

The Effects of Shortened Sleep

Background

The benefits for health and wellbeing of eating a healthy, nutritionally balanced diet, taking regular exercise and participating in a variety of social activities are well documented. Many would also acknowledge a good night of quality sleep is important for optimum daily functioning. Sleep deprivation has been cited as the cause of some major disasters, including the grounding of the Exxon Valdez oil tanker, which dumped approximately 11 million US gallons of crude oil onto 1,300 miles of Alaskan coastline in 1989. Additionally, falling asleep at the wheel is estimated to be responsible for up to 20% of all road traffic accidents in the UK. The term sleep deprivation implies an extreme state of fatigue, which is accompanied by effects that are widely acknowledged and accepted. The effects of *shortened sleep* however are generally not as well-known although the impact, particularly on learning and general wellbeing, can be just as significant.

Impact of shortened Sleep

- ❖ **Increased anxiety** - Not getting enough sleep increases the levels of cortisol, the hormone responsible for stress and anxiety. This can also lead to low mood, increased irritability, decreased social and communication skills, reduced sense of humour and/ or depression.
- ❖ **Weight gain** – Shortened sleep can lead to weight gain in two ways. Firstly, by staying up later and eating when you should be asleep, particularly if eating snack foods high in sugar and/or fat. Secondly, hormones that impact upon appetite are released during sleep. Ghrelin is an appetite stimulant while leptin is the hormone that makes you feel full. Shortened sleep decreases leptin secretion and consequently increases hunger.
- ❖ **Decreased cognitive performance** – Tiredness can lead to difficulties with concentration, attention, processing and working memory. Capabilities in performing complex or multiple tasks, problem solving and creativity are also impaired. In addition, replenishment of neurotransmitters is thought to take place during sleep. Therefore shortened sleep may have implications for organising and transferring information into long term memory.

- ❖ **Impaired judgement** – Shortened sleep can lead to poor decision making skills and increased risk taking. In particular, errors of judgement concerning the level and effects of tiredness on personal functioning are common. Ignoring signs of fatigue leads to drowsiness or unintended sleep episodes, which can be fatal if they happen while driving or operating machinery.
- ❖ **Health issues** – Shortened sleep can often lead to an increase in sore throats, colds and viruses. Persistent or long term shortened sleep can increase the risk of developing heart disease, high blood pressure, diabetes and obesity.

How much sleep is recommended?

Sleep needs change dramatically across the lifespan. Young infants sleep for approximately two thirds of a 24 hour day and from about 18 months onwards their total sleep time starts to decrease. Toddlers (aged 1-3) require 12 - 14 hours; pre-schoolers (3-5 years) between 11 and 13 hours; school aged children (5-10 years) 9 to 11 hours and adolescents (10–17) require 8.5 – 9.25 hours of sleep per night.

As a rough gauge, it has been suggested¹ that adults need one hour of sleep for every two waking hours, which works out at approximately eight hours of sleep per night.

Sleep quality

It is not just a question of quantity, the quality of sleep also determines how rested we feel when we wake. Many years of research has confirmed that sleep is an active state during which particular processes take place in the brain and the body. Furthermore, these processes change as sleep moves through a distinct set of stages that occur in cycles.

When we first fall asleep we enter Non Rapid Eye Movement (NREM) sleep and progress through stages 1 and 2 (light sleep) in to stage 3 (deep sleep). We then move back up in to the lighter stages of sleep before entering Rapid Eye Movement Sleep (REM). Once REM is over, we usually return to stage 2 sleep and then stage 3 and so on. Sometimes brief awakenings occur after REM sleep. Sleep cycles through these stages approximately four or five times throughout the night. The first cycle of REM only lasts a short period of time but with each cycle it becomes longer. This means that in the first half of the night we spend

¹ Maas, J.B. (2009). *Everything you must know about sleep but are too tired to ask*, available at: <http://www.massmed.org>

longer in slow wave sleep (deep sleep) whereas in the second half of the night we spend longer in REM sleep.

Stage 3 sleep (deep sleep) is considered to be the most restorative stage for both the brain (memory consolidation) and body (growth hormone is released enhancing growth and regenerating proteins, cells and tissue). However, research on sleep is ongoing and recent evidence suggests that both stage 2 NREM and REM may also have an important part to play in memory and learning. Furthermore, it has long been speculated that REM sleep may have an important mood regulating function due to the fact that it allows dreaming to occur.

What controls sleep?

When sleep is working properly it is said to be a highly regulated process. A 'two process model' was proposed in the 1980s and is still widely accepted today as an explanation for how sleep is regulated. Two important bio-physical systems are thought to interact in order to maintain a consistent sleep-wake pattern. One system is known as the 'sleep clock' (based on the circadian rhythm), whereby levels of blue light are detected by the eye and messages are sent to a particular group of cells in the brain that use this information to determine whether to release hormones that induce wakefulness (cortisol) or sleepiness (melatonin). This is thought to operate alongside another system – the 'sleep drive' – which measures periods of wakefulness and sleep and creates a homeostatic drive for one when enough of the other has accumulated.

Sleep hygiene

While sleep is intended to be a highly regulated process, a number of factors can confuse the two regulating systems causing the sleep-wake rhythm to go off course and, in some cases, more severe sleep problems to develop. The concept of 'sleep hygiene' was introduced nearly 100 years ago and is basically a collection of behavioural tips that are intended to keep the regulating systems in check². Some of the tips relate to behaviours that support healthy sleep routines such as setting regular rise times, avoiding long naps in the daytime and getting regular exercise. Others relate to the environment and establishing a 'sleep-friendly' bedroom.

² Pigeon, W.R (2010) *A Sleep Manual: how to achieve the perfect night's sleep* New Holland Publishers: London

Sleep and teenagers

Teenagers are considered to have increased vulnerability to sleep deprivation due to the fact that their circadian rhythm is thought to shift by approximately two hours making them more inclined to go to bed late while social constraints dictate that they still need to be up early in the mornings for school which creates a sleep deficit. Additionally, an increase in the availability and use of light-emitting technology in the day to day lives of teenagers is known to have a negative impact on sleep³ as the blue light emitted from these devices mimics the natural blue light from the sun which, as we know, plays a significant role in regulating the sleep clock. Use of this technology late at night is not advised although, in reality, this is common practice among many teenagers.

Sleep in the media

It would appear that awareness regarding the importance of sleep, and the increased vulnerability of teenagers to developing sleep problems, is growing. Increasingly, this issue is attracting a lot of media attention⁴ and is frequently highlighted as a problem in newspaper articles⁵. In an attempt to respond to this need, some organisations are developing educational interventions for young people such as the *Sound Sleep*⁶ programme launched in 2011 by Sleep Scotland which is delivered in schools and specifically aims to educate young people on this issue and promote healthy sleep practices.

Conclusion

Falling asleep instantly, needing an alarm clock to waken in the morning, repeatedly hitting the snooze button and sleeping in at weekends are all indicators of accumulated shortened sleep. The only way to reduce the sleep debt is to sleep for the recommended amount of time on a regular basis.

³ Falbe, J, Davison, K and Frankle, R et al (2015) Sleep Duration, Restfulness and Screens in the Sleep Environment. *Pediatrics* 135 (2) 367 -375.

⁴ Bradford, E (26th August 2013) 'Half of teenagers sleep deprived say experts' BBC News report. Retrieved from <http://www.bbc.co.uk/news/uk-scotland-23811690>

⁵ Dillner, L (3rd November 2013) 'How much sleep do teenagers need?' The Guardian

⁶ Sleep Scotland (2011) Sound Sleep teaching resource manual