
Australasian
Society of
Lifestyle
Medicine

Sleep physiology - Introduction

Unit: 3.3.1

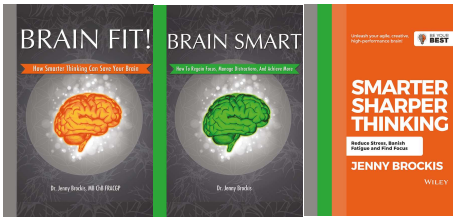
Presenter: Dr Jenny Brockis

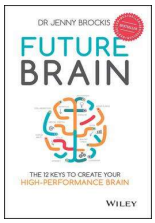
Version 1.0

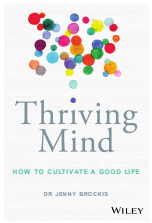
About Jenny

Dr Jenny Brockis

Founder & Director
Brain Fit
www.drjennybrockis.com
jenny@drjennybrockis.com







DR. JENNY BROCKIS
CREATING THRIVING TEAMS & LEADERS

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Declarations

- No conflicts of interest

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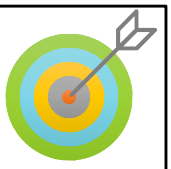
Learning outcomes



By the end of this topic, you will be able to:

1. Describe the physiology of sleep
2. Identify how sleep deprivation impacts health
3. Describe what a good night's sleep looks like

Readings

Required reading

1. Chapter 18 – To Sleep, Perchance to… Get everything Else Right (West & Egger, 2017)

Recommended reading

1. Elevated inflammatory markers in response to prolonged sleep restriction are associated with increased pain experience in healthy volunteers (Haack, Sanchez, & Mullington, 2007)
2. About sleep's role in memory (Rasch & Born, 2013)
3. Brain basics: Understanding sleep (National Institute of Neurological Disorders and Stroke (NINDS), 2019)

Introduction

Why we need sleep

Why so many people are sleep deprived

The impact of chronic sleep deprivation on health and well-being

- Why we need sleep
- Why so many people are sleep deprived
- The impact of chronic sleep deprivation on health and wellbeing

Describe the physiology of sleep


What's the big deal
with sleep?

Sleep as the vital indicator

We spend 1/3
of life asleep

(Sleep Health Foundation, 2019)

Sleep as the vital indicator

27 years asleep
by age 82

(Sleep Health Foundation, 2019)

Sleep as the vital indicator

60% of adults report difficulty with sleep

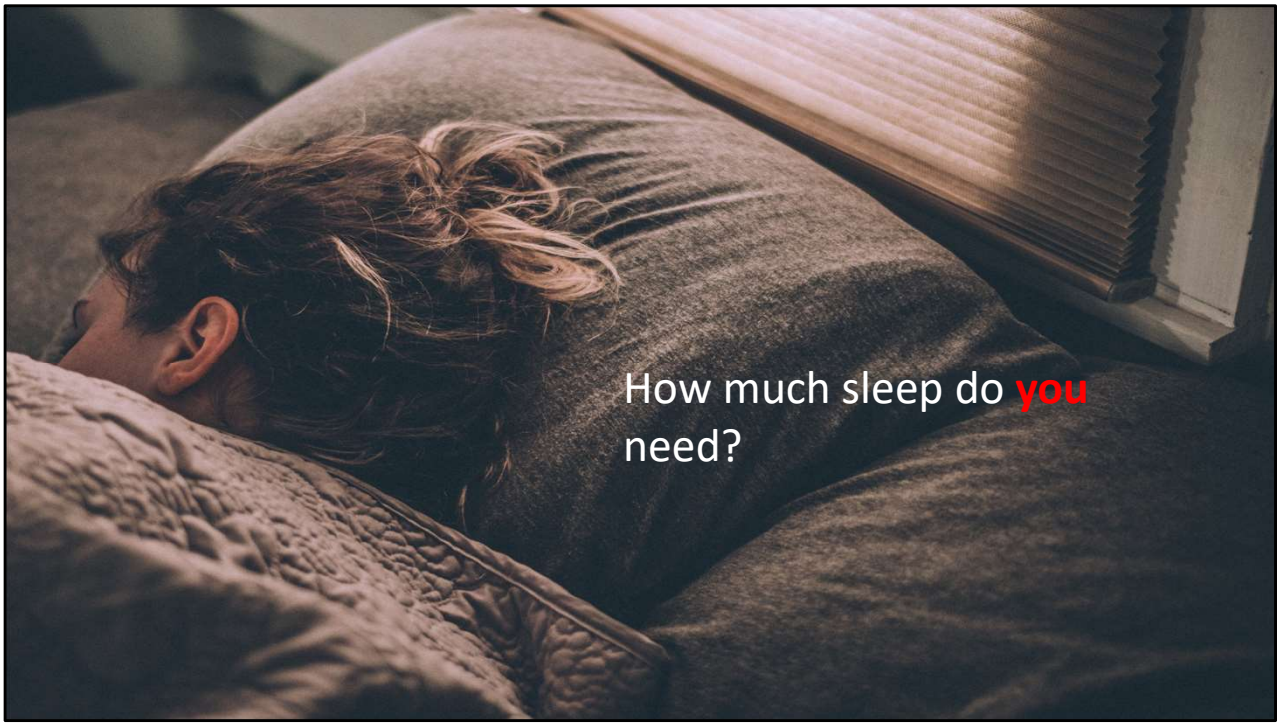
(Sleep Health Foundation, 2019)

Sleep Health Foundation Australia has reported 60% of adults regularly experience some form of sleep difficulty either falling asleep or maintaining sleep three or more times a week and 14.8% have symptoms which could result in a diagnosis of clinical insomnia

Sleep as the vital indicator

50% get less than 6.3 hours per night

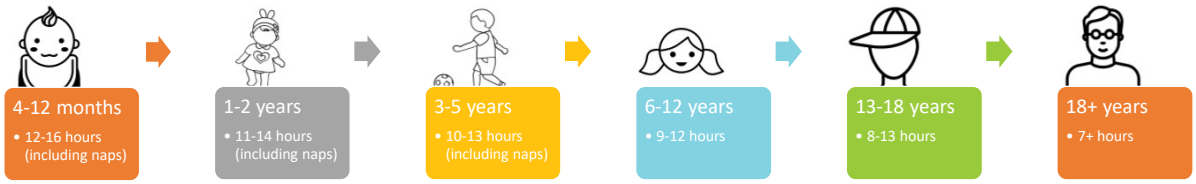
(Sleep Health Foundation, 2019)


How much sleep do you need?


Natural short sleepers

Healthy sleep duration

for each stage of life



4-12 months
- 12-16 hours (including naps)

1-2 years
- 11-14 hours (including naps)

3-5 years
- 10-13 hours (including naps)

6-12 years
- 9-12 hours

13-18 years
- 8-13 hours

18+ years
- 7+ hours

Adapted from Sleep Education (n.d.)

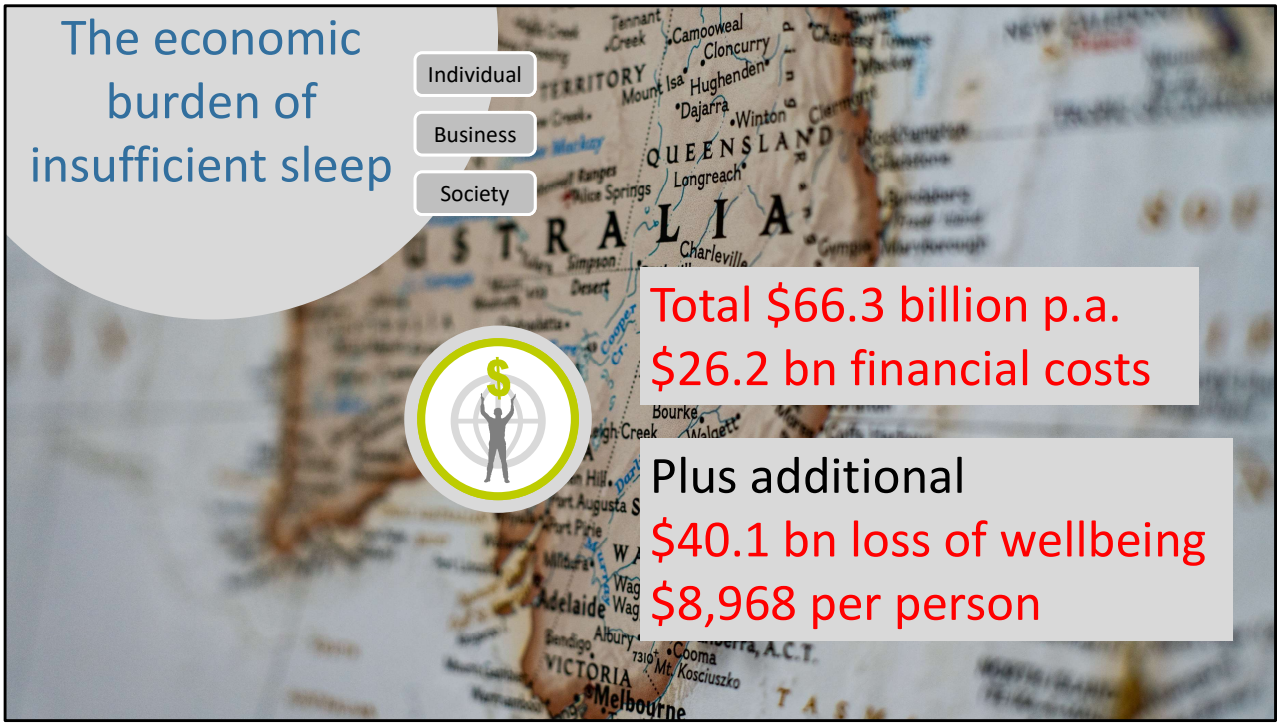
Sleep is the third pillar for a healthy lifestyle along with nutrition and exercise

It is essential to

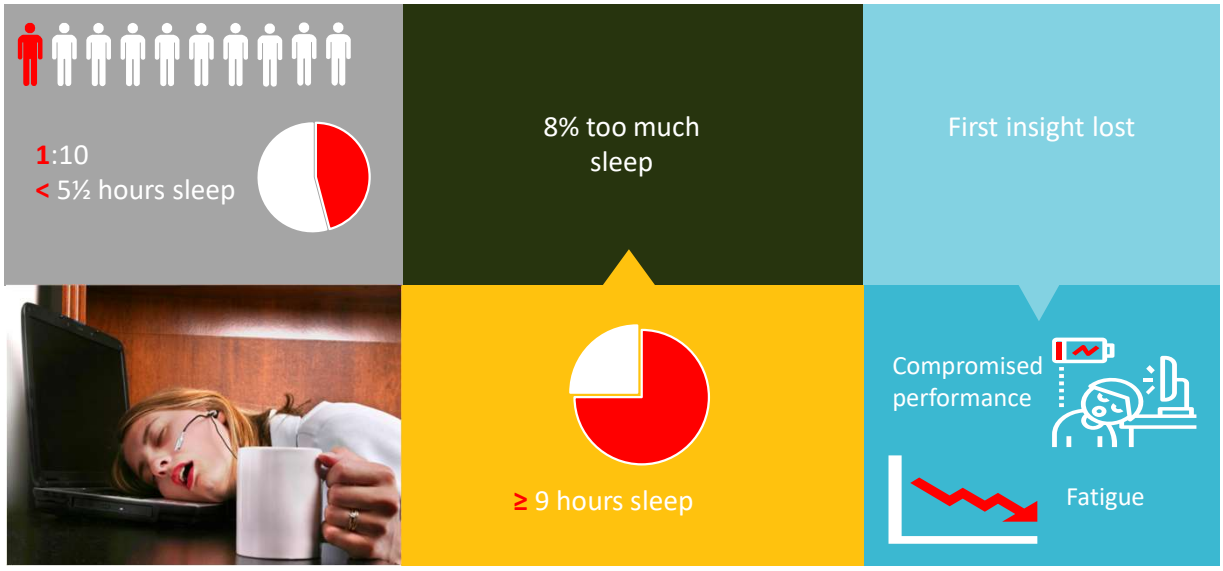
- Survival
- For repair and restoration of muscles and tissue
- Synthesis of hormones
- Boost the immune system
- Learning and memory consolidation
- Eliminate metabolic waste
- Weight maintenance
- Emotional regulation and positive affect
- Good heart health
- Lower stress
- Lower inflammation
- Improved attention and productivity
- Improved athletic performance
- Healthy memory including forgetting
- Creativity

Identify how sleep deprivation impacts health


The burden of
insufficient
sleep


The economic burden of insufficient sleep
Individual
Business
Society
Total $66.3 billion p.a.
$26.2 bn financial costs
Plus additional
$40.1 bn loss of wellbeing
$8,968 per person

The burden of insufficient sleep: The individual



(Kwok et al., 2018; Wild, Nichols, Battista, Stojanoski, & Owen, 2018)

Average Australian getting 7 hours of sleep
One in 10 (12%) sleep less than 5.5 hours of which 75% say this affects them during the day

8% get more than 9 hrs – paradoxically too much sleep is also bad for health (increased risk of death and cardiovascular disease)
The first insight lost when chronically tired is our subjective detection of our level of fatigue and compromised performance

Sleep Health Survey 20% admitted falling asleep behind wheel 5% said accident result of falling asleep or driving drowsy
ONE AUSTRALIAN dies every day due to drowsy driving or industrial accidents

The burden of insufficient sleep: Impact on shift workers

16% of Australian workforce

25-33% reduced sleep time

Women more vulnerable

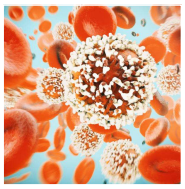
(Hafner, Stepanek, Taylor, Troxel, & van Stolk, 2017; Sleep Health Foundation, 2017)

- Shift workers – night shift, FIFO, on call and long hours account for 16% of the Australian Workforce
- Austin Health & the Institute for Breathing and Sleep report night shift leads to reduced sleep time (25-33%) and circadian desynchrony and women are more vulnerable through additional domestic duties
- Risk is of impaired driving performance, increased errors and accidents at work, poor decision-making and delayed reaction time

The burden of insufficient sleep: Impact on shift workers

Poor decision making, delayed reaction time, increased errors and accidents

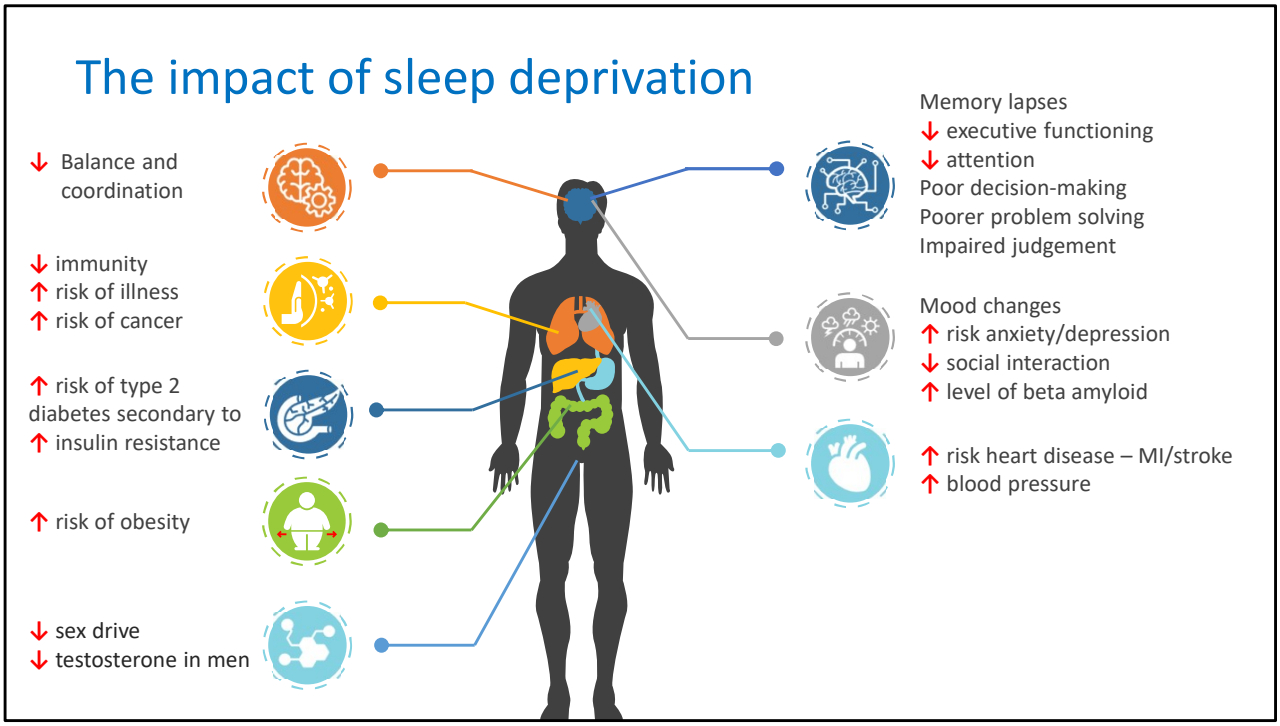
10-15% shift work sleep disorder



Probable carcinogen

(Hafner, Stepanek, Taylor, Troxel, & van Stolk, 2017; Sleep Health Foundation, 2017)

- WHO listed night shift work as a probable carcinogen (2007) – cancer of breast and prostate
- 10-15% experience shift work sleep disorder

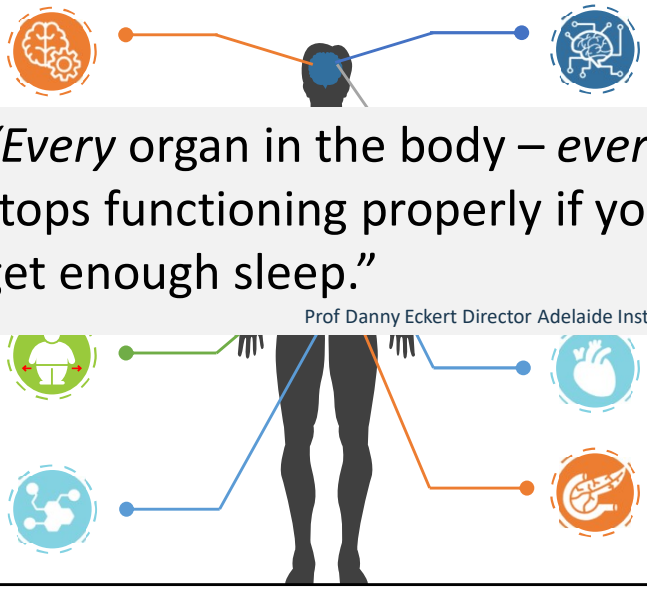


Poor balance and coordination
Lower sex drive
Lower testosterone in men
Impaired immunity
Increased risk of illness
Increased risk of cancer
Increased risk of type 2 diabetes secondary to Increased insulin resistance
Increased risk of obesity

Memory lapses
Reduced executive functioning
Reduced attention
Poor decision making
Poorer problem solving
Impaired judgement
Mood changes
Increased risk anxiety/
Depression
Reduced social interaction
Increased level of beta amyloid

Increased risk heart disease – MI/stroke
High blood pressure

The impact of sleep deprivation



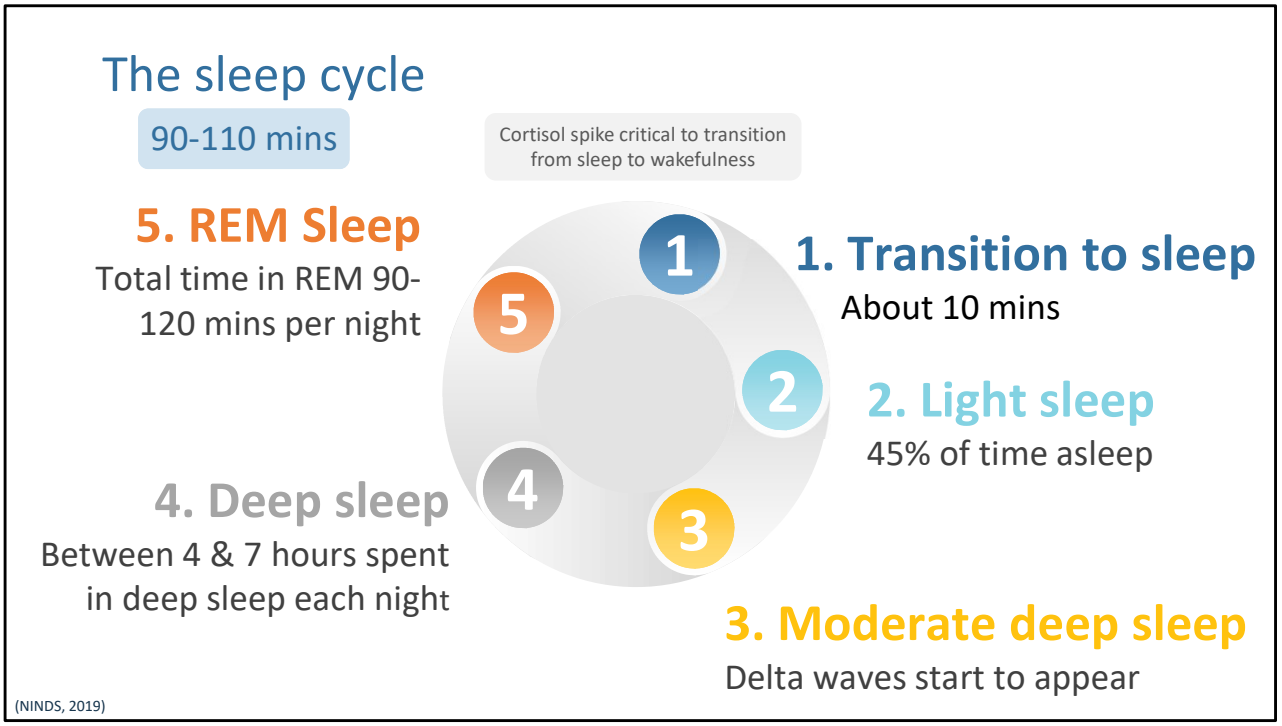
"Every organ in the body – *every* cell, stops functioning properly if you don't get enough sleep."

Prof Danny Eckert Director Adelaide Institute for Sleep Health

He goes on Take an average 20 year old restrict his sleep for five hours over five nights and measure blood glucose on night one and five Will transition from healthy to pre-diabetic
Do the same measurement with testosterone and it is as if he's aged by 10 years
Your cognition and reaction times are NO LONGER NORMAL

And Prof Romula Bucks Head of Psychological Sciences UWA has found that disturbing someone's sleep in their twenties will increase their relative risk of depression four fold


Describe what a good night's sleep looks like
How sleep works



Stage One – Transition to sleep
Lasts around ten minutes
Easily woken
Muscle tone relaxes, brain waves slow
Hypnic jerk
Skin vasodilatation
YOU GOV 6 in 10% taking more than an hour to drift off and women have more difficulty than men 13% to 7%

Stage Two – Light sleep
Starts after 10-25 minutes
Light sleep
Microsleeps
Heart rate slows BP drops
Memory consolidation
Synaptic pruning

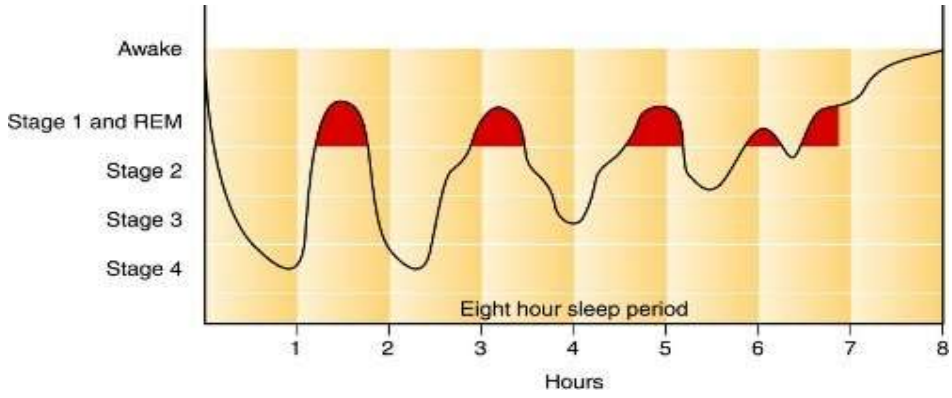
Stage Three – Moderate Deep Sleep
Delta waves start to appear
Tissue repair undertaken

Stage Four – Deep Sleep
Hard to wake up from
Body temp and blood pressure fall
Between 4 and 7 hrs spent in deep sleep each night

Throughout sleep DNA remodelling and repair occurs
Leptin is produced and cortisol gradually rises

Stage 5 – REM Sleep
Dreaming
Breathing more rapid and shallow
Body temp and blood pressure start to rise
Increase heart rate
First occurs about 90 minutes into first cycle
Total time in REM 90-120 mins per night

Sleep hologram



Decrease in deep sleep over each cycle

Increase in REM sleep over each cycle

In sleep deprivation, time spent in REM sleep is lost along with emotional regulation

(Bernard et al., 2011)

Time spent in deep restorative sleep diminishes over each cycle
Time spent in REM sleep increases over each cycle
In sleep deprivation, time spent in REM sleep is lost along with emotional regulation


Sleep is a VITAL sign and needs to be considered in all consultations

References (1/2)

Bernard, A., Latreille, J., Gardinier, S., Cornette, F., de Chauny, E. M., Pross, N., Staner, L., Metzger, D., Tenenhaus, M., Morizot, F., Tschachler, E., & Guinot, C. (2011). Effect of chronic sleep deprivation on skin status in healthy young women.

Haack, M., Sanchez, E., & Mullington, J. M. (2007). Elevated inflammatory markers in response to prolonged sleep restriction are associated with increased pain experience in healthy volunteers. *Sleep, 30*(9), 1145-1152. https://doi.org/10.1093/sleep/30.9.1145

Hafner, M., Stepanek, M., Taylor, J., Troxel, W. M., & van Stolk, C. (2017). Why Sleep Matters—The Economic Costs of Insufficient Sleep: A Cross-Country Comparative Analysis. *Rand Health Quarterly, 6*(4), 11. https://www.ncbi.nlm.nih.gov/pubmed/28983434

Kwok, C. S., Kontopantelis, E., Kuligowski, G., Gray, M., Muhyaldeen, A., Gale, C. P., Peat, G. M., Cleator, J., Chew-Graham, C., Loke, Y. K., & Mamas, M. A. (2018). Self-Reported Sleep Duration and Quality and Cardiovascular Disease and Mortality: A Dose-Response Meta-Analysis. *Journal of the American Heart Association, 7*(15), e008552. https://doi.org/10.1161/JAHA.118.008552

Lang, C. J., Reynolds, A. C., Appleton, S. L., Taylor, A. W., Gill, T. K., McEvoy, R. D., Ferguson, S. A., & Adams, R. A. (2018). Sociodemographic and behavioural correlates of social jetlag in Australian adults: Results from the 2016 National Sleep Health Foundation Study. *Sleep Medicine, 51*, 133-139. https://doi.org/10.1016/j.sleep.2018.06.014

National Institute of Neurological Disorders and Stroke (NINDS). (2019). *Brain basics: Understanding sleep*. https://www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Understanding-Sleep

Paul, S., & Brown, T. M. (2019). Direct effects of the light environment on daily neuroendocrine control. *Journal of Endocrinology, 243*(1), R1–R18. https://doi.org/10.1530/JOE-19-0302

Rasch, B., & Born, J. (2013). About sleep's role in memory. *Physiological Reviews, 93*(2), 681-766. https://doi.org/10.1152/physrev.00032.2012

Sleep Council. (n.d.). *Circadian rhythms*. https://sleepcouncil.org.uk/advice-support/sleep-hub/sleep-matters/circadian-rhythms/

References (2/2)

Sleep Education. (n.d.). Healthy sleep duration. http://sleepeducation.org/docs/infographics/healthy-sleep-duration-poster.pdf

Sleep Health Foundation. (2017). *Asleep on the job: Costs of inadequate sleep in Australia*. Sleep Health Foundation. https://www.sleephealthfoundation.org.au/files/Asleep_on_the_job/Asleep_on_the_Job_SHF_report-WEB_small.pdf

Sleep Health Foundation. (2019). *Sleep Health Foundation Fact Sheets*. https://www.sleephealthfoundation.org.au/fact-sheets.html

Sudy, Á. R., Ella, K., Bodizs, R., & Kaldi, K. (2019). Association of Social Jetlag With Sleep Quality and Autonomic Cardiac Control During Sleep in Young Healthy Men. *Frontiers in Neuroscience, 13*, 950. https://doi.org/10.3389/fnins.2019.00950

Thompson, M. (n.d.). *How sleep works - The two-process model of sleep regulation*. HowSleepWorks. https://www.howsleepworks.com/how_twoprocess.html

West, C., & Egger, G. J. (2017). Chapter 18 - To sleep, perchance to... get everything else right. In G. J. Egger, A. F. Binns, S. R. Rössner, & M. Sagner (Eds.), *Lifestyle Medicine: Lifestyle, the Environment and Preventive Medicine in Health and Disease* (3rd ed., pp. 291-308). Elsevier Science & Technology.

Wild, C. J., Nichols, E. S., Battista, M. E., Stojanoski, B., & Owen, A. M. (2018). Dissociable effects of self-reported daily sleep duration on high-level cognitive abilities. *Sleep, 41*(12). https://doi.org/10.1093/sleep/zsy182

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