Sleep Science: Sleep, Sleepiness, and Sleeplessness

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sleepiness II

circadian rhythms; the body’s symphony
treating circadian disorders
delayed sleep phase disorder

- normal sleep routine
  - bedtime at 2 am, arise time at 10 am
  - male teens
- evening
  - advance goal bedtime ½ hour a night
  - dim light for 2 hours before goal (blue blocking glasses)
  - 0.5 mg melatonin 2 hours before goal
- morning
  - advance goal wake time ½ hour each morning
  - bright light for 1-2 hours; must come after Tmin
  - exercise
• initially introduce dim and bright light to conform to natural sleep schedule
• advance dim and bright light $\frac{1}{2}$ hour a night till desired sleep period is achieved.
• advance 0.5 mg melatonin 2 hr before each night's goal bedtime.

google: bright light therapy lamps 10,000 lux, $40
light

- ≈ 500 lux: outdoor, sunny day
- ≈ 100-300 lux: typical indoor light
- ≈ 50 lux: dimly lit room

Distance matters: measure light at the eye, not at the source

Blue light and full spectrum light

Tailor pace of light exposure: ½ hr day or ½ hr week?
light: how much and what kind

- < 50 lux has minimal affect on alertness
- > 500 lux natural light has minimal added affect on alertness

why 10,000 lux lamp?
- brief exposure, 1-2 hr
- used to move the circadian rhythm
- we usually don’t receive the full 10,000 lux
advanced sleep phase disorder

- normal sleep routine
  - bedtime at 8 pm, arise time at 4 am
  - older adults

- evening
  - delay goal bedtime ½ hour a night
  - 1 hour of bright light starting at 2 hours before goal
  - exercise 2-3 hours before goal

- morning
  - morning dim light
  - 0.5 melatonin at goal wake-up?
jet lag
Jet lag characteristics

- Rapid travel across time zones
  - sleep/wake-environment desynchrony
  - insomnia, lethargy, gastrointestinal upset, impaired alertness/performance, disorientation
- 1 day is needed to adjust for each time zone change
  - jet lag is more severe in travel to east
  - individual differences are great - 1/3 of travelers experience no jet lag
- Severity
  - direction of travel
  - number of time zones
  - individual susceptibility

Arendt et al., 2005
direction of travel

- **Daytime travel EAST across at least 6 time zones**
  - early morning in the destination environment corresponds to one’s internal clock bed time
  - bed time in the destination environment corresponds to one’s internal clock wake time
  - sleep onset insomnia

- **Daytime travel WEST across at least 6 time zones**
  - dinner time in the destination environment corresponds to one’s internal clock bed time
  - early morning in the destination environment corresponds to one’s internal clock wake time
  - sleep maintenance or terminal insomnia
east travel

origin environment

noon 12 pm
12 hrs travel
6 time zones

Tmin 5 pm

destination environment

6 am 10 am 6 pm 11 pm 6 am
management of jet lag

- **Sleep hygiene**
  - ↓ caffeine/alcohol
  - planned naps - on flight, early day destination environment
  - synchronize sleep to the destination environment as soon as possible

- **Light manipulation**
  - bright light exposure during destination daytime (limit exposure in morning before Tmin- blue blocking glasses)
  - dim light environment approaching sleep period

- **Melatonin**
  - 0.5 mg 2 hours before usual bedtime and advancing ½ hour a night for 7 nights before travel to entrain phase advance
  - 0.5 mg 2 hours before goal bedtime at destination

- **Short half-life hypnotics**
  - on flight
  - at destination bedtime
1 mg melatonin schedule
based on natural bedtime of 9:30

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+ Ambien
social jet lag
The difference between our body clock and our social preference

Functionally, the difference in sleep time during workdays (weekdays) and free days (weekends)
traveling 2 time zones west without traveling

- **weekdays (Nashville)**
  - 11 pm – 7 am

- **FR & SA (Los Angeles)**
  - maintaining the 11 – 7 schedule, feels like 1 am – 9 am

- **SU (Nashville)**
  - 11 pm feels like 9 pm [not sleepy]
  - 7 am MO feels like 5 am [sleepy]

- **Staying up till 1 am FR & SA without traveling**
  - insomnia on SU, difficulty falling asleep
  - difficulty waking up MO
shiftwork

traveling 8 time zones west
Negative Health Effects of Shiftwork

Circadian rhythm disruptions
- Body temperature
- Respiratory rate
- Hormonal production
- Menstrual cycle
- Urinary excretion
- Cell division

Brain effects
- Sleep loss
- REM sleep reduction
- Stage 2 sleep reduction
- Fatigue
- Reduced brain volume

Cardiovascular disorders
- 40% increased risk for:
  - Angina pectoris
  - Hypertension
  - Myocardial infarction

Gastrointestinal disorders
- Dyspepsia
- Heartburn
- Abdominal pains
- Flatulence

Mental Health
- Stress
- Anxiety
- Depression
- Neuroticism
- Reduced vigilance
- 'Burnout syndrome'

Reproductive effects
- Spontaneous abortion
- Low birth weight
- Prematurity

Increased cancer
- Breast cancer
- Colorectal cancer

violating 500,000 years of evolution
shiftwork

definition
▪ employment outside of the usual day hours
▪ work intrudes into the usual sleep period
▪ affects 20% of workers
  ▪ service industry
  ▪ healthcare industry
  ▪ manufacturing

factors affecting shiftwork success
▪ circadian
▪ sleep
▪ domestic
▪ coping strategies

Rosekind, 2005
Monk, 2005
circadian

- an unnatural temporal environment
  - higher rate of breast cancer (& other cancers) in female (& male) shiftworkers due to hormonal disruption
  - physiological rhythms designed for night sleep
  - timing of melatonin secretion
  - body temperature cooling
  - advancing age less tolerant
- best schedule?
  - rapid rotation- every few days
  - slow rotation- every 2 weeks
sleep

- less sleep
  - shift workers average 1-2 hours less sleep a “night”
  - less satisfying sleep- REM sleep disproportionately affected
  - chronic state of sleep deprivation
    - drive home most dangerous part of shiftwork

- weekend sleep
  - don’t revert back to night sleep schedule
  - compromise: 50% adjustment
  - if normal sleep is 11 pm bedtime and work sleep is 8 am bedtime, choose 3:30 am bedtime
domestic

social and family obligations
- the greater these are, the more catch-up sleep is disrupted and the greater the shiftwork impairment
- obligations
  - household management
  - childcare
  - spousal
  - sexual performance
  - social
coping strategies

education
- understand need for sleep
  - be sensitive to sleepiness
  - be motivated to protect sleep time
- strategic use of planned naps
- managing light and dark exposure

scheduling
- if possible, avoid economic pressure for overtime and minimization of vacation

family/friend support
- educate those around you to your special needs and lower social obligations
Circadian Interventions I

- Align circadian rhythm of alertness with the night work and sleepiness with daytime sleep schedule
- Have as much exposure to bright light as possible when you need to be alert (light has immediate alerting effects)
- Avoid light exposure in the morning after night shift (wear dark glasses driving home from work)
- It takes a week or more for circadian rhythms and sleep to adapt when transitioning from day to night and vice versa
Circadian Interventions II

- Optimize and protect sleep environment
  - Comfortable temperature setting
  - Reduce noise
  - Darken room
- Limit work periods (ideally to no more than 12 hours)
- Prophylactic naps (prior to night shift) and during shift

cool, quiet, dark

let's learn more about sleeplessness
next time