

Why we need sleep



How fatigue affects you

MSAC

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There are health, safety, performance and wellbeing advantages from having adequate sleep. Aim for seven to eight hours sleep within a 24-hour period.

Background

While working with the mining and extractives industry to manage fatigue in the workplace, providing more information on how fatigue affects people at work and at home is useful.

Fatigue is an issue in Australia. Attempts to reduce the effects of fatigue have had little impact compared to similar campaigns around other issues such as drink driving and smoking, which have had significant improvements in the social acceptance for effective management strategies.

While the focus on managing hours of work and rest are useful, a better understanding of why we sleep and how sleep affects the safety, health and productivity of everybody could be beneficial. Fatigue can affect everyone and it's often insufficient sleep that is the main cause.

People have suggested that sufficient sleep is not that important and is "lazy". Songs tell us we can "sleep when I'm dead" and "A good captain can't fall asleep". There couldn't be any worse advice.

Research shows that people who average six hours or less sleep each night are at twice the risk of a car crash and someone who sleeps around five hours triples the risk (Stutts, Wilkins, Osberg & Vaughn (2003).

Poor decision making is not the only negative outcome of too little or poor quality sleep. Research shows that poor quality or too little sleep can contribute to obesity and type II diabetes. It is also linked to some cancers, cognitive decline in the elderly and higher death rates.

Some sleep disorders (in particular obstructive sleep apnoea) are implicated in increased blood pressure, strokes and heart attacks. In children, too little sleep can show up as ADHD-like symptoms and for teens, links have been shown to increased drug and alcohol use, feelings of uselessness and suicidal thoughts.

The following information provides a better understanding of sleep and its management. It's not conclusive but a starting point.

Benefits of sleep

How sleep cleans the brain

Sleep is a homeostatic response to being awake. Basically, the longer you are awake, the more you need to sleep. Researchers at the University of Rochester Medical Center (URMC) for Translational Neuromedicine found the brain has a unique “waste disposal system” during sleep. Called the “glymphatic system”, researchers saw that certain glial cells have channels that open up when people are asleep and remove chemicals and toxins that have built up in the brain during wakefulness.

Adenosine triphosphate (ATP) is a substance released by glial cells within the brain and can help with neurotransmission (communication from one brain cell to the next). Glial ATP is rapidly broken down to adenosine, which acts on adenosine receptors to depress neuronal activity. Basically, a build-up of adenosine in the brain serves as a sleep-promoting drive. As long as a person is awake, they are creating a drive to sleep slowly over the day, through the build-up of adenosine.

Figure 1 shows how the chemical might build up during wakefulness. When a lot of this is built up, the brain will have reduced function and a drive for sleep will soon begin. During sleep, the cleanout begins. By pumping cerebrospinal fluid through your brain’s tissues, the glymphatic system flushes waste from your brain, back into your body’s circulatory system. From there, the waste eventually reaches your liver, where it is eliminated.

During sleep, the glymphatic system becomes 10 times more active than during wakefulness. Simultaneously, brain cells are reduced in size by about 60%. Some of these toxins may be responsible for diseases such as Alzheimer’s.

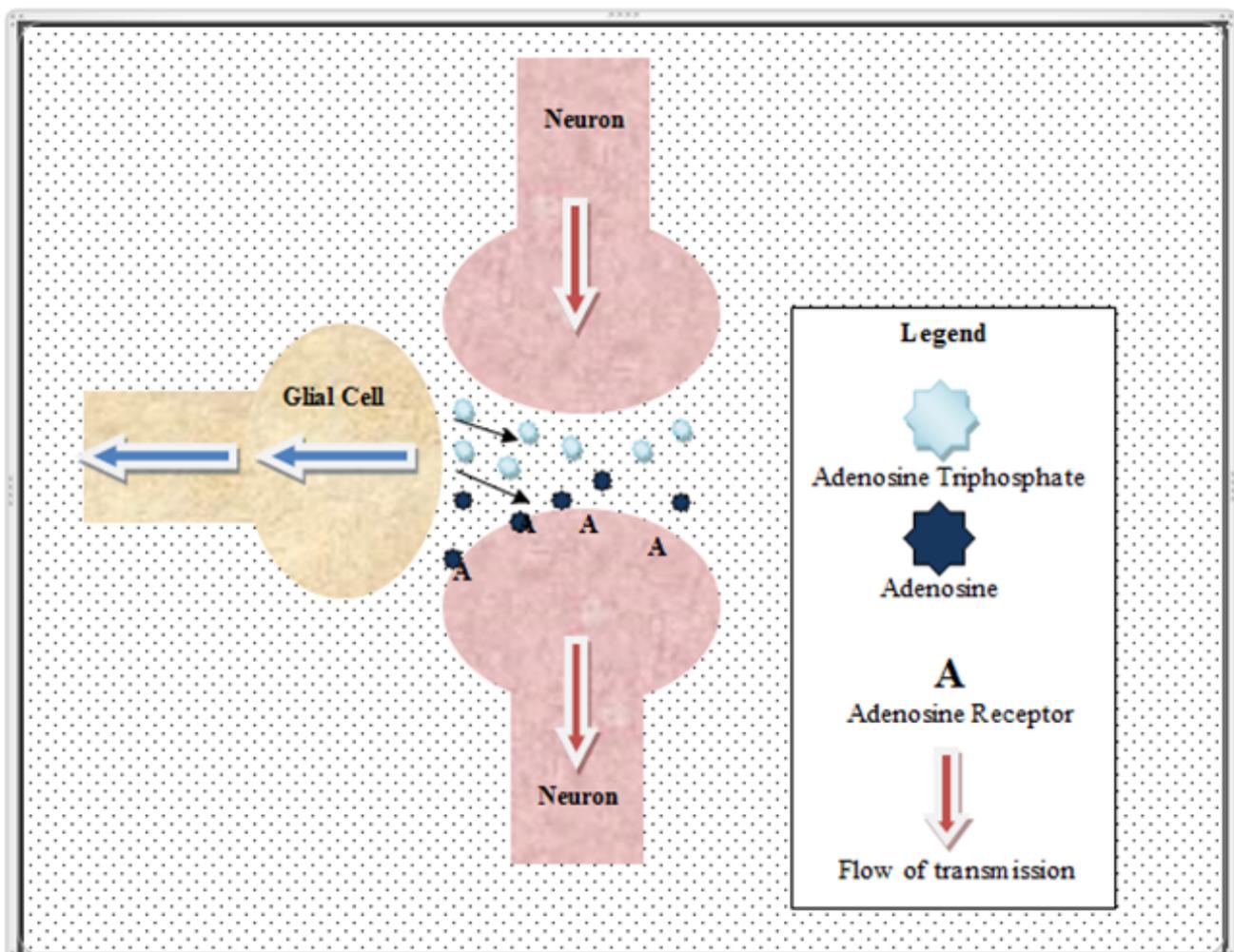


Figure 1: Transformation of adenosine triphosphate to adenosine between neurons and removal of toxins. From Beyond Midnight Consulting “Comprehensive Fatigue Resource Book 2nd Ed (2015).

Circadian rhythms

Ever heard of circadian rhythms? These are the patterns of sleep and wakefulness and are associated with increases in the hormone melatonin for sleep onset and cortisol for helping to wake and deal with the stresses of the day. Core body temperature fluctuates and cools to its lowest point around 3am and reaches its peak around 8pm-9pm.

Humans are diurnal, which means they naturally sleep at night and are awake during the day. Working nightshift causes issues as people are working when they should be asleep (creating drowsiness and associated safety issues) and attempt to sleep during the day when we are programmed to be awake (causing short or poor quality sleep).

Shift workers estimate that they often average about five hours of sleep during the day, which can impact heavily on subsequent nightshifts. While there is some evidence that shift workers can adjust their rhythm to nightshift the longer they are on shift, there is other evidence that some will never adjust to working nightshift. History indicates that years of nightshift causes health problems for many workers. If the best possible conditions for day sleep are available, workers tend to sleep better and perform better.

Some workers tend to be more biologically suited to nightshift than others. Some workers can sleep better during the day than they do at night. More work needs to be done to establish how many successive nightshifts are best for safety and productivity. It should be recognised that there are individual differences and each shift worker should be viewed separately.

The impact of too little or too much sleep

The cost of sleep disorders

An Australian study was conducted by Hillman & Lack (2013). It looked at the results of the 2010 sleep survey by the Australian Sleep Health Foundation (www.sleephealthfoundation.org.au), where it was identified that about 20% to 35% of Australians had sleeping difficulties.

The study estimated that half of the people with sleeping difficulties had sleep disorders such as obstructive sleep apnoea, insomnia and restless legs syndrome. The other half who had sleeping difficulties had bad sleep habits or chose to limit sleep opportunities. The economic impact of sleep disorders is estimated to cost Australia \$5.1 billion a year. Of that, about \$4.3 billion is non-medical costs and loss of productivity costs resulting from accidents attributed to sleep disorders and associated sleep loss.

Sleep and mortality

A 22-year follow-up study on sleep and mortality (population-based) of more than 21,200 twins found an elevated risk of early death for both men and women who slept less than seven hours or more than eight hours (Hublin *et al.* 2007). The results are shown in figure 2.

The study also found that this same association was found in 22 published studies of mortality and sleep length. An earlier study of more than 82,900 women (Patel *et al.* 2004) found that the lowest risk factor for mortality was found in those obtaining seven to eight hours of sleep. Those sleeping five hours or less had a 15% higher risk of death and those sleeping more than nine hours, the risk rose a staggering 42%. It is likely that sleeping over nine hours was indicative of sleep disorders such as obstructive sleep apnoea.

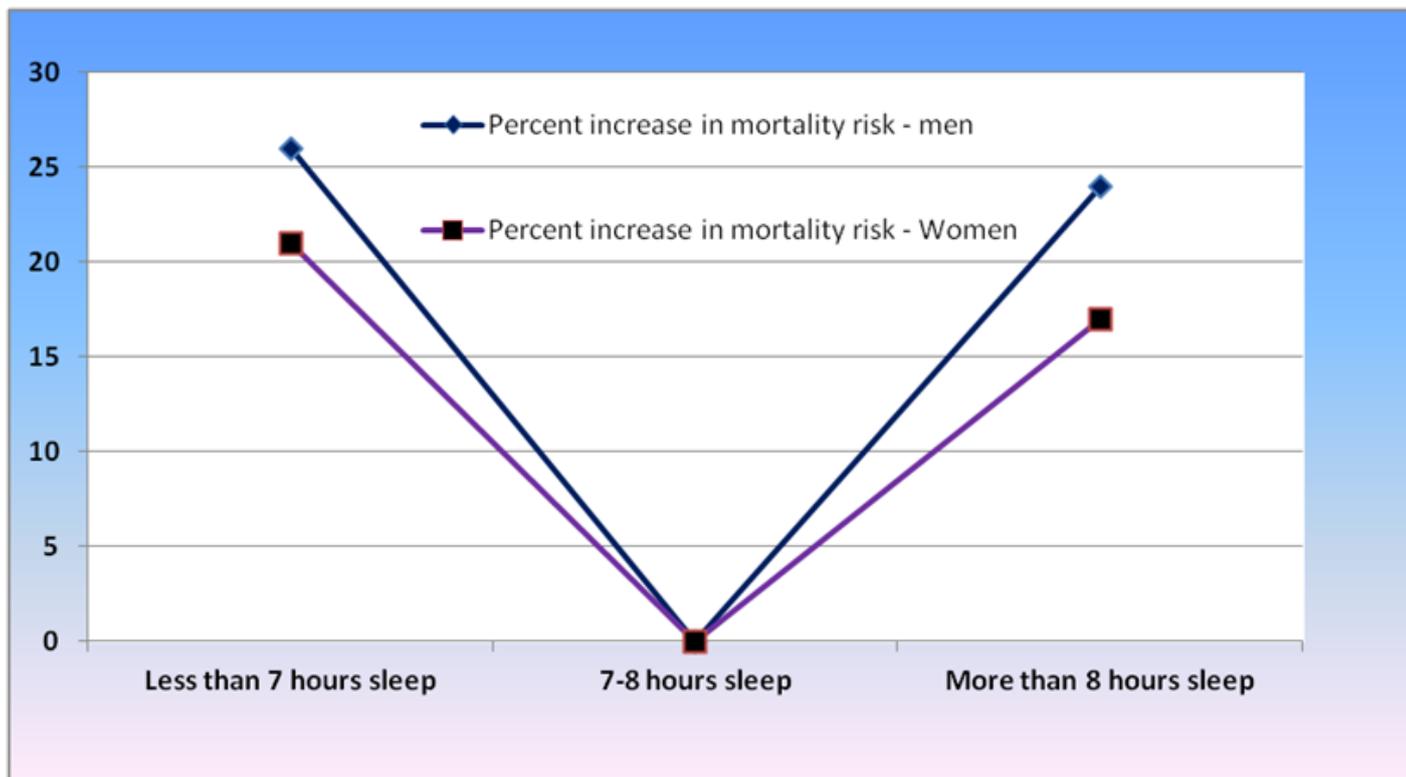


Figure 2: Sleep length and risk of mortality. Based on Hublin et al. (2007). From Beyond Midnight Consulting Comprehensive Fatigue Resource Book 2nd Ed (2015).

Sleep and type II diabetes

A recent analysis of 10 research projects (Cappuccio *et al.* 2010) including more than 107,000 people found that the risk of type II diabetes was highly linked to length of sleep, initiating sleep and maintaining sleep. An earlier study (Ayas *et al.* 2003) of more than 70,000 women enrolled in a nurses' health study, found similar results.

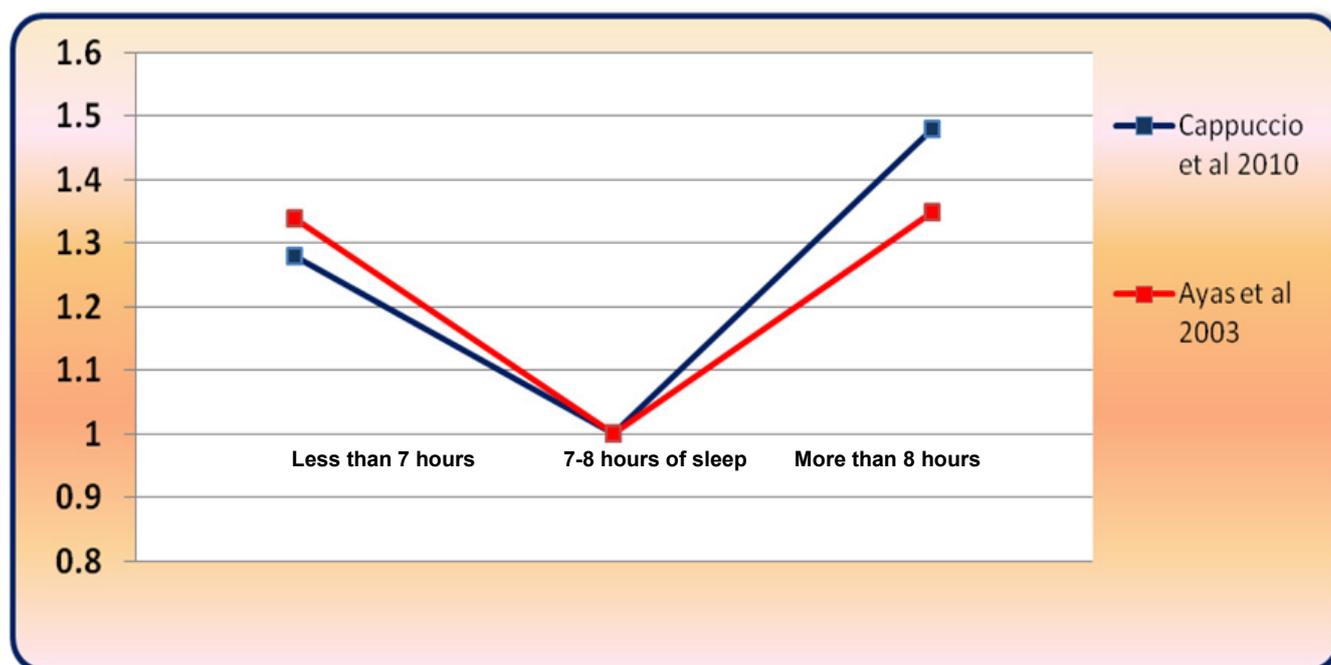


Figure 1: Risk ratio of T2D for length of sleep. Adapted from Cappuccio et al. (2010) and Ayas et al. (2003). From Beyond Midnight Consulting "Comprehensive Fatigue Resource Book 2nd Ed (2015). X-axis is risk ratio for Type II Diabetes.

Obesity

The past three to four decades saw a large reduction in the amount that people sleep. A study in the US in 2005 (National Centre for Health Statistics, 2005) showed more than 30% of people between 30 and 64 years reported sleeping less than six hours a night. It is highly likely that this reflects sleep in most developed countries.

With less sleep, there has been a corresponding increase in obesity, with the US and now Australia, very high on the obesity ladder. Another study (van Cauter & Knutson, 2008) that investigated sleep and obesity in children and adults, reviewed 47 studies of which 42 showed a correlation between reduced sleep length and increased obesity.

Sleep and cognitive decline

A study of 2012 cognitively unimpaired individuals over 65 years old (Keage *et al.* 2012) showed that having a nap during the day, reduced their risk of cognitive decline 10 years later by 52% (compared to those who did not nap). They also found that those who had less than six-and-a-half hours of sleep each night on average were 105% more likely to develop cognitive impairment over the following 10 years. Those who reported excessive daytime sleepiness were 121% more likely to suffer cognitive decline.

Other contributing factors

A range of other factors can contribute to and compound fatigue. Understanding and controlling these influences will require a holistic approach to fatigue risk management in the workplace. These factors can include:

- Core body temperature
- High and low physical demands
- Light
- Noise
- Hot and cold working environments
- Vibration
- Working around hazardous substances

Workplace benefits of enhanced fatigue education and awareness

To better understand how an organisation would benefit from fatigue education and awareness, the education must include all members of the organisation including stakeholders, CEOs and workers. If they drive to work, they are at risk.

More information

More information on fatigue and fatigue-related documents can be found on the Department of Industry's website www.resourcesandenergy.nsw.gov.au.

Acknowledgments

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