Sleep Science:
Sleep, Sleepiness, and Sleeplessness

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sleepiness II

circadian rhythms;
the body's symphony

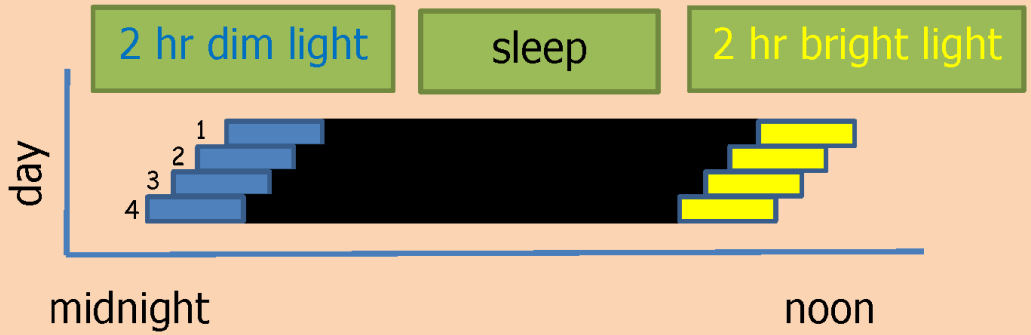
fppt.com

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

COORDINATED PHOTOTHERAPY: DELAYED SLEEP PHASE



- initially introduce dim and bright light to conform to natural sleep schedule
- advance dim and bright light ½ 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

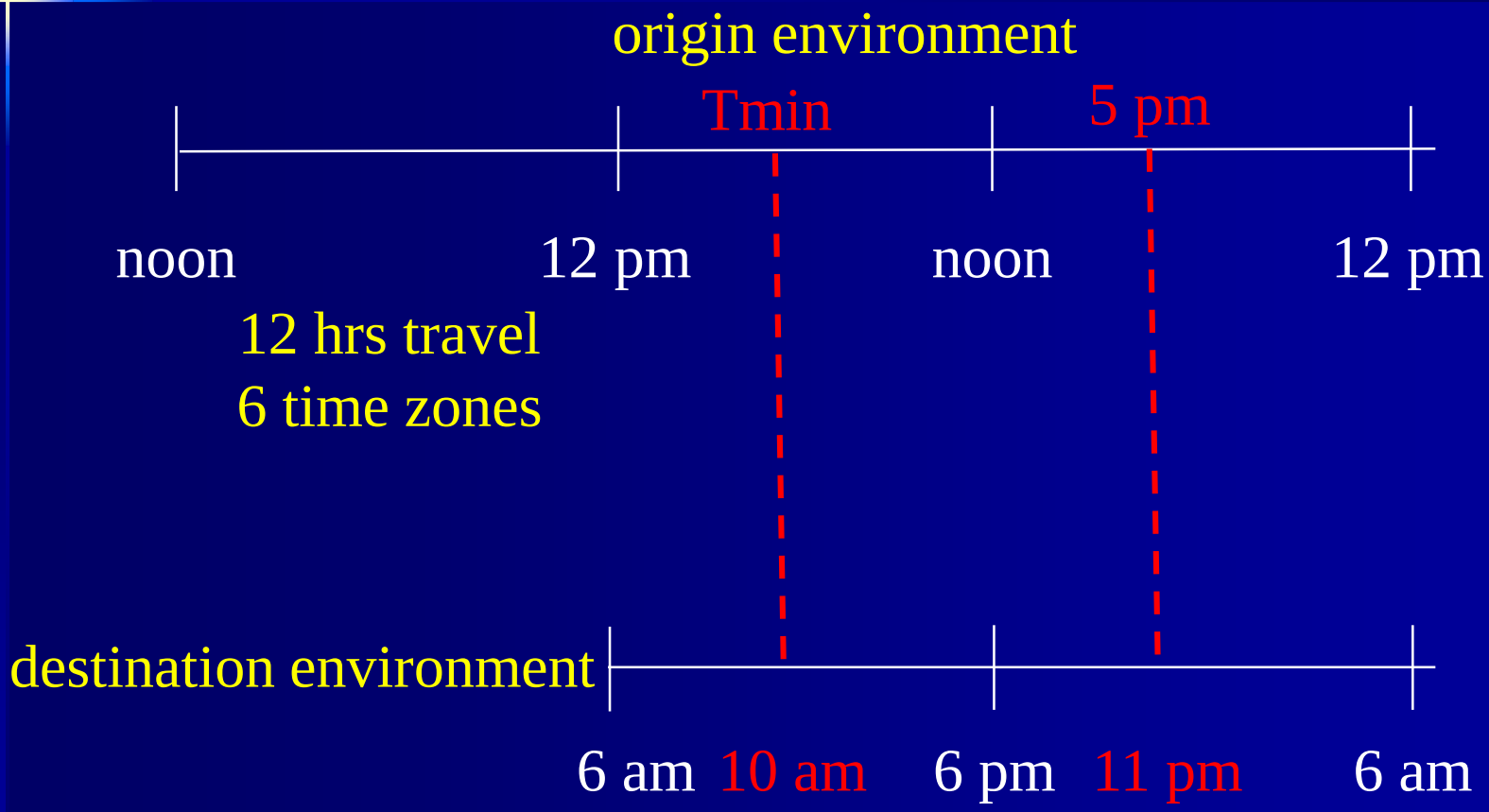
- Rapid travel across time zones
  - sleep/wake-environment desynchrony
  - insomnia, lethargy, gastrointestinal upset, impaired alertness/performance, disorientation
- 1 day is needed to adjust for each time zone change
  - jet lag is more severe in travel to east
  - individual differences are great- 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
Tmin
5 pm
noon
12 pm
noon
12 pm
12 hrs travel
6 time zones
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

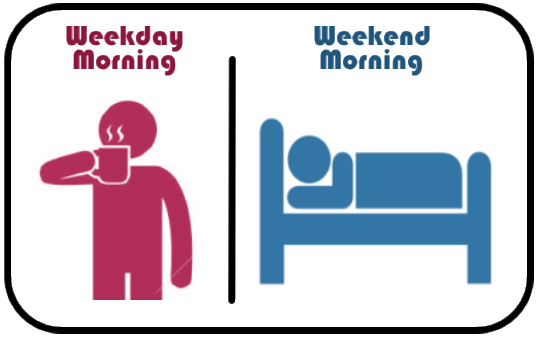
date	Nashville time	NY time +1 hr	Spain time +7 hr
4/4	**7:30**		
4/5	**7:00**		
4/6	**6:30**		
4/7	**6:00**		
4/8	**5:30**		
4/9	5:00	**6:00 pm**	
4/10	4:30	**5:30 pm**	
4/11	4:00		**11:00 pm**
4/12	3:30		**10:30 pm**
4/13	3:00		**10:00 pm**
4/14	2:30		**9:30 pm**
4/15	2:00		**9:00 pm**
4/16	1:30		**8:30 pm**
4/17	1:00		**8:00 pm**
4/18	12:30		**7:30 pm**

+ Ambien

social jet lag

social jetlag

- The difference between our body clock and our social preference
- Functionally, the difference in sleep time during workdays (weekdays) and free days (weekends)



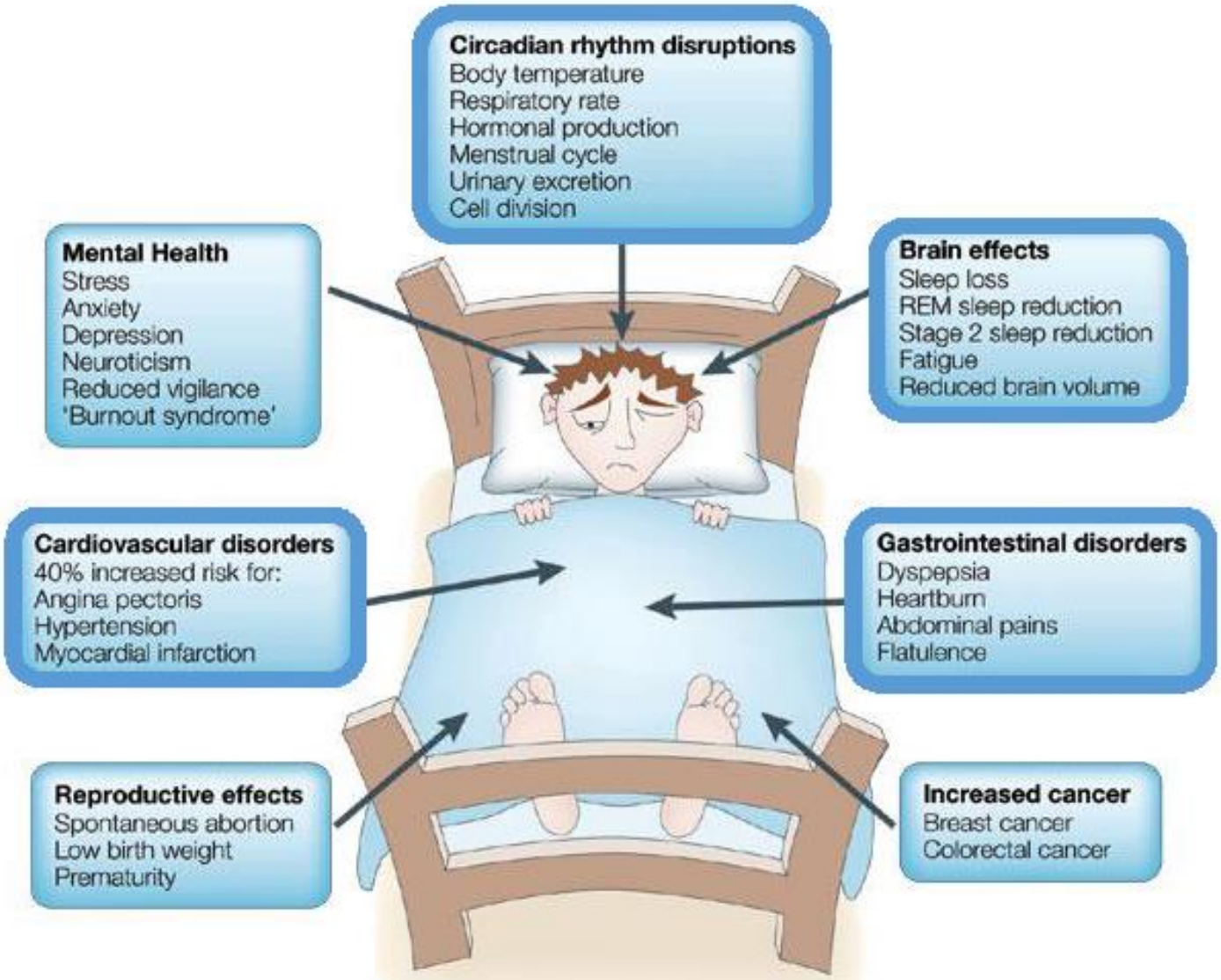
traveling 2 time zones west without traveling

- 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



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

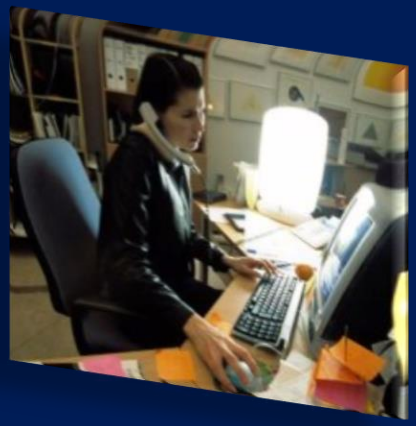
- social and family obligations
  - the greater these are, the more catch-up sleep is disrupted and the greater the shiftwork impairment
  - obligations
    - household management
    - childcare
    - spousal
    - sexual performance
    - social

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



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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

1. Richardson GS, Malin HV. *J Clin Neurophysiol.* 1996;13:17-31.
2. Wagner DR. *Neurol Clin.* 1996;14:651-670.
3. Reid K et al. *Med Clin North Am.* 2004;88:631-651.

let's learn more about sleeplessness next time