

24/7 Health

Second annual Sleep Loss Symposium: working and sleeping around the clock

Naomi L Rogers and Ronald R Grunstein

Accidents, such as the Exxon Valdez grounding, show how long work hours and fatigue can affect health and performance — pharmacological, behavioural, technological and legal countermeasures are available

Thanks to Edison and other 19th century inventors, we now live in a 24/7 society. Electric lighting keeps factories, supermarkets and airports operating around the clock. Planes fly across multiple time zones. Trucks are driven all night. Health care delivery is a 24-hour business. The price we pay is that lack of sleep and circadian disruption are contributing to work, parenting, social and family pressures, sleep and other medical disorders, and voluntary sleep curtailment.

The second annual Sleep Loss Symposium, held in Sydney on 17 November 2004, was organised by the Woolcock Institute of Medical Research, University of Sydney. The symposium focused on the risks associated with working and sleeping around the clock, with presentations from internationally recognised experts from the United States, Sweden and Australia.

Health effects

Torbjörn Åkerstedt (Professor of Behavioral Physiology, Karolinska Institute, Stockholm) reviewed evidence in shiftworkers of the increased risk of cardiovascular disease (50% higher incidence of coronary heart disease and increased risk of myocardial infarction), gastrointestinal complaints (50% greater risk of developing peptic ulcers) and breast cancer.^{1,2} He highlighted recent studies showing that shortened sleep leads to reduced insulin responses to high glucose levels, decreased leptin and increased ghrelin levels, increased triglyceride levels, higher cortisol levels, reduced thyroid axis activity and altered timing of melatonin secretion. The term “shift work sleep disorder” is used to describe insomnia or excessive sleepiness in relation to work schedules that occur during the habitual sleep phase. Shiftworkers have higher risk of peptic ulcer, fatigue-related accidents and depression than those without the disorder.

Åkerstedt's work has recently focused on an increasingly common result of sleep disturbance and chronic exposure to stress — “burnout” — a major burden on the Swedish social security system and common in health care workers. The clinical symptoms of burnout include overpowering fatigue with a lack of restitution from sleep, impairment of memory function, depressive symptoms, poor work performance and lack of empathy; it is distinct from chronic fatigue syndrome. Åkerstedt highlighted the impact

of disturbed sleep in more severe cases of burnout, and described positive responses to individual sessions of cognitive behaviour therapy during about a 12-month period.

Neurobehavioural effects

Naomi Rogers (Senior Research Fellow, Woolcock Institute, Sydney) presented data illustrating the effects of chronic sleep loss with and without circadian disruption. People with sleep restricted to 3–7 hours in each 24 hours for up to 2 weeks had performance decrements comparable to those of people kept awake continuously for 3 days and nights. Importantly, individuals fail to recognise their level of impairment, highlighting the ineffectiveness of self-monitoring sleepiness and accident risk. Many speakers highlighted the importance of individual differences in susceptibility to sleep loss, with some individuals being particularly sensitive to sleep loss, while others remain relatively resistant.³ Evidence for individual differences in tolerance to shift work, ability to sleep and subsequent sleepiness were also described by Åkerstedt.

David Dinges (Professor of Psychology in Psychiatry, University of Pennsylvania) gave examples of real-world effects of sleep loss, including the grounding of the Exxon Valdez on Bligh Reef in Alaska and air crashes (eg, American Airlines crash in Little Rock, Arkansas in 1999).

The Exxon Valdez grounding on Bligh Reef just after midnight on 24 March 1989 was found to be directly contributed to by fatigue due to sleep loss. The captain, first mate and second mate had all been awake and working excessive hours loading the vessel and had gone below deck to sleep. The third mate was also sleep-deprived and in violation of the federal statute governing hours of duty in ship mates, but was left to guide the vessel out of Prince William Sound. On leaving the Sound, the third mate failed to correctly manoeuvre the vessel, and it ran aground. As a result of this accident, eight cargo tanks were ruptured and about 250 000 barrels of crude oil emptied into the ocean, causing a serious environmental catastrophe. The Exxon company was ordered to pay \$US5.25 billion in damages — a decision it is still appealing.

In June 1999, an American Airlines flight (AA1420) from Dallas to Little Rock, Arkansas, overran the end of the runway and crashed into lighting towers, killing 11 (including the captain). At the time of the crash, the captain had been working for at least 16 consecutive hours, and was attempting to land the plane at a time that was 2 hours after his normal bedtime. As well, in the United States, the National Transportation Safety Board (NTSB) estimates that at least 100 000 crashes, 71 000 injuries and 1500 deaths in motor vehicle accidents are a result of the driver falling asleep.

Serious accidents resulting from fatigue and sleep loss are not restricted to the transportation area. Dinges also presented recently published data about serious medical errors in hospitals. In one report, it was found that when nurses worked more than 12.5

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hours in one shift (which was the case in nearly 40% of their shifts) the chance of a near error was nearly double, and there was a threefold greater incidence of there being one or more serious errors during that shift.⁴ A recent study of sleep and errors among first-year and second-year medical residents reported that 66% of residents slept for an average of 6 hours or less per night, and 22% of residents slept for an average of 5 hours or less per night. In those averaging 5 hours or less of sleep, there was an increased likelihood of serious accidents or injury, conflicts with other professional staff members, use of medications to maintain wakefulness, working in an impaired condition, significant medical errors, and being named in a malpractice suit.⁵ Reducing the work hours of intensive care unit residents from an average 85 hours to 65 hours per week resulted in increased sleep duration and a reduction in errors and performance failures.^{6,7} On 85-hour work weeks, residents had 50% more attentional lapses during the day and more than twice the attentional lapses at night compared with the 65-hour work week schedule. In addition, during the 85-hour work week, residents made 35.9% more serious medical errors, including 56.6% more non-intercepted serious medical errors, 20.8% more serious medication errors and 5.6 times more serious diagnostic errors.

Countermeasures

Dinges described the use of various countermeasures including pharmacological, behavioural and technological. He spoke about the need to reduce the use of illegal and dangerous pharmacological wake-promoting substances (such as amphetamines), and discussed safer alternatives (such as caffeine and modafinil), and behavioural countermeasures such as naps. Technological countermeasures, such as fitness-for-duty devices and automated fatigue-detection devices (eg, those that monitor the rate and number of eye closures), were reviewed. However, to date there is no validated and accurate device for predicting when someone is likely to fall asleep.

Dinges also provided a critique on one of the controversial areas in sleep and circadian research, as industries try to manage their fatigue-related problems — biomathematical models to predict fatigue and performance. He discussed the currently available models (widely used in Australian rail and other transport industries) that were recently objectively tested using a variety of sleep loss and circadian disruption scenarios, with the results published in a special edition of the journal *Aviation, Space and Environmental Medicine*.⁸ While all models were able to accurately predict fatigue during total sleep deprivation, none could accurately predict fatigue and performance during different chronic sleep restriction or circadian disruption scenarios. This presentation highlighted the need to validate these models before they are ready to be used in the real world, despite the fact that some models have been adopted into industry settings already.

Medicolegal

Ron Grunstein (Clinical Associate Professor, Woolcock Institute, Sydney) provided an overview of the current medicolegal situation

when an accident or injury is related to fatigue induced by sleep loss and long work hours. Examples included the Selby train crash in the United Kingdom, in which the driver of a motor vehicle caused two trains to crash, killing 10 people and injuring more than 70 others. The driver had not slept the previous night and was sentenced to 5 years in prison. In a recent case in Australia, it was deemed that a commercial truck may be considered a part of the work place, and an employer was held liable for the death of the driver, who had not slept for 2 days before the crash because of work demands. In another case, a medical officer at a Queensland hospital made a diagnostic error resulting in the death of a young patient; fatigue due to extended work hours and lack of sleep was deemed to be the underlying cause of his misdiagnosis. The doctor's work hours were restricted by the Medical Board, and professional bodies called on Queensland Health to change its work practices. Grunstein highlighted how occupational health laws and work hours may potentially affect hospital administrators and supervising consultants, who may be liable for fatigue-related errors by junior doctors working extended hours under their supervision.

Panel discussion

The symposium concluded with a wide-ranging, interactive panel discussion with all the speakers. Many delegates expressed frustration at the lack of action in some industries, where work hours and excessive shiftwork place not only individuals, but large sections of the community, in danger. Some panelists identified specific areas for attention by occupational health practitioners, including screening for sleep disorders and ensuring that work hours were a health, and not just an industrial, issue. The conclusion was that 24/7 operations were here to stay — health researchers will need to develop ways to maximise the health and safety of workers, patients and the community at large.

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