

Adolescent Sleep in the Digital Age

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Conflicts of Interest

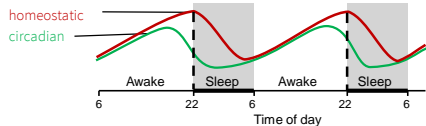
- Collaborations with Oventus, Nyxoah, Zella therapeutics
- None relevant to topic of presentation

Outline

- Physiology of sleep
- Technology & sleep
- Consequences of insufficient sleep in adolescents
- Improving sleep in adolescents
 - Navigating the digital age

Physiology of Sleep

What Makes us Sleep?



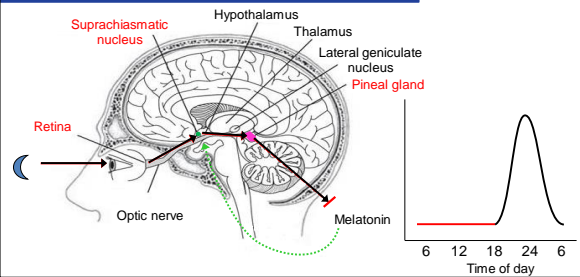
The **homeostatic drive** to sleep increases the more time is spent awake and decreases the more time is spent asleep

The **circadian drive** for wake results from circadian variations in sleep/wake promoting substance(s)

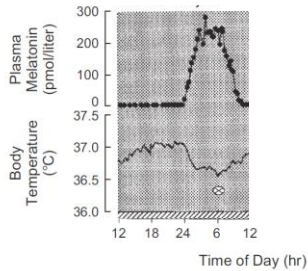
High homeostatic drive + low circadian drive for wake = sleep onset

Borbély et al., *Hum Neurobiol*, 1982

Anatomy of the Circadian System



Melatonin & Light

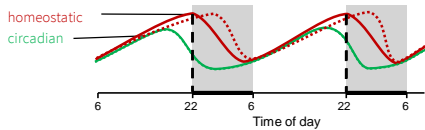


Czeisler et al., *NEJM*, 1995

Recommended & Achieved Sleep Duration

- Recommended adolescent (14-17y) sleep duration = 8-10hrs

Adolescent Sleep



- The **homeostatic drive** increases more slowly
 - The **circadian drive** is phase delayed
- ➔ Delayed sleep-wake phase disorder (prevalence 7-16%)

Insomnia prevalence in adolescence 3-12%

International Classification of Sleep Disorders 3rd Ed., AAASM, 2014

Technology & Sleep

Electronic Devices

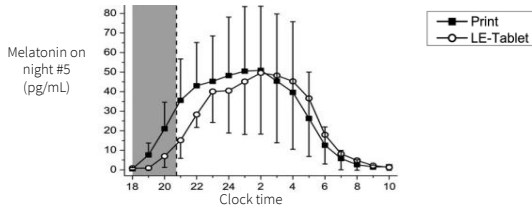
- 28% of world's population own a smart device
- 90% of population use an electronic device (>3 nights/week) within 1 hour prior to bed
- Over 70% of Australian adolescents have 2 or more devices in their room at night (Gamble, *PLoS One* 2014)
 - smart phone (80%), computer (55%), TV (32%)
- School age children spend approx. 7 hours/day in front of a screen (Gradisar, *J Clin Sleep Med*, 2013)

National Sleep Foundation, *Sleep in America* 2011

Light Emitting Electronic Devices

- Electronic devices emit shortwave blue light (400-495nm)
- Sources of shortwave blue light include:
 - Sun
 - Fluorescent & LED lights
 - Flat screen TV
 - Tablets
 - Smart phones
 - E-readers
 - Computers

Light Emitting Devices & Melatonin



- Device use vs reading print delays sleep onset ~30mins

Chang et al., PNAS, 2015
Chinoy et al., Physiological Reports, 2019

Electronic Devices: Non-Light Effects

- Acute increase in alertness
- Physical & mental arousal due to the content
- Re-conditions the bed to be a place of alertness
- Device use replaces sleep time

- Smart devices, video gaming, computers have greater effect than TV (more interactive, light proximity to eyes)

Consequences of Insufficient Sleep

Adolescents & Insufficient Sleep

- Accident risk
 - 55% of fatigue-related car accidents are drivers <25y
 - Workplace and home-place accidents
 - Sleep loss exacerbates effects of alcohol
- Increased risk taking behaviour
- Increased stimulant use

Adolescents & Insufficient Sleep

- Increased negative mood & impaired emotional regulation
- Increased future risk of developing depression, anxiety, suicidal ideation, attempts & completions (Pigeon, 2012)
- Obesity
- Poor school performance
- Impaired immune function

Improving Sleep in Adolescents

Education

- Sleep education (child & parent)
 - Recommended sleep duration
 - Consequences of insufficient sleep
 - Importance of healthy sleep pattern across lifetime
 - General sleep hygiene
 - Tech. specific sleep hygiene
 - Tips for reducing screen time

Education - Good Sleep Hygiene (I)

- Daily Routine: get up & go to bed at same time every day
- Bedtime routine (eat, wash, teeth, story/read, sleep)
- Exercise daily & consume minimal caffeine (esp. >4pm)
- Deal with 'stress' during the day/early evening
- No caffeine or heavy exercise <3 hrs before bed

Education - Good Sleep Hygiene (II)

- Bedroom comfortable & inviting (cool, quiet, dark)
- Avoid work within 90 mins of bed
- Get plenty of bright light in the mornings
- Restrict naps to 20 mins
- Allow adequate time for sleep

Education - Tech Specific Sleep Hygiene

- Avoid screen time within 60 mins of bed; no screens in bedroom
- Blue-light blocking glasses
- Blue-light screen filters
- Utilise screen time counters/loggers & limits/locks on devices



Alternative Diagnoses, Treatments & Referral

Consider

- Sleep disorders – OSA
- Depression

Where to refer

- Sleep Physician
- Sleep Psychologist
- Psychologist/Psychiatrist

Treatments

- Education
- Light therapy (mornings)
- Cognitive behavioural therapy
- Mindfulness/relaxation

Bartel, et al., Sleep & mental wellbeing: exploring the links. Vic Health Promotion Foundation, 2018.

Summary – Sleep in the Digital Age (I)

- Chronic sleep loss and its consequences have a significant detrimental impact on the health, academic performance and safety of today's youth.
- Current literature indicates that technology use is the main factor contributing to this sleep loss.

Summary – Sleep in the Digital Age (II)

- Interactive device use (computers, video games and mobile devices) is most frequently associated with adverse sleep outcomes although passive screen time (TV) is also implicated.
- Mechanisms likely include psychosocial stimulation, technology use displacing sleep time and circadian disruption due to blue light exposure.

Tips for Navigating the Digital Age (I)

- Changes in health policies surrounding sleep practices in adolescents are required.
- Primary care givers can directly educate children & parents on the significance of insufficient sleep.
- Tips for parents to reduce children's screen time:
 - Set firm limits/rules on technology
 - No screens in bedrooms (especially before/after bedtime)
 - Set time limits
 - Implement screen-free days
 - Make screen-time a reward

Tips for Navigating the Digital Age (II)

- Tips for parents to reduce children's screen time:
 - Role model healthy behaviour
 - Educate on consequences of excessive technology use
 - Discourage multitasking with screens
 - Encourage physical activity
 - Utilise in-built applications and settings

Additional Resources

- Bartel et al., Sleep and mental wellbeing: exploring the links, Victorian Health Promotion Foundation (2018)
- Adolescent sleep needs and patterns: Research report and resource guide. US National Sleep Foundation.
- Australasian Sleep Association:
<https://www.sleep.org.au/professional-resources/health-professionals-information>