs or mine sites making recruitment of a large and specialised workforce from the surrounding community practically impossible. In these situations, a non-residential workforce typically travels to site for periods of work and returns home during blocks of days off. Lastly, temporary work environments such as those involved in emergency services or military operations also involve sleeping away from home. Given the industries described above are high-risk, mitigation of health and safety issues related to inadequate sleep is critical.

A widely held (and largely anecdotal) assumption is that sleep at home is better than sleep away, particularly when away for work. To accept this would be to assume that for workers sleeping away from home, who are also often shift workers, the foreign or 'away' sleeping location is an additional barrier to adequate sleep. An alternative view however, is that sleeping away from home has some advantage related to fewer competing demands on time and favourable environmental conditions. Further, in circumstances where workers are away for significant periods at the same site, the work location may be extremely familiar.

This narrative review explores the idea that sleep in these unique work situations is impacted by the particular shift work

Abbreviations: FIFO, fly-in fly-out; PSG, polysomnography.

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'ecosystem'. Within this ecosystem, independent variables such as work pattern or physical environment and mediating demographic factors such as age and general health, interact to influence the recovery value of sleep obtained between shifts. It is our conjecture that it is the unique work/life 'ecosystem' that determines how well workers sleep. We will explore each of these factors firstly by looking at sleep in various work environments and follow with a discussion of the legitimacy of the comparison between work and home sleep. Finally, we will discuss the extent to which these data contribute to the notion that home sleep is always best.

Keywords were used to search the key databases, PubMed and Google Scholar (shift work, sleep, field), Bibliographies of relevant articles were scanned and used to refine the keywords to include industries which utilise working arrangements that require sleep at work (away from home). Where articles did not include assessment of sleep at home and at work they were not included, unless the content was relevant for context. The authors accessed references in the grey literature in addition to the peer-reviewed literature, as the grey literature is an important source of field studies addressing the question of this narrative review.

### Types of work requiring 'away' sleep

#### *Remote or isolated workplaces*

The resources sector employs a large proportion of the non-residential workforce in Australia and other resource rich countries [9]. Non-residential workforces housed in accommodation camps are common in mining, oil and gas operations because the local community cannot provide all of the required personnel, the worksite is remote from the local town or because the facilities in adjacent towns are not able to cater for large numbers of people. Such operations generally employ structured shift arrangements, and often involve day and night shifts. Despite a proliferation of non-residential workforces in some sectors, very few studies have compared the sleep of non-residential employees at home and at work.

The off-shore oil rig, with reduced light exposure and social/domestic activities [10] appears to have the makings of an ideal sleeping environment, despite being away from home. Bjorvatn and colleagues used self-report instruments to examine the sleep of oil-rig workers required to sleep on the rig between shifts. They showed that there were no differences in total sleep obtained whilst away on the rigs during work periods compared to that obtained at home during time off [11]. This was in contrast to an earlier report by Parkes and colleagues showing that self-reported sleep on the rigs averaged 7.2 h on night shift and 6.99 h on day shift, compared to 7.7 h during leave periods at home [12]. In another study by Bjorvatn et al. [10] sleep on night shift was reported as being slightly shorter than other studies, at 6.5 h, but longer than the same workers on day shift the following week. Unfortunately, there was no comparison to home sleeps. The same group looked at sleep at home and offshore on different shift patterns [13]. No difference was found in home sleep following return from different shift patterns. As with the previous studies, work factors were the main influence on sleep. This suite of studies on offshore workers suggests that in some situations sleep may not be shorter in the 'away', work environment possibly due to the conditions on the oil rig. In contrast, a study of fly-in fly-out (FIFO) miners demonstrated that despite the removal of most social and domestic activities, being away from home did not translate into more sleep [14]. This suggests that factors other than location are

impacting on sleep (positively or negatively) in each of these environments.

The Polar Regions provide examples of isolated workplaces to which workers can be deployed for short treks or summer camps, or for long periods at research stations [15]. While there are many unique aspects to this type of deployment, namely the extreme physical conditions and periods of confinement [15], it is similar to the off-shore oil-rig environment in terms of reduced light exposure (winter months) and social/domestic activities. Weymouth et al. [16] compared home sleep with sleep during a short, 12 d field camp to Antarctica and found no differences in total sleep obtained or sleep disturbance as measured by actigraphy, despite individuals sleeping in polar tents for the majority of the camp. In a 13-mo deployment however, marked changes in sleep as measured by polysomnography (PSG) were observed [17], with sleep worse in all months compared to home baseline and worsening with time. While it is clear that 'away' sleep was negatively impacted, it is not possible to know how much of a role the actual conditions played (physical conditions, work demands) and how much was due to being away from home. We would argue that the conditions, which can be extreme, would have played a large role in any changes to sleep. Having said that, while the 13-mo deployment would have facilitated a degree of familiarity, it is difficult to quantify 'familiarity' and the role it may play in sleep outcomes. Importantly, in these particular circumstances, familiarity with the location did not appear to benefit sleep.

Studies of the sleep of workers who slept at home between 12 h shifts have demonstrated that workers obtain approximately 6 h sleep [18,19]. This is similar to the amount of sleep miners (also working 12 h shifts) obtained when sleeping at work in purpose-built facilities [14]. In terms of home and work comparisons, Ferguson et al. [14] showed that Australian FIFO miners got 7.3 h on days off at home, significantly more sleep than during blocks of work sleeping away. Further, Muller et al. [20] reported 6.6 h of sleep on day shift, 6.7 h on night shift and 8.2 h on days off. However in both studies, the comparison between away (on-site) sleeps and home sleeps is confounded by work. The home sleeps of FIFO-based workforces occur on days off and are thus not restricted by work hours. Ferguson and colleagues suggested that any benefit associated with sleeping in the absence of domestic and social distractions whilst sleeping at work, may be overridden by factors such as the roster (specifically, the 06:00 h day shift start time acting to truncate night-time sleep) and the circadian influence on sleep propensity during day sleeps between night shifts. Well-controlled lab studies clearly show that reduced sleep opportunity equates to less sleep [e.g., [5]] and day sleep is shorter and lighter than night sleep due to the circadian influence on sleep [21–23]. The sleep in camps and oil rigs is thus impacted by shift factors even though the length of the sleep opportunity (break between shifts, typically 12 h) should provide for eight hours of sleep. Of particular interest is the way in which workers utilise their time-off between shifts and how those choices impact on the amount of sleep they can obtain. Typically however, this information has not been recorded. The 12 h shift rosters provide a nominal 11–12 h sleep opportunity. Many 'mobile' work environments such as planes, trains and ships are associated with work schedules that provide much shorter sleep opportunities.

#### *Mobile workplaces*

Occupations such as aviation, rail and maritime necessitate sleep in a moving vehicle due to the long work periods (such as trans-meridian travel in aviation or freight haul operations in

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