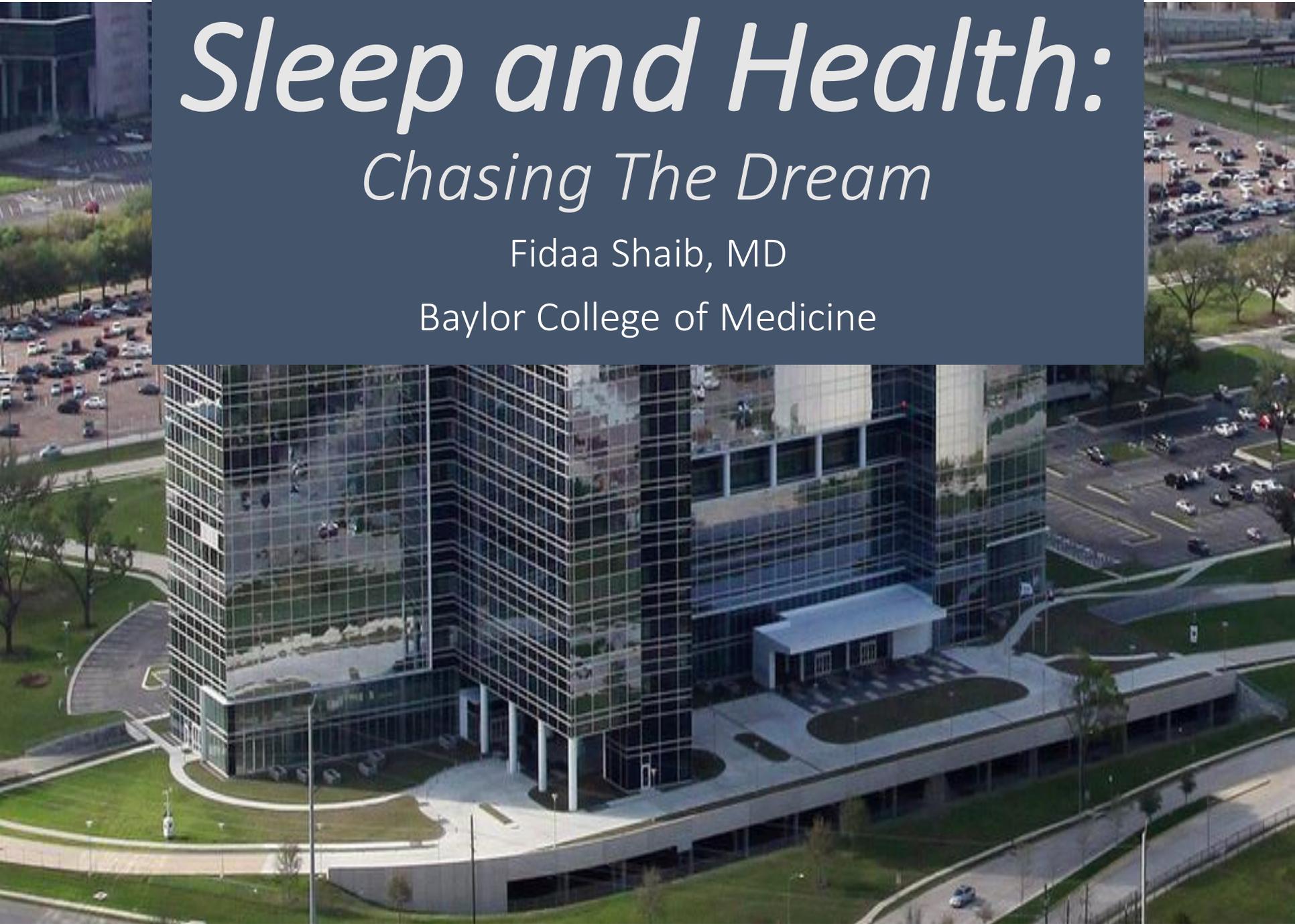


Sleep and Health: Chasing The Dream

Fidaa Shaib, MD

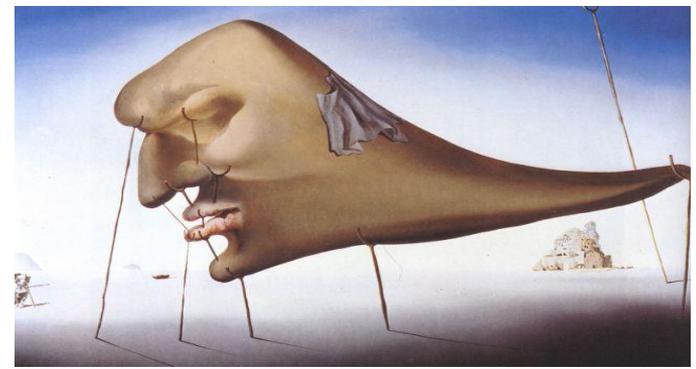
Baylor College of Medicine



Disclosure

- No financial disclosure
- No risk of sleepiness associated with the content of this talk
- If you experience sleepiness, it is most likely secondary to:
 - Sleep Deprivation
 - Underlying sleep disorder
 - Other

What is Sleep?



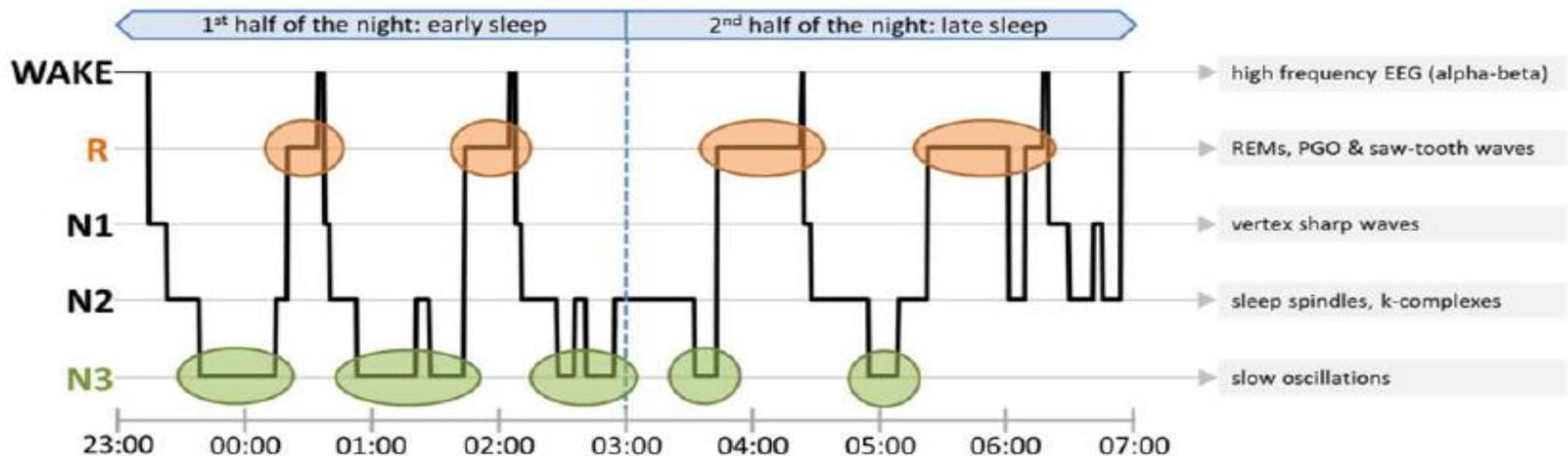
“A normal reversible, recurring behavioral state of disengagement and unresponsiveness to the environment that is characterized by typical changes in the electroencephalogram (EEG)”

“Essential physiological need state that must be satisfied to ensure survival”

Why do we sleep?

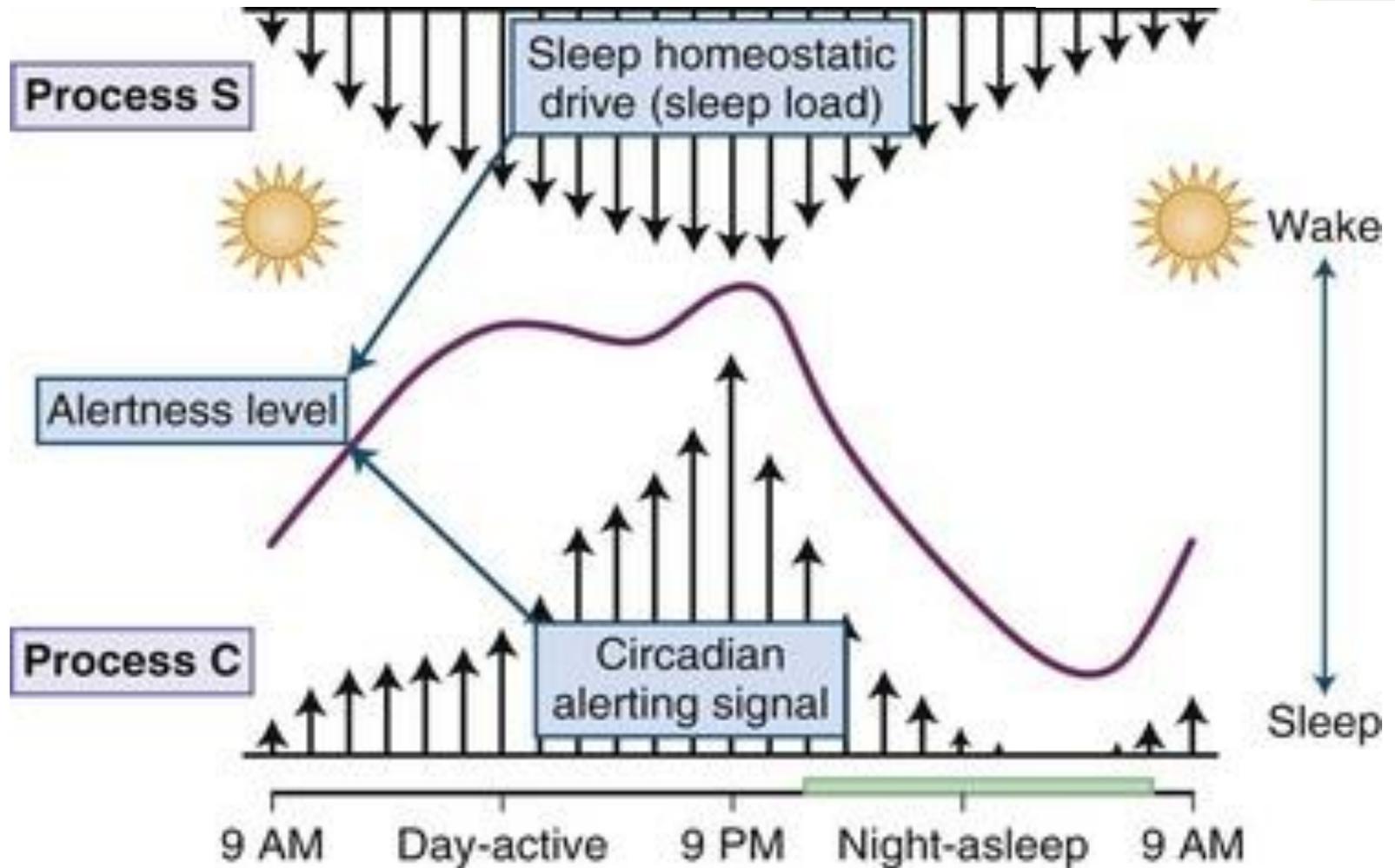
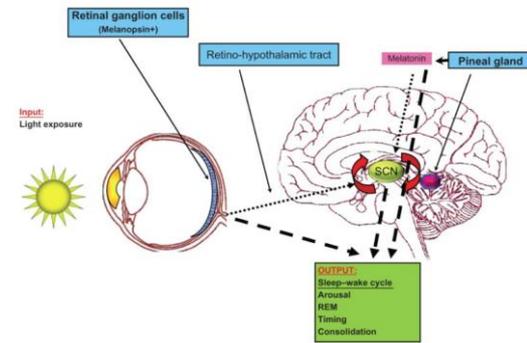
- Allen Rechtschaffen : “if sleep does not serve an absolute vital function, then it is the biggest mistake the evolutionary process ever made.”

Normal Sleep is Exquisitely Organized



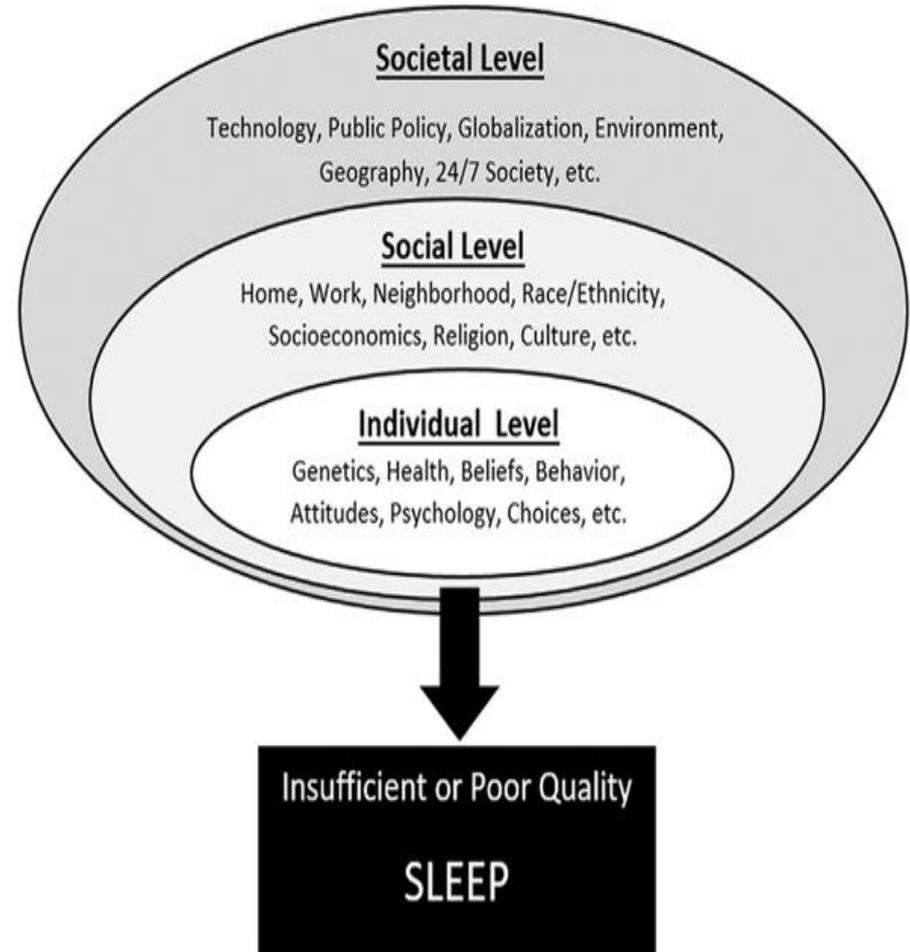
- Average adult needs approximately 7.5–8 hours regardless of environmental or cultural differences
- Significant genetic influence from twin studies
- Long or a short sleeper : sleep need are determined by heredity rather than by different personality traits or other psychological factors.
- Modified by Social (e.g., occupational) or biological (e.g., illness) factors + *Stimulants*

Normal Sleep is Elegantly Regulated



Sleep Health: Quality , Quantity, and Timing

- *Sleep deficiency / Deprivation: Inadequate or mistimed sleep related to societal factors , technology, work hours, globalization*
- *High prevalence of primary sleep disorders: sleep apnea, insomnia, narcolepsy, and restless legs syndrome*



Sleep and Potential Health Outcomes

Sleep Measure	Associated Health Outcomes	Sample References
Satisfaction/Quality	Mortality	Kojima et al., 2000 ⁶⁵ ; Elder et al., 2008 ⁶⁶ ; Rod et al., 2011 ⁶⁷ ; Hublin et al., 2011 ⁶⁸
	Metabolic Syndrome	Jennings et al., 2009 ⁶⁹ ; Troxel et al., 2010 ⁷⁰
	Diabetes/impaired glucose metabolism	Vgontzas et al., 2009 ⁷¹ ; Haseli-Mashhadi et al., 2009 ⁷² ; Knutson et al., 2011 ⁷³ ; Pyykkonen et al., 2012 ⁷⁴
	Hypertension	Vgontzas et al., 2009 ⁷⁵ ; Fiorentini et al., 2007 ⁷⁶ ; Rod et al., 2011 ⁶⁷
	Coronary heart disease	Laugsand et al., 2011 ⁷⁷ ; Hoevenaar-Blom, 2011 ⁷⁸ ; Appelhans, 2013 ⁷⁹
	Depression	Baglioni, 2011 ⁸⁰
Alertness/Sleepiness/ Napping	Mortality	Hays, 1996 ⁸¹ ; Newman et al., 2000 ⁸²
	Coronary heart disease	Newman et al., 2000 ⁸² ; Sabanayagam et al., 2011 ⁸³
	Impaired neurobehavioral performance	Dinges et al., 1997 ⁸⁴
Timing (e.g., shift work, chronotype)	Mortality	Åkerstedt et al., 2004 ⁸⁵
	Coronary heart disease	Kawachi et al., 1995 ⁸⁶ ; Frost et al., 2009 ⁸⁷
	Metabolic syndrome	Karlsson et al., 2001 ⁸⁸ ; Lin et al., 2009 ⁸⁹ ; Pietroisti et al., 2010 ⁹⁰
	Diabetes/impaired glucose metabolism	Pan et al., 2011 ⁹¹ ; Buxton et al., 2012 ⁹² ; Reutrakul et al., 2013 ⁹³
	Accidents	Folkark and Åkerstedt, 2004 ⁹⁴ ; Barger et al., 2005 ⁹⁵
Efficiency (sleep latency, wake after sleep onset)	Mortality	Newman et al., 2000 ⁸² ; Nilsson et al., 2001 ⁹⁶ ; Mallon et al., 2002 ⁹⁷ ; Dew et al., 2003 ⁹⁸
	Metabolic syndrome	Troxel et al., 2010 ⁷⁰
	Diabetes/impaired glucose metabolism	Cappuccio et al., 2010 ⁹⁹ ; Engeda et al., 2013 ¹⁰⁰ ; Kawakami et al., 2004 ¹⁰¹ ; Knutson et al., 2011 ⁷³ ; Lou, 2012 ¹⁰²
	Hypertension	Vgontzas et al., 2009 ⁷⁵ ; Javaher et al., 2008 ¹⁰³ ; Phillips and Mannino, 2007 ¹⁰⁴
	Coronary heart disease	Laugsand et al., 2011 ⁷⁷ ; Grandner et al., 2012 ¹⁰⁵
	Depression	Baglioni et al., 2011 ⁸⁰
Duration	Mortality	Wingard and Berkman, 1983 ¹⁰⁶ ; Kripke et al., 2002 ¹⁰⁷ ; Hublin et al., 2007 ¹⁰⁸ ; Youngstedt et al., 2004 ¹⁰⁹
	Obesity	Gangwisch et al., 2005 ¹¹⁰ ; Cappuccio et al., 2008 ¹¹¹ ; Hasler et al., 2004 ¹¹² ; Buxton et al., 2010 ¹¹³
	Metabolic Syndrome	Hall et al., 2008 ¹¹⁴
	Diabetes	Ayas et al., 2003 ¹¹⁵ ; Gottlieb et al., 2005 ¹¹⁶ ; Yaggi et al., 2006 ¹¹⁷
	Hypertension	Gottlieb et al., 2006 ¹¹⁸ ; Gangwisch et al., 2006 ¹¹⁹ ; Cappuccio et al., 2007 ¹²⁰ ; Stranges et al., 2010 ¹²¹
	Coronary heart disease	Mallon et al., 2002 ⁹⁷ ; Ayas et al., 2003 ¹²² ; Hoevenaar-Blom et al., 2011 ⁷⁸
	Impaired neurobehavioral performance	Van Dongen et al., 2003 ¹²³ ; Van Dongen et al., 2004 ¹²⁴ ; Belenky et al., 2003 ¹²⁵

Joint Consensus Statement of the American Academy of Sleep Medicine and Sleep Research Society on the Recommended Amount of Sleep for a Healthy Adult: Methodology and Discussion

Sleep. 2015

- **≤6 hours** of sleep : inappropriate to support optimal health in adults.
- **7–9 hours** of sleep : appropriate to support optimal health in adults.
- The appropriateness of **≥ 9** hours of sleep on optimal adult health could not be ascertained
- No consensus on appropriateness of **6–7** hour range, but the median vote indicated this duration was in the inappropriate range.

Minimum sleep duration threshold to support optimal health in adults:

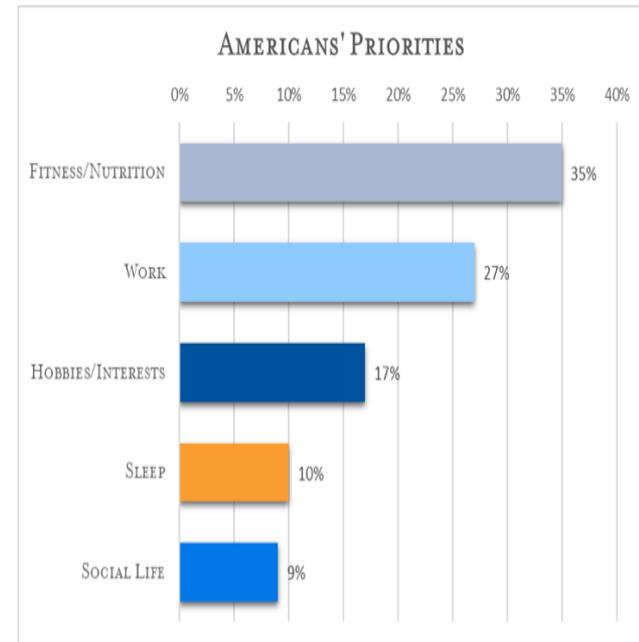
7 hours

Why Sleep Deprived?

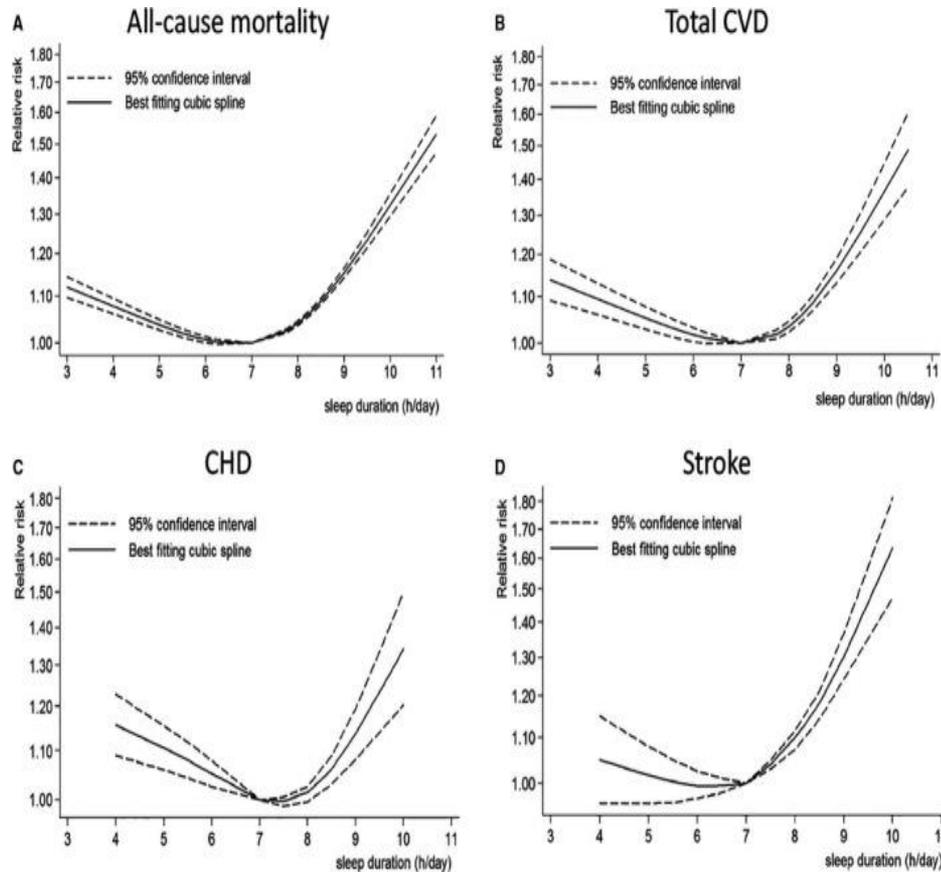
- **Behavioral**
- Circumstantial to occupation / work environment / social obligations
- Chronic sleep disruption with other medical and sleep disorders

2019 Sleep Health and Scheduling

 NATIONAL SLEEP FOUNDATION



Sleep Duration and Mortality +

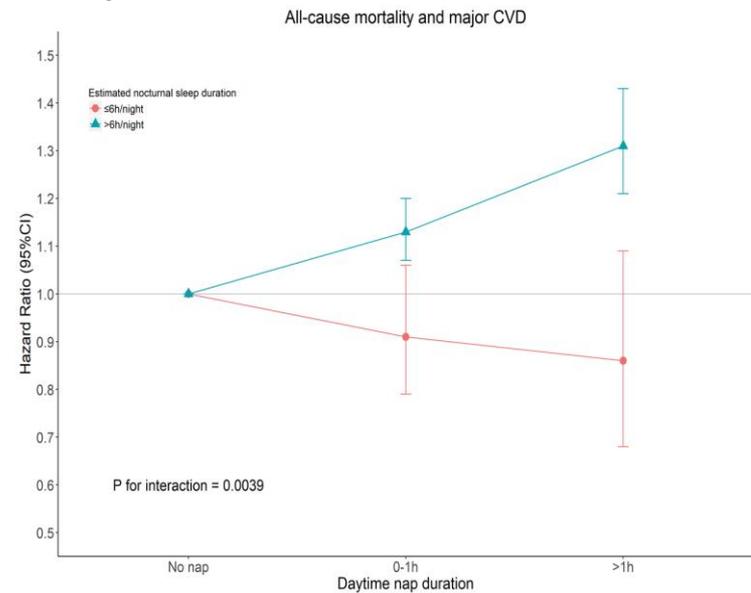
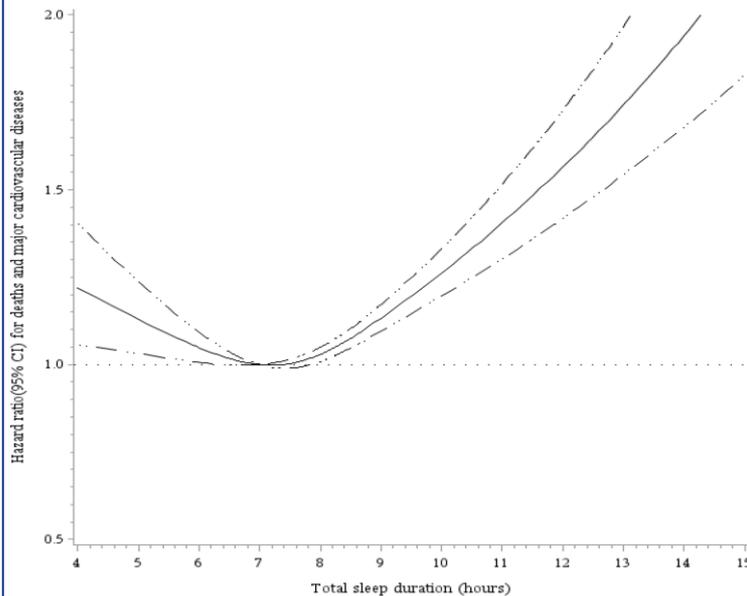


Compared with 7 hours per day:

- 1 hr ↓ : ↑ 6%, 6%, 7%, and 5% increased stroke, respectively,
- 1 hr ↑ : ↑ 13%, 12%, 5%, and 18% increased risk, respectively.

Sleep Duration Health consequences: Cardiovascular Disease

- Increased risk for cardiovascular disease ± mortality
- >60% increased likelihood of hypertension
- Increased CRP concentrations, a predictor of



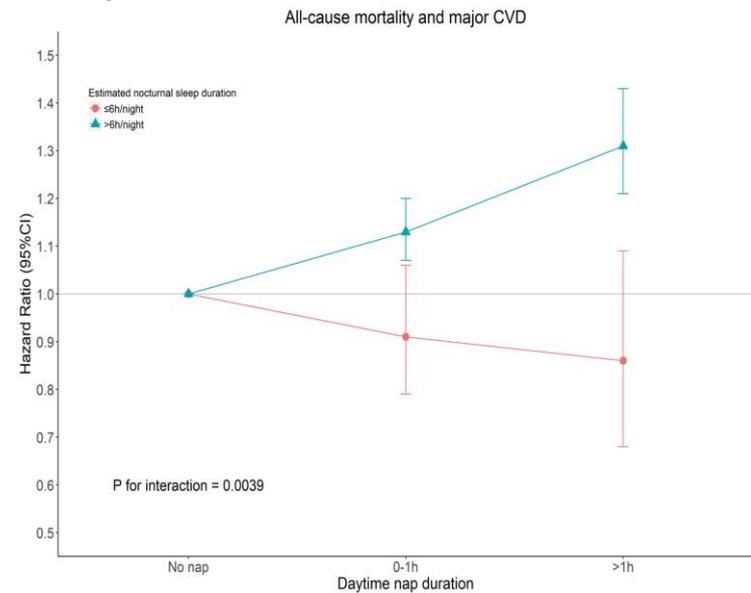
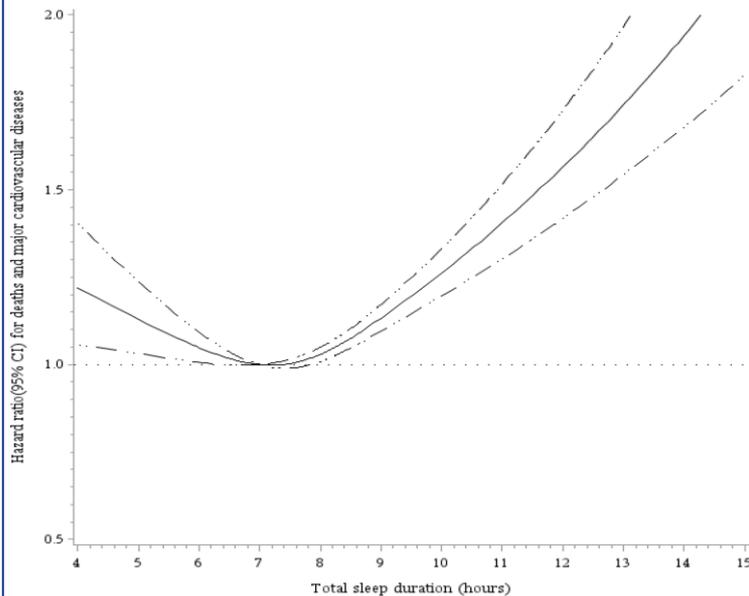
[Sleep Med Rev. 2010 Jun; 14\(3\): 191–203.](#)

[J Am Coll Cardiol. 2004 Feb 18;43\(4\):678-83.](#)

[Eur Heart J. 2018 Dec 5](#)

Sleep Duration Health consequences: Cardiovascular Disease

- Increased risk for cardiovascular disease ± mortality
- >60% increased likelihood of hypertension
- Increased CRP concentrations, a predictor of



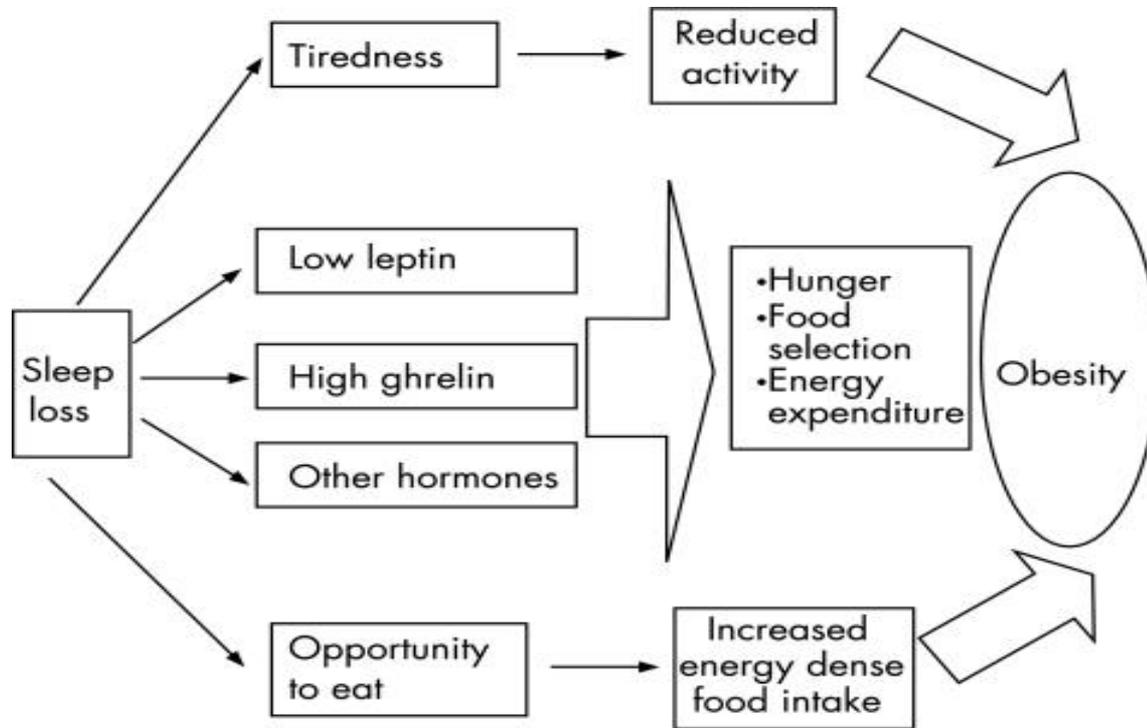
[Sleep Med Rev. 2010 Jun; 14\(3\): 191–203.](#)

[J Am Coll Cardiol. 2004 Feb 18;43\(4\):678-83.](#)

[Eur Heart J. 2018 Dec 5](#)

Sleep Duration Health consequences: **Obesity**

- Increased risk of obesity more pronounced in children and adolescent with dose response inverse relationship



[Sleep Med Rev. 2010 Jun; 14\(3\): 191–203.](#)

[Arch Dis Child. 2006 Nov; 91\(11\): 881–884.](#)

Sleep Duration Health consequences: Diabetes

- Compared with sleep times of 7 to 8 hours per night, self-reported usual sleep times of 6 or less or 9 or more hours per night : associated with a higher adjusted odds ratio (OR) for IGT and DM

Table 3. Data for Diabetes Mellitus or Impaired Glucose Tolerance by Reported Usual Sleep Time in Stratified Analyses

Variable	No. of Subjects	Reported Usual Sleep Time per Night, h*			P Value†
		≤5	6	≥9	
Sex					
Male	722	1.93 (1.04-3.56)	1.19 (0.79-1.80)	1.91 (1.07-3.42)	.04
Female	764	1.83 (1.07-3.11)	2.18 (1.46-3.24)	1.84 (1.06-3.19)	<.01
Age, y					
<70	690	1.62 (0.87-3.03)	1.70 (1.12-2.58)	1.91 (0.97-3.75)	.02
≥70	796	2.00 (1.20-3.34)	1.58 (1.08-2.33)	1.87 (1.14-3.05)	<.01
AHI					
<5	715	1.95 (1.08-3.50)	1.81 (1.22-2.70)	1.79 (1.02-3.16)	<.01
≥5	771	1.77 (1.03-3.02)	1.45 (0.97-2.17)	1.95 (1.12-3.40)	.02
Insomnia					
Absent	997	1.76 (0.81-3.83)	1.78 (1.22-2.59)	1.89 (1.21-2.96)	<.01
Present	480	1.66 (0.98-2.82)	1.40 (0.88-2.22)	1.56 (0.66-3.70)	.21

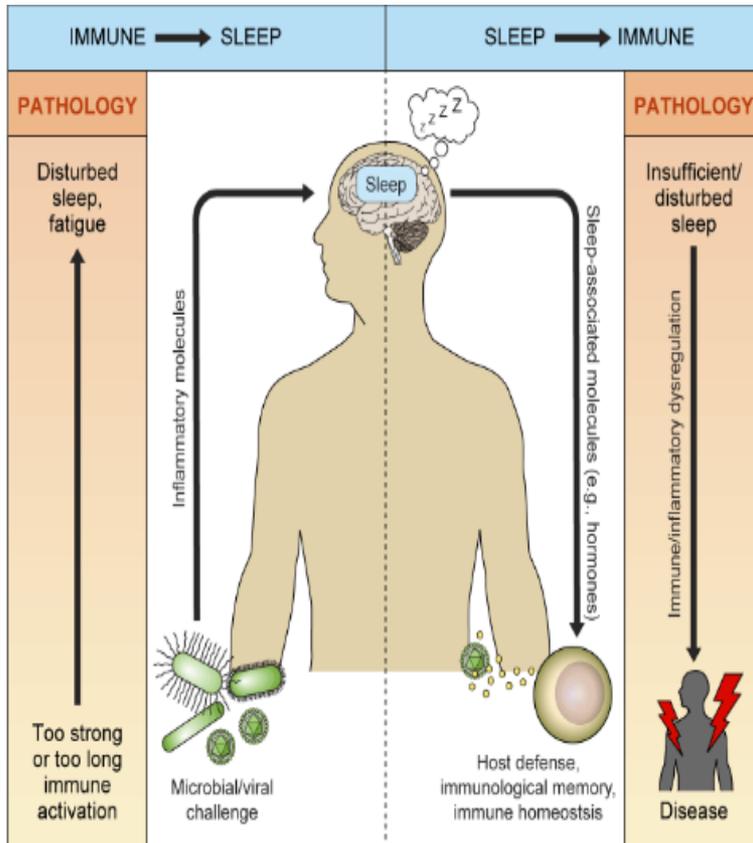
Abbreviation: See Table 1.

*Data are given as odds ratios (95% confidence intervals) for the presence of either diabetes mellitus or impaired glucose tolerance relative to normal glucose tolerance, from logistic regression models using 7 to 8 hours of sleep per night as the referent category. Analyses are adjusted for age, age², sex, waist girth, race/ethnicity (non-Hispanic white vs other), ln(AHI + 1), and the study site from which the subjects were recruited.

†P values reflect the overall significance level of the effect of sleep time on diabetes mellitus and impaired glucose tolerance within strata, based on the likelihood ratio χ^2 ; there was no significant interaction of sleep time with sex, age, AHI, or presence of insomnia.

Arch Intern Med. 2005 Apr 25;165(8):863-7.

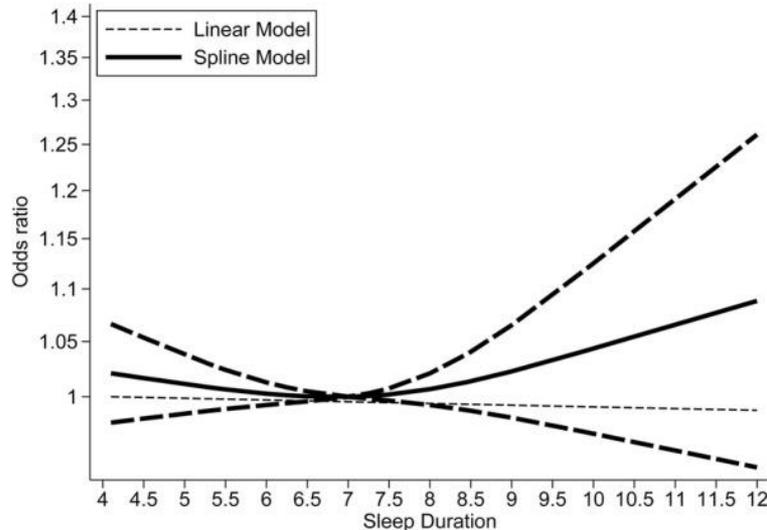
Sleep Duration Health consequences: Immune system



- Sleep promotes inflammatory mediator homeostasis
- Sleep induces the release of growth hormone during the early part of the night (SWS) → enhance the proliferation and differentiation of T cells as well as to promote type 1 cytokine activity
- Sleep disruption / deprivation : ↓ amount of growth hormone → ↓ adaptive immune response → *increased susceptibility to infectious disease and decreased response to vaccines*
- Sleep deprivation triggers chronic, systemic low-grade inflammation:
 - Diabetes
 - Atherosclerosis
 - neurodegeneration

[Physiol Rev.](#) 2019 Jul 1;99(3):1325-1380.

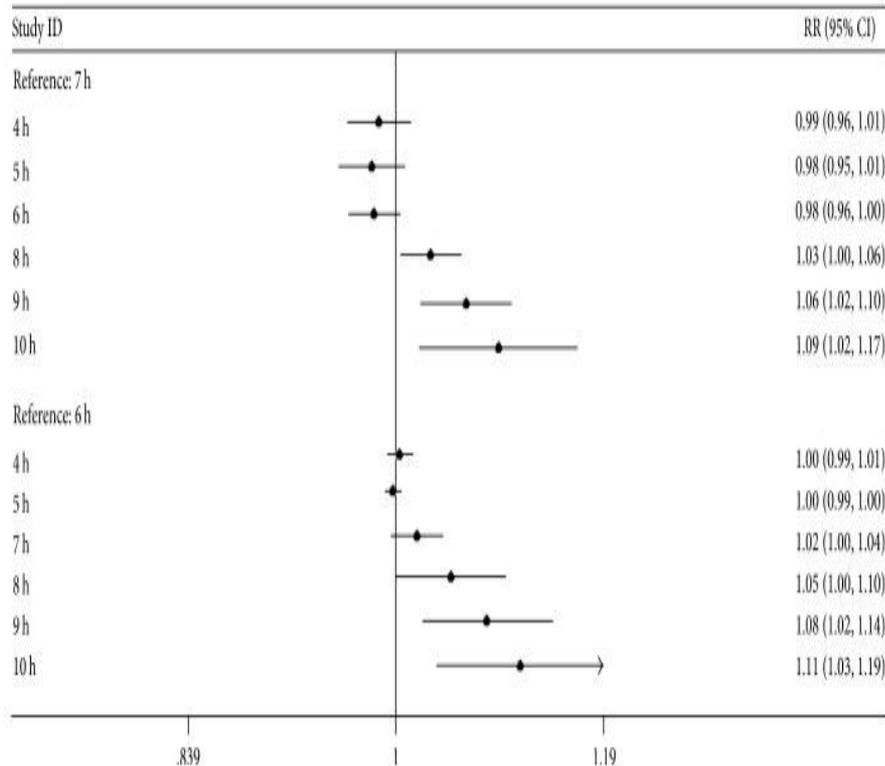
Sleep Duration Health consequences: Cancer Risk



- Meta-analysis , 65 studies, 1,550,524 participants and 86,201 cancer cases:
- Categorical meta-analysis:
 - neither short nor long sleep duration was associated with increased cancer risk
- Subgroup analysis:
 - short sleep duration was associated with cancer risk among Asians
 - long sleep duration increased the risk of colorectal cancer

[BMC Cancer](#). 2018 Nov 21;18(1):1149.

Sleep Duration Health consequences: Breast Cancer Risk



Meta-analysis , 10 studies involving 415,865 participants:

- Increased risk trend was found between sleep duration and breast cancer
 - women with a longer sleep duration might have a significantly increased risk of breast cancer but not women with a shorter sleep duration.
 - risk of estrogen receptor-positive breast cancer increased with increasing sleep hours compared to the reference hours

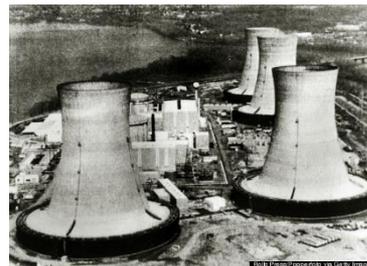
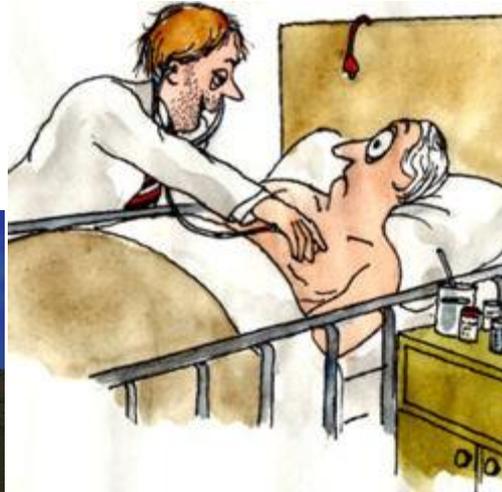
Sleep Duration Health consequences: Neurocognitive Function

Multiple experimental studies among healthy adults:

- Neurocognitive performance impaired when the nightly sleep period is restricted to less than 7 hours.
- Amount of sleep restriction demonstrates a dose-response to performance impairment acutely and cumulatively.
- Subjective reports of participants did not correspond to their objective performance

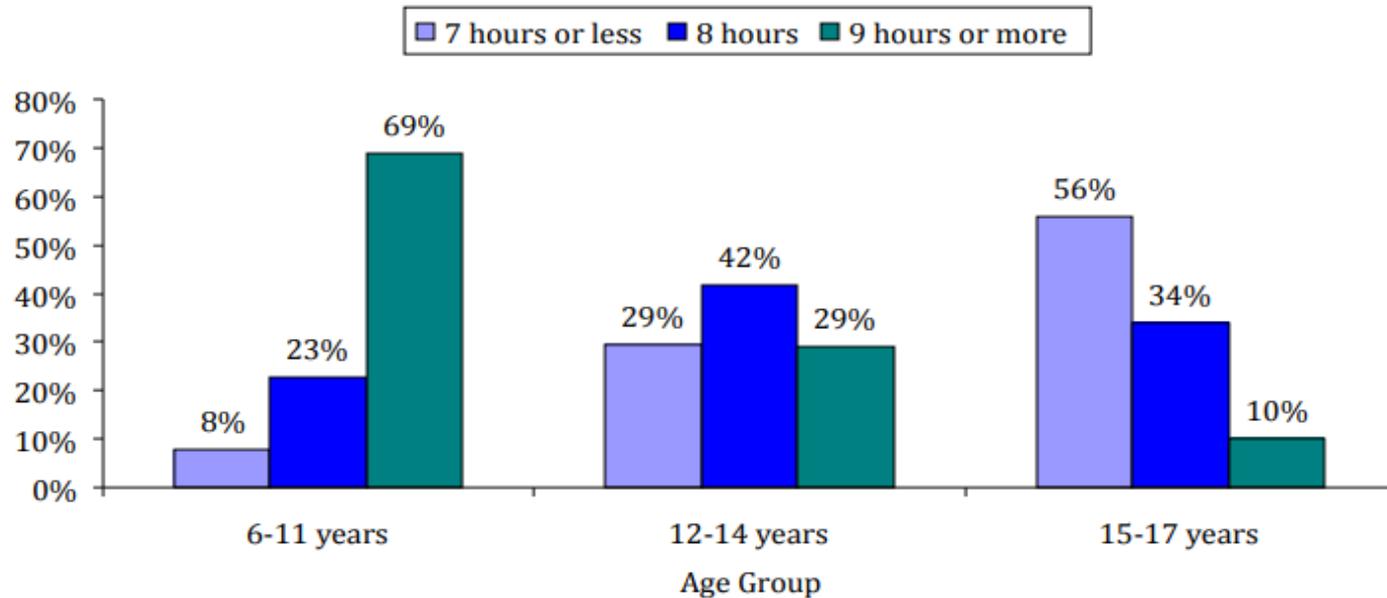
Humans are unable to assess their own functional capacity and often overestimated their ability to perform.

Sleep Duration Health consequences: Safety



Sleep Duration : Adolescents and young Adults

2014 *Sleep in America*® Poll Sleep In The Modern Family



Sleep Duration: Adolescents and young Adults

Contributing Factors

- Development/pubertal onset and a more evening-type circadian phase preference
- Alteration in sleep–wake homeostasis with slower rate to accumulate sleep pressure allowing later bedtime
- Electronic Media
- School start times
- Caffeine
- Medical / psychiatric

Consequences

- Sleep Loss and Depression, Mood Disturbances, and Suicidal Ideation
- Obesity Risk
- Drowsy driving and MVA
 - Night
 - Driver alone
 - Young male > young female

Steps to Help Achieve Healthy Sleep

- Sleep Health Literacy / Education: Sleep as a priority in the modern world
- Promote Healthy Sleep behaviors
 - Sleep Hygiene
 - Behavioral Modifications
 - Environmental Modifications
 - Understanding individual differences: Age, gender
 - Evaluate and Treat underlying Sleep Disorders
- Identify High risk populations:
 - Pediatric and adolescent
 - Electronic Media

A white-framed poster mounted on a light gray wall. The poster contains the text 'EAT CLEAN', 'EXERCISE', 'DRINK WATER', 'SLEEP', and 'REPEAT' in a bold, sans-serif font. 'REPEAT' is highlighted in a dark blue rectangular box.

EAT CLEAN
EXERCISE
DRINK WATER
SLEEP
REPEAT

Shaib@bcm.edu