Sleep, Sports Performance And Injuries

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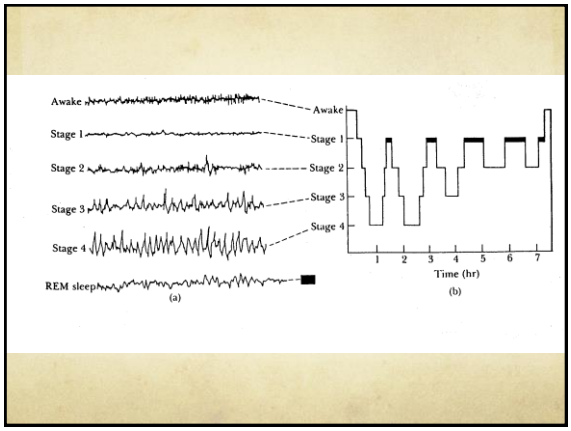
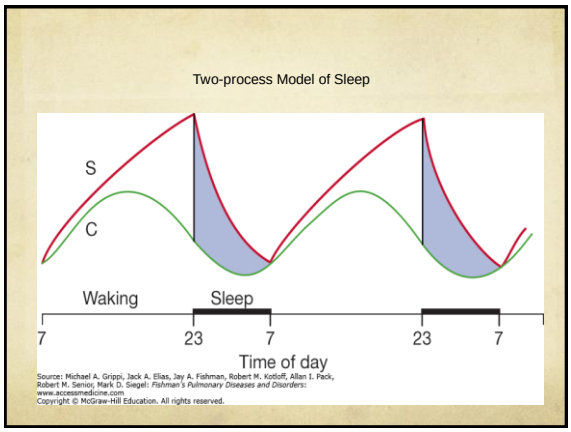
- No financial relationship or compensation from any company or corporation

Sleep


Awake
Stage 1
Stage 2
Stage 3
Stage 4
REM sleep
(a)
Awake
Stage 1
Stage 2
Stage 3
Stage 4
1 2 3 4 5 6 7
Time (hr)
(b)


Two-process Model of Sleep
S
C
Waking
Sleep
7
23
7
23
7
Time of day
Source: Michael A. Grippi, Jack A. Elias, Jay A. Fishman, Robert M. Kotloff, Allan I. Pack, Robert M. Senior, Mark D. Siegel: Fishman's Pulmonary Diseases and Disorders:
www.accessmedicine.com
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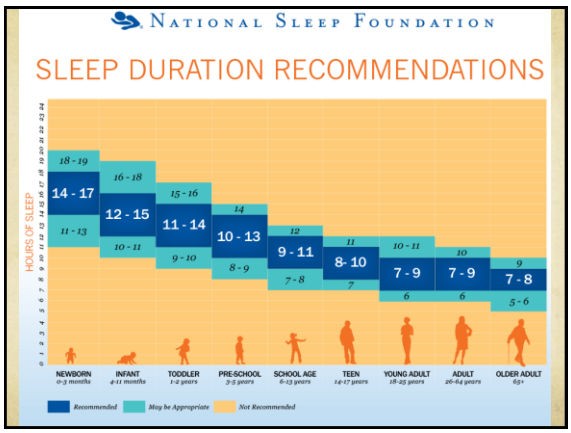
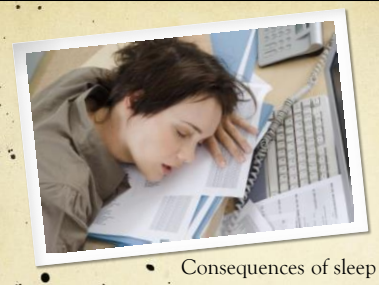

National Sleep Foundation
SLEEP DURATION RECOMMENDATIONS
HOURS OF SLEEP
18 - 19
14 - 17
11 - 13
16 - 18
12 - 15
10 - 11
15 - 16
11 - 14
9 - 10
14
10 - 13
8 - 9
12
9 - 11
7 - 8
11
8- 10
7
10 - 11
7 - 9
6
10
7 - 9
6
9
7 - 8
5 - 6
NEWBORN
0-3 months
INFANT
4-11 months
TODDLER
1-2 years
PRE-SCHOOL
3-5 years
SCHOOL AGE
6-13 years
TEEN
14-17 years
YOUNG ADULT
18-25 years
ADULT
26-64 years
OLDER ADULT
65+
Recommended
May be Appropriate
Not Recommended

Sleep Deprivation

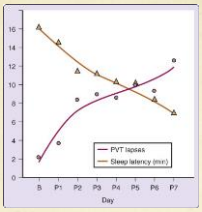
Sources of Sleep Deprivation

- Social obligations
- Other obligations (studying, child care, work)
- Insomnia
- Occult sleep disorder
- Shift work
- Poor sleep hygiene
- Medical conditions (e.g.,pain, thyroid disease)
- Mood, anxiety and stress
- Fragmented sleep (texts, phone calls)
- Time zone travel
- Medications



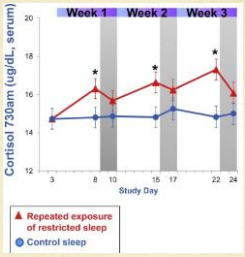
Consequences of sleep deprivation:

- Increased sleepiness
- Decreased attention and concentration
- Impairments in problem solving
- Changes in mood and anxiety
- Delayed reaction times
- Alterations in metabolic functions (e.g., cortisol, glucose metabolism,



Similar functions relating mean daily sleep latency on the Multiple Sleep Latency Test (MSLT) and mean daily lapses on the visual psychomotor vigilance test (PVT) to the cumulative effects of sleep restriction (about 5 hours of bedtime nightly across 7 consecutive nights (P1 to P7). (Modified from Dinges DF, Pack F, Williams K, et al. Cumulative sleepiness, mood disturbance, and psychomotor vigilance performance decrements during a week of sleep restricted to 4–5 hours per night. Sleep 1997;20:275.)

Repeated Sleep Restriction and Recovery



Cortisol levels after awakening across repeated sleep restriction-recovery patterns. Data present estimated mean ± SEM based on mixed model analysis. * $p < 0.05$ between conditions. Simpson, Diolombi, et al., Repeating patterns of sleep restriction and recovery: Do we get used to it? Behavior, and Immunity, 2016-11-01, Volume 58, Pages 142-151.

Sleep and Sports Performance

Sleep Before Competitions

- 283 Elite Australian athletes
- Age: 24.1 yrs
- Years in sport: 11
- Sleep duration: 7:42
- 64% slept worse than usual prior to event in the past 12 months
- No difference in gender or sport (individual vs team)
- 82% reported increased sleep onset latency
- 37% reported middle of the night awakenings
- 27% reported early morning awakenings
- 36% reported unrefreshing sleep

Juliff, L. E., Halson, S. L., & Peiffer, J. J. (2015). Understanding sleep disturbance in athletes prior to important competitions. Journal of science and medicine in sport, 18(1), 13-18.

Sleep Before Competitions

Attributions for sleep problems:

- 84% ~ thoughts about competition
- 44% ~ nervousness about competition
- 22% ~ unfamiliar surroundings
- 18% ~ environmental factors

Strategies to facilitate sleep:

- 52% ~ no strategy
- 21% ~ tried to relax
- 13% ~ sleeping pills
- 26% ~ reading
- 19% ~TV

Juliff, L. E., Halson, S. L., & Peiffer, J. J. (2015). Understanding sleep disturbance in athletes prior to important competitions. Journal of science and medicine in sport, 18(1), 13-18.

- 25 year retrospective NFL study, n=64 games
- West Coast teams should have advantage over East Coast
- Monday Night Football games started at 9:00p.m. EST
- West Coast teams essentially always played at 6:00 p.m. 'body clock' time
- East Coast teams played at either 9:00 p.m. or midnight 'body clock' time
- Logistic regressions included home team advantage, point spread

Smith, R, Guilleminault, C, Efron, B; Circadian Rhythms and Enhanced Athletic Performance in the National Football League. *Sleep* 1997; 20 (5): 362-365.

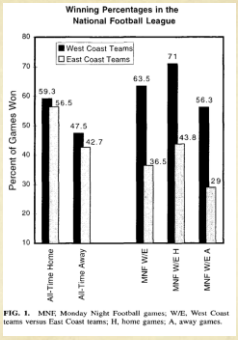


FIG. 1. MNF, Monday Night Football games; W/E, West Coast teams versus East Coast teams; H, home games; A, away games.

Smith, R, Guilleminault, C, Efron, B; Circadian Rhythms and Enhanced Athletic Performance in the National Football League. *Sleep* 1997; 20 (5): 362-365.

S's Men's varsity basketball team N=11

Study design:

- At baseline
  - 2-4 weeks of sleep monitoring, 6-9 hours of sleep per night
  - Epworth Sleepiness Scale, POMS
  - PVT
  - Free throws, 3-pointers, sprint speed
  - Subjective ratings of performance
- Intervention
  - Minimum of 10 hours time in bed/asleep, nightly
  - Improvement in all performance areas
    - Free throws improved from 7.9 to 8.8 out of 10 $p < 0.001$
    - 3-point attempts improved from 10.2 to 11.6, out of 15 $p < 0.001$).
    - Sprint times reduced from 16.2 to 15.5 seconds.
    - PVT showed decreased reaction times and fewer lapses.

Mah CD, Mah KE, Kezirian EJ, et al; The effects of sleep extension on the athletic performance of collegiate basketball players. Sleep 2011; 34- pp. 943-950

S's Men's and Women's varsity tennis team N=12 (7 women, 5 men)

Study design:

- At baseline
  - Record habitual sleep for 1 week
  - Epworth Sleepiness Scale
  - Stanford Sleepiness Scale
  - Accuracy of tennis serve

Intervention

- Minimum of 9 hours sleep for 1 week
  - ESS decreased from 12.15 to 5.6 $p<.05$
  - SSS decreased from3.56 to 2.67 $p<.05$
  - Accuracy of tennis serves improved from 36% to 42% $p<.05$

Schwartz, J &Simon, RD. Sleep extension improves serving accuracy: A study with college varsity tennis players. 2015 *Physiology & Behavior*, 151, 541-544

Sleep and Sports Injuries

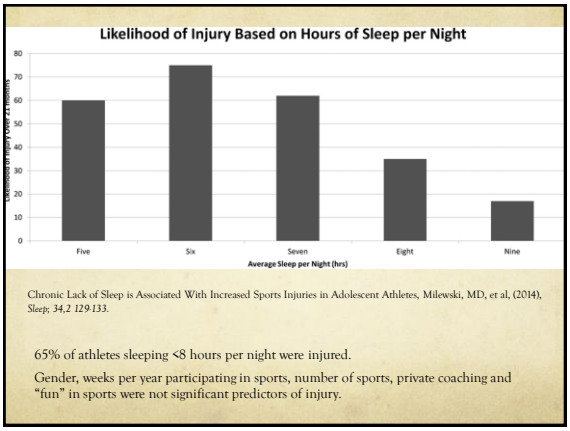
NBA data

- Teramoto et al., (2016) conducted a strictly archival study reviewing 2012-2015 NBA data
- Assessed in-game injuries in relation to game schedules
- Injuries are more frequently associated with away games
- The authors speculate that sleep deprivation may play a role in this

Game Injuries in Relation to Game Schedules in the National Basketball Association. (2017) Teramoto, M, Cross, CL, Cushman, DM, Maak, DG, Petron, DJ &Willick, SE. *Journal of Science and Medicine in Sport*, 20;3, 230-235

Adolescent sports data

- 112 middle and high school student athletes
- All S's completed a 10-item questionnaire assessing time spent participating in sports, strength training, private coaching, estimated total sleep time and overall enjoyment of sports participation.
- Injury frequency was assessed via archival record review. 64 athletes (57%) sustained at least one injury in the 21-month study period



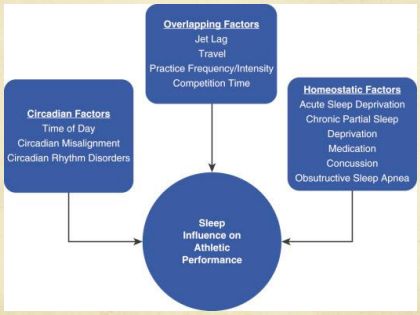
Chronic Lack of Sleep is Associated With Increased Sports Injuries in Adolescent Athletes, Milewski, MD, et al, (2014), *Sleep; 34,2 129-133.*

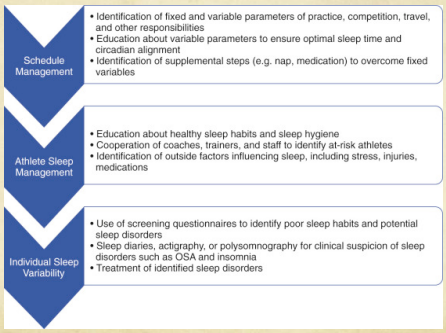
65% of athletes sleeping <8 hours per night were injured.

Gender, weeks per year participating in sports, number of sports, private coaching and "fun" in sports were not significant predictors of injury.

Sleepiness Countermeasures

(*...there is no substitute for sleep...*)





Specific Strategies

Sleep Hygiene Guidelines

- Don't go to bed unless sleepy
- Maintain a relatively consistent rise time
- Avoid caffeine within 6 hours of bedtime
- Avoid alcohol within 4 hours of bedtime
- Don't smoke within several hours of bedtime

Specific Strategies

Sleep Hygiene Guidelines

- Make the bedroom conducive to sleep; comfortable bed, pillows, surroundings
- Minimize light and noise, no pets on the bed
- Avoid hand-held electronics 30 min prior to bedtime, or adjust settings to eliminate blue light
- Upon awakening, maximize exposure to bright light.