



Too Many Teens Get Too Little Sleep: Impact on Adolescent Mental & Physical Health

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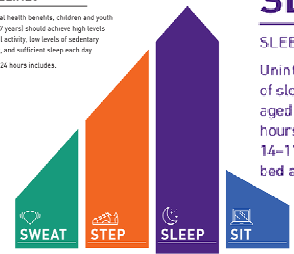
Overview

- Scope
- Causes
- Effects
- SIA as a Solution

Scope of the Problem

GUIDELINES

For optimal health benefits, children and youth aged 5-17 years should achieve high levels of physical activity, low levels of sedentary behavior, and sufficient sleep each day. A healthy 24 hours includes:




SLEEP

Uninterrupted 9 to 11 hours of sleep per night for those aged 5-13 years and 8 to 10 hours per night for those aged 14-17 years, with consistent bed and wake-up times

(<http://www.csep.ca/en/guidelines/24-hour-movement-guidelines>)

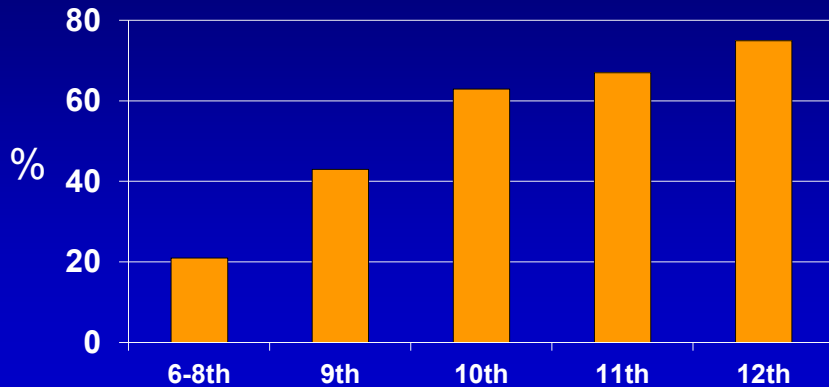
	Hours of Sleep										
	< 6	7	8	9	10	11	12	13	14		
13-18 years											



(Paruthi et al., 2016)
(Hirshkowitz et al., 2015)

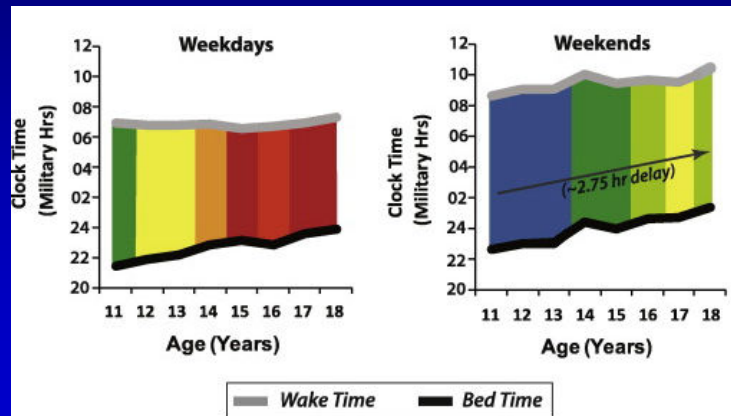
Scope of the Problem

< 8-10 hrs on school nights



Year/Grade in School (NSF 2006 Sleep in America Poll)

Causes of Shortened Sleep



(Hagenauer & Lee, 2012)

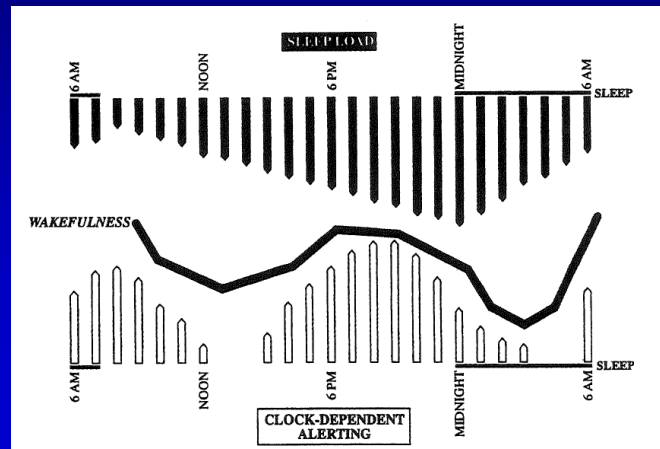
Causes of Shortened Sleep

- Teen-selected bedtimes
- Structured after-school activities
 - Work
 - Homework
 - Sports
- Unstructured options
 - Social media
 - Portable electronics
 - Internet
 - On-demand video



Causes of Shortened Sleep

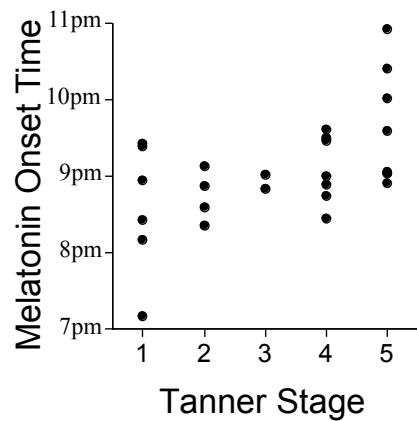
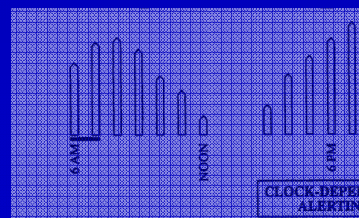
Sleep & arousal influenced by 2 biological processes.



Causes of Shortened Sleep

Across adolescence,

- Melatonin secretes later

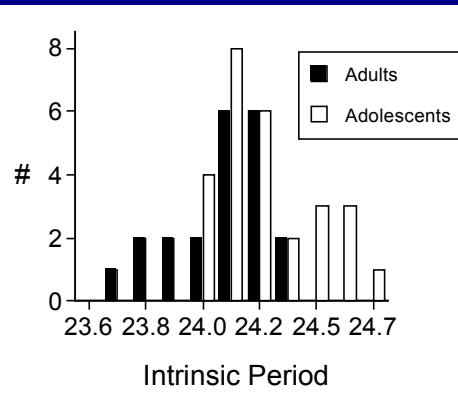
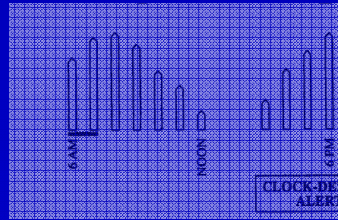


Carskadon et al., 2004

Causes of Shortened Sleep

Across adolescence,

- Melatonin secretes later
- Intrinsic period is longer

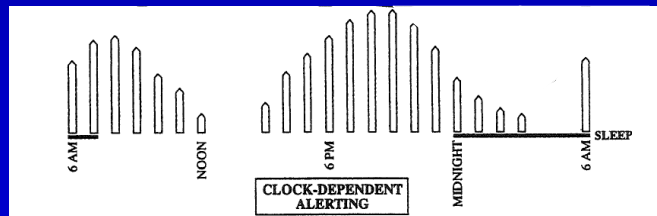


Carskadon & Acebo, 2005

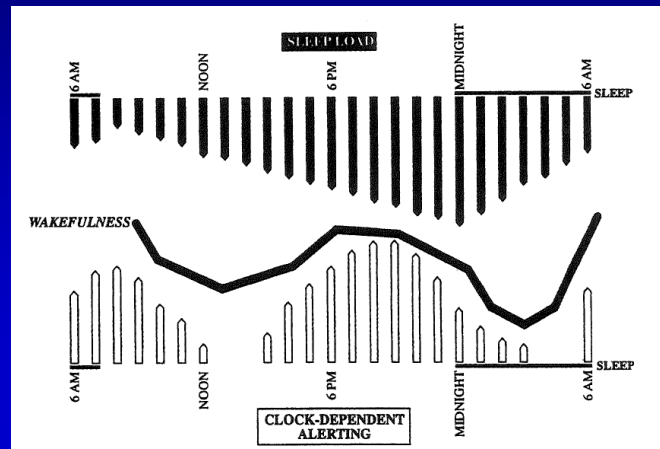
Causes of Shortened Sleep

Across adolescence,

- Melatonin secretes later
- Intrinsic period is longer
- Biological predisposition to later sleep period

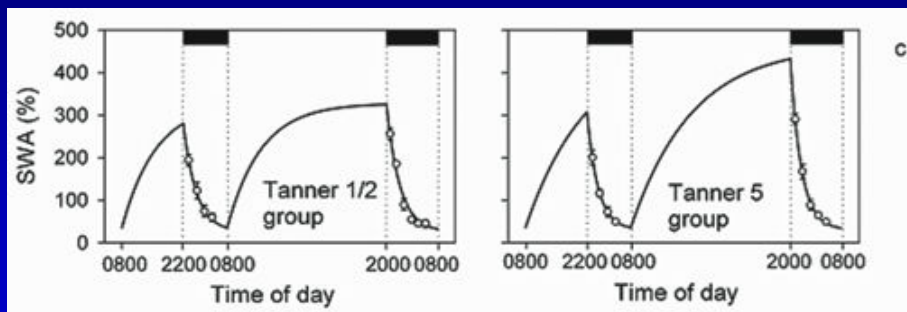


Causes of Shortened Sleep



Causes of Shortened Sleep

Across adolescence



- Build-up of sleep pressure slows

Jenni et al., 2005

Causes of Shortened Sleep

Across adolescence



- Build-up of sleep pressure slows
- Biological permission to stay awake longer

Causes of Shortened Sleep

Biology pushes sleep later

- + Social pressure/opportunity later
- + Early school start

= Chronically short sleep on school nights

Effects of Shortened Sleep



Effects of Shortened Sleep: Thought and Emotion



Real-World Evidence

Short or disrupted sleep correlates with:

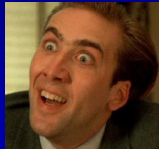
- ↑ Daytime sleepiness
- ↓ Attention
- ↓ Regulation of Impulses & Behaviors
- ↓ School performance
- ↑ Risky behaviors and accidental injuries
- ↑ Accidents in teen drivers
- ↑ Negative mood & ↓ Mood regulation

(Beebe, 2011)

Effects of Shortened Sleep: Thought and Emotion



Real-World Evidence



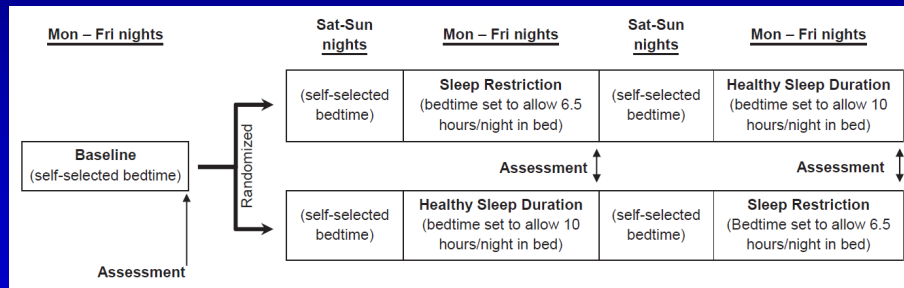
(<http://www.tylervigen.com/>)

Effects of Shortened Sleep: Thought and Emotion



Evidence of Causation

(Baum et al., 2014; Beebe et al., 2008, 2009, 2010, 2011, 2013, 2015, 2017; Garner et al., 2015; Simon et al., 2015; van Dyk et al., under review)



Effects of Shortened Sleep: Thought and Emotion

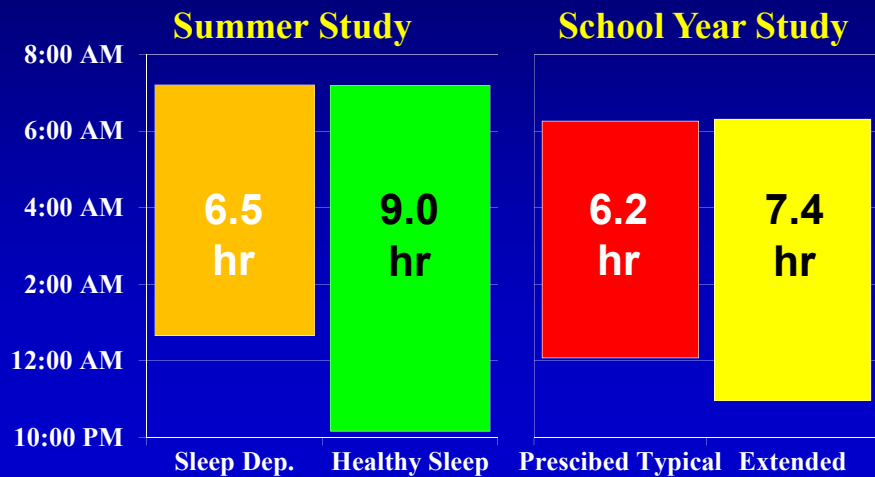


- Healthy teens who sleep 5-7 hr on school nts
- 5-week protocol involving 2 wks extending time in bed by 1.5 hours each school night

(Garner et al., 2017; Van Dyk et al., under review)

Week 1 nights	Week 2 nights		Week 3 nights		Week 4 nights		Week 5 nights	
S M T W T	F S	S M T W T	F S	S M T W T	F S	S M T W T	F S	S M T W T
	Washout Weekend	Sleep Extension	Normal Weekend	Sleep Extension	Washout Weekend	Prescribed Typical Sleep	Normal Weekend	Prescribed Typical Sleep
Baseline Week	↓ Random							
	Washout Weekend	Prescribed Typical Sleep	Normal Weekend	Prescribed Typical Sleep	Washout Weekend	Sleep Extension	Normal Weekend	Sleep Extension
	Office Visit ↑				Office Visit ↑		Office Visit ↑	

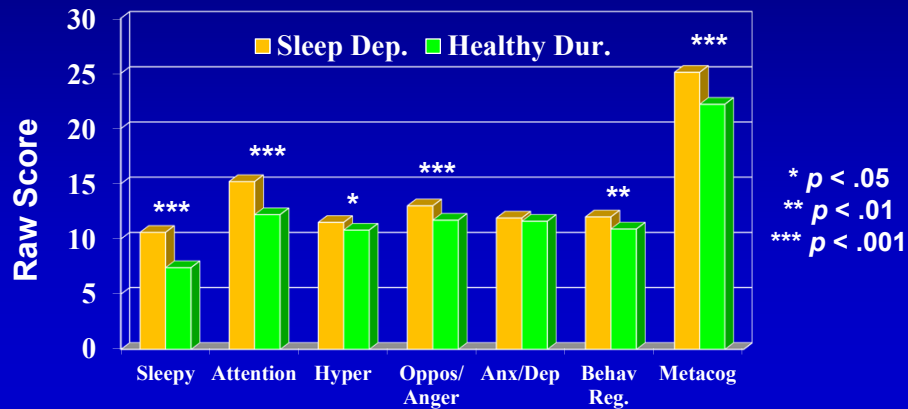
Effects of Shortened Sleep: Thought and Emotion



Effects of Shortened Sleep: Thought and Emotion



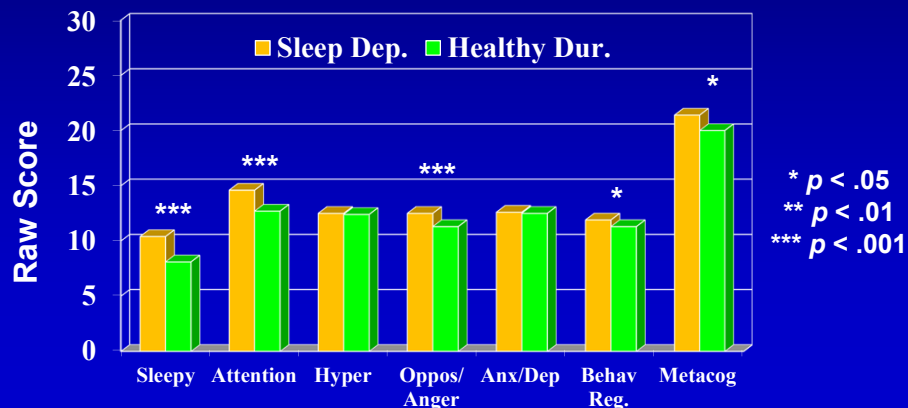
Evidence of Causation (Parent Report)



Effects of Shortened Sleep: Thought and Emotion



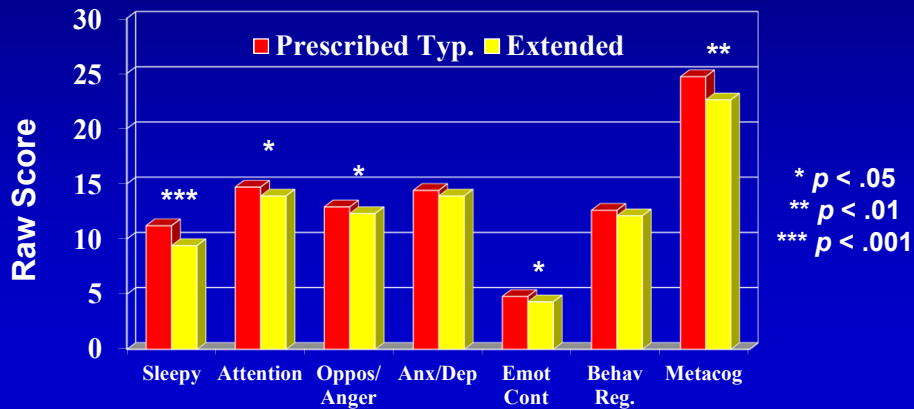
Evidence of Causation (Teen Self-Report)



Effects of Shortened Sleep: Thought and Emotion



Evidence of Causation (Teen Self-Report)



Effects of Shortened Sleep: Thought and Emotion



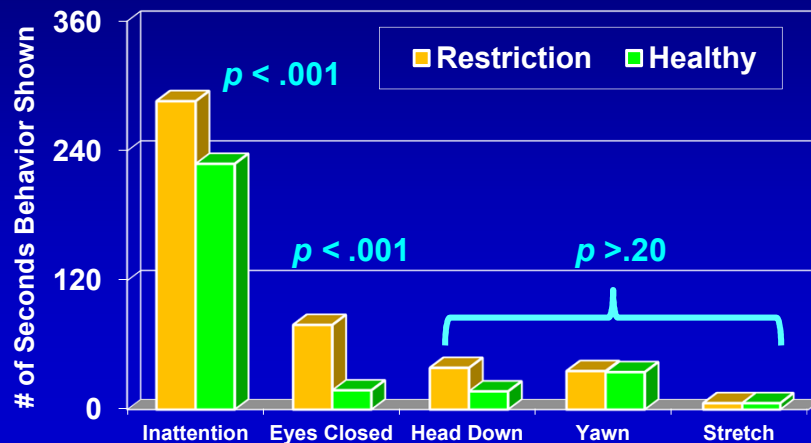
Evidence of Causation (Simulated Class)



Effects of Shortened Sleep: Thought and Emotion



Evidence of Causation (Simulated Class)



Effects of Shortened Sleep: Thought and Emotion



Simulated Drives

- Rural
- Urban/Suburban

Vulnerability Measure

- Change in attention outside of simulator

Primary Outcome

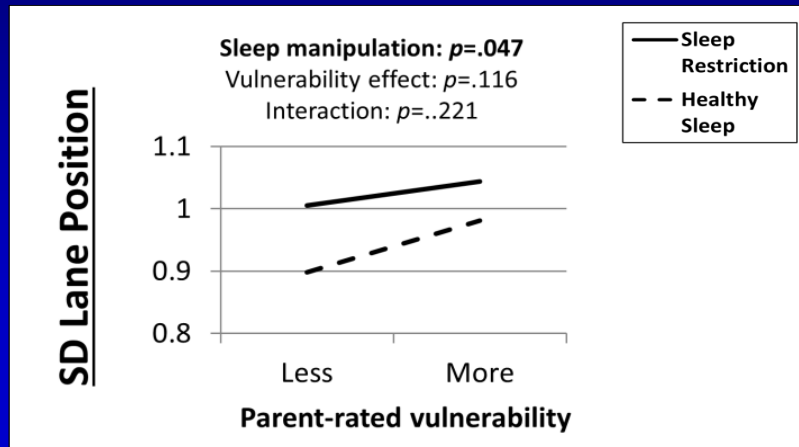
- Lateral vehicle control
(SD Lateral Lane Position)



Effects of Shortened Sleep: Thought and Emotion



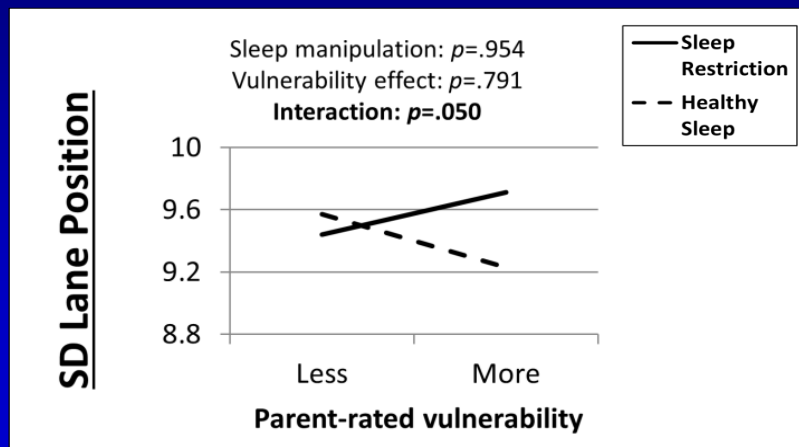
Rural Drive



Effects of Shortened Sleep: Thought and Emotion



Urban/Suburban Drive

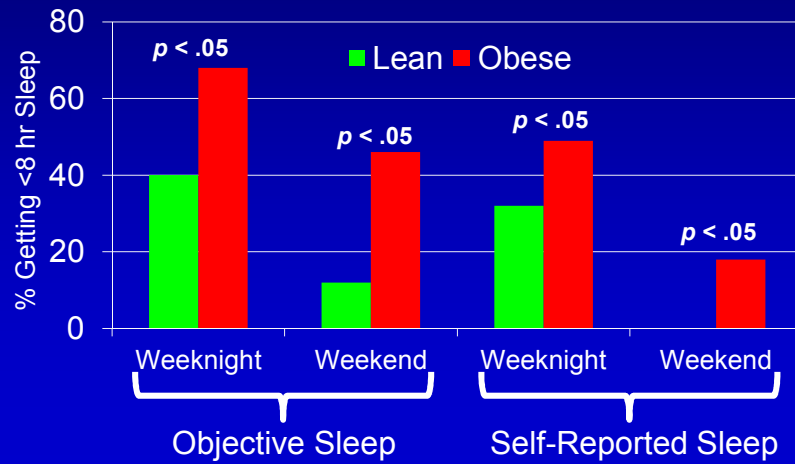


Effects of Shortened Sleep: Obesity



Real-World Evidence

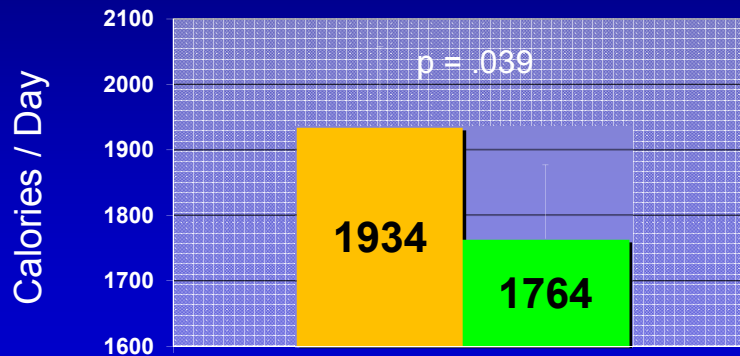
(Beebe et al., 2007)



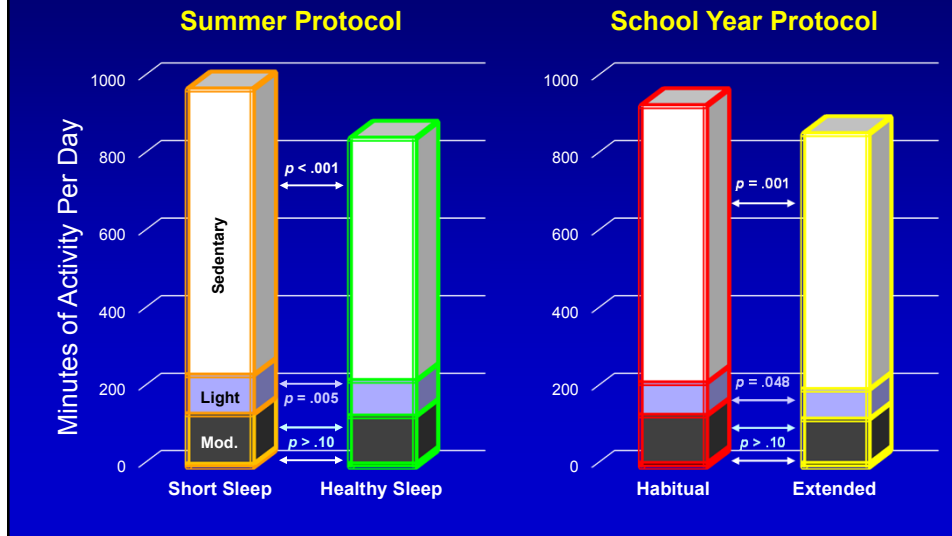
Effects of Shortened Sleep: Obesity



Evidence of Causation (Dietary Intake)



Effects of Shortened Sleep: Obesity



Effects of Shortened Sleep: Athletics



Real-World Evidence

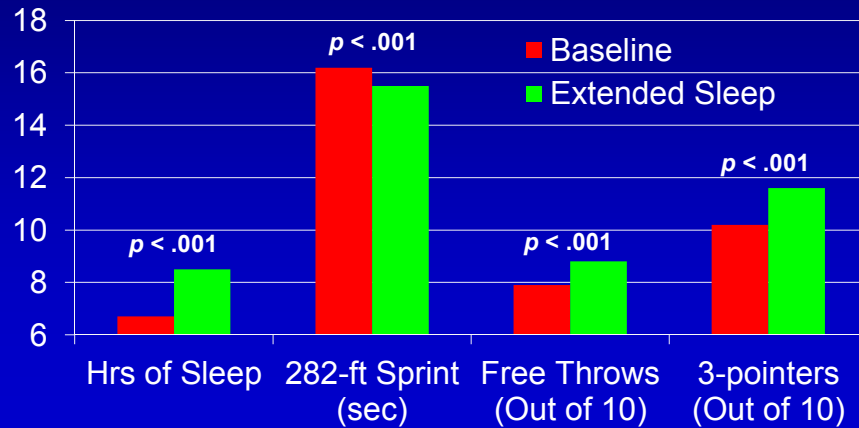
- Short sleep is associated with certain types of sports injuries in youth.
(Luke et al., 2011)
- Even among elite teen athletes, less sleep is associated with less willingness to train hard.
(Engle-Friedman et al, 2010)

Effects of Shortened Sleep: Athletics



Evidence of Causation

(Mah et al., 2011)

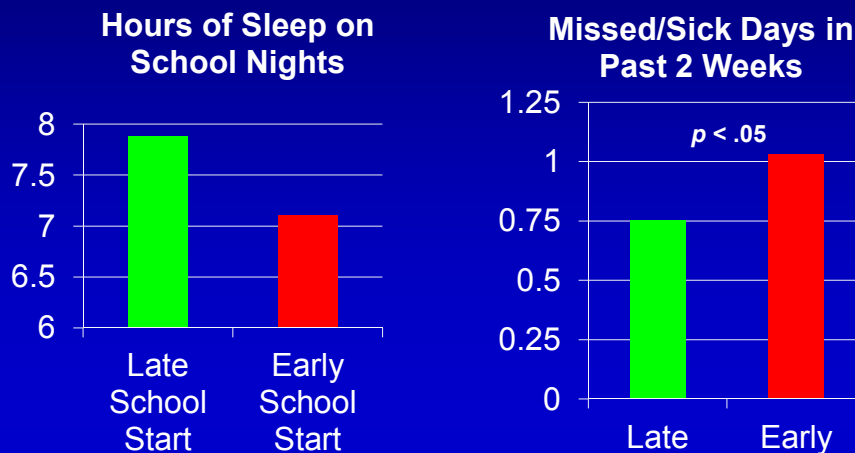


Effects of Shortened Sleep: Immune Functioning



Real-World Evidence

(Wahlstrom, 2002)



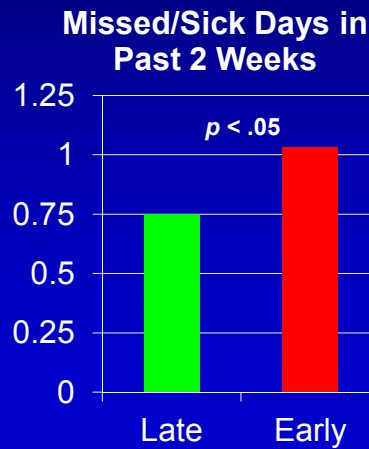
Effects of Shortened Sleep: Immune Functioning



Real-World Evidence

(Wahlstrom, 2002)

~1/4 day every 2 weeks
= 5 days every year

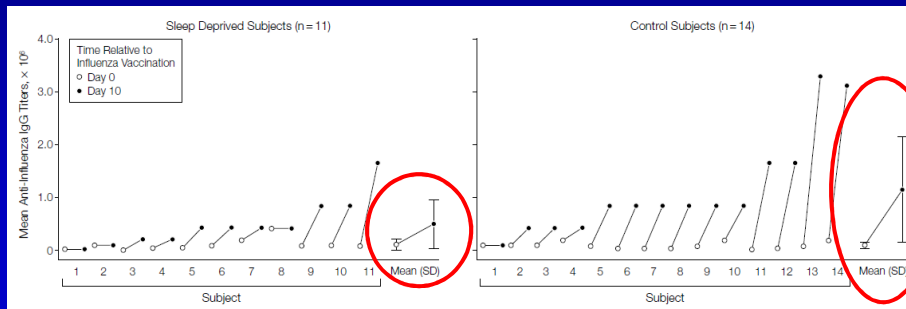


Effects of Shortened Sleep: Immune Functioning



Evidence of Causation

(Spiegel et al., 2002)



Effects of Shortened Sleep

Short sleep during adolescence is very common and causes real-world problems:

Thought & Emotion

- Daytime sleepiness
- Attention & Learning
- Mood / Emotion
- Driving Safety



Physical Health

- Obesity
- Athletics
- Illness



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as the Solution

Set the stage

Intervene

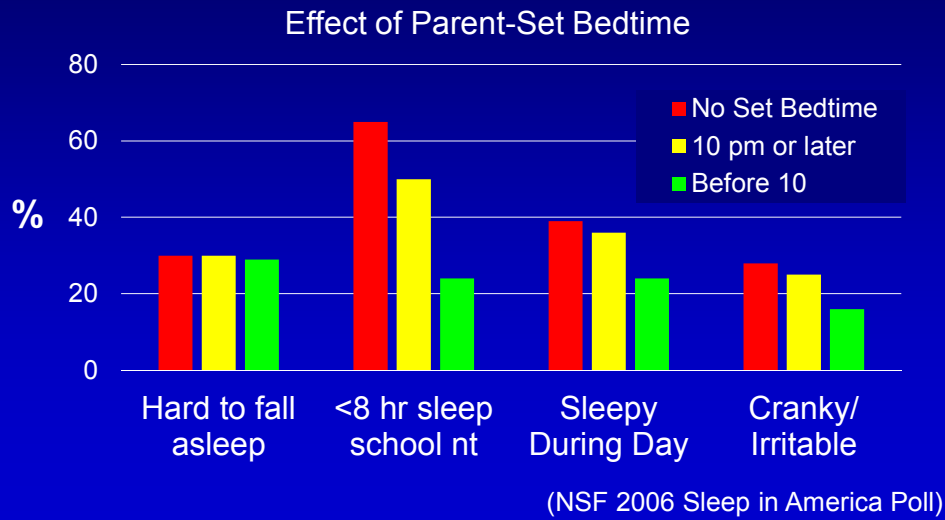
Advocate

as the Solution

Set the Stage: **Sleep Hygiene**

- *Talk about prioritizing sleep!*
- Take a good, hard look at competing activities
- Avoid caffeine late in the day or at high doses
- Avoid cigarette smoke (second-hand, too)
- Get out in daylight and move around, but have a calming, dimmer-light evening wind-down.
- Limit screen time during the evening “wind-down”
- Keep a consistent sleep schedule
- Avoid napping if trying to promote nocturnal sleep

Intervene: It's OK to set limits



Advocate: Address societal barriers

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™



Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

POLICY STATEMENT

School Start Times for Adolescents

(Owens et al, 2014)



ADOLESCENT SLEEP, HEALTH,
AND SCHOOL START TIMES
THE NATIONAL CONFERENCE

www.schoolstarttimeconference.org/



ABOUT US GET INVOLVED LEARN MORE

Start School Later

Health, Safety, and Equity in Education

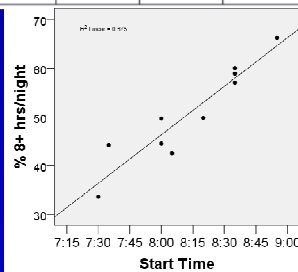
"Starting school later was the most significant and beneficial decision I made in all the years I was an educator."

— Kenneth Dragseth, Ph.D.
Retired Superintendent
Edina Public Schools, Minnesota

(www.startschoollater.net)

Advocate: Address societal barriers

School Start Time	7:30 AM	7:35 AM	8:00 AM	8:00 AM	8:05 AM	8:20 AM	8:35 AM	8:35 AM	8:35 AM	8:55 AM
School Year	2010-2011	2011-2012	2011-2012	2010-2011	2011-2012	2010-2011	2010-2011	2010-2011	2010-2011	2012-2013
District & State	Boulder Valley School District, CO	Teton County Schools, WY	Boulder Valley School District, CO	Mahtomedi School District, MN	Boulder Valley School District, CO	St. Louis Park High School, MN	South Washington Co., MN	South Washington Co., MN	South Washington Co., MN	Teton County Schools, WY
School	Fairview High School	Jackson Hole High School	Boulder High School	Mahtomedi High School	Fairview High School	St. Louis Park High School	Woodbury High School	East Ridge High School	Park High School	Jackson Hole High School
Sample Size	333	446	1379	884	1353	902	1249	960	1407	459
Sleep ≥ 8 hours/night	33.6%	44.2%	44.5%	49.7%	42.5%	49.8%	57.0%	58.9%	60.0%	66.2%

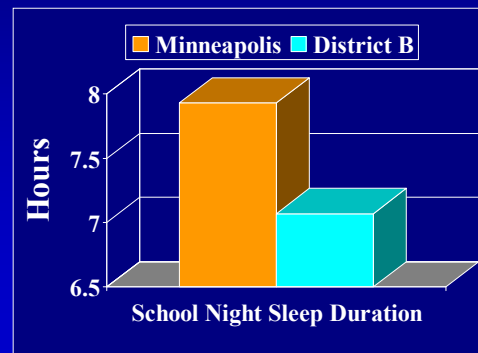


(Wahlstrom, 2014)

Advocate: Address societal barriers

School start shift 7:30 → 8:40 in Minneapolis

- Students slept more
- Students less sleepy
- Better attendance
- Fewer sick days
- Better mood
- Grades unchanged

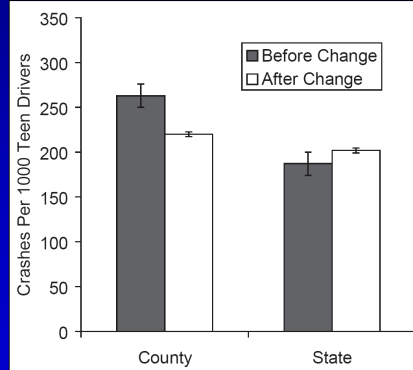
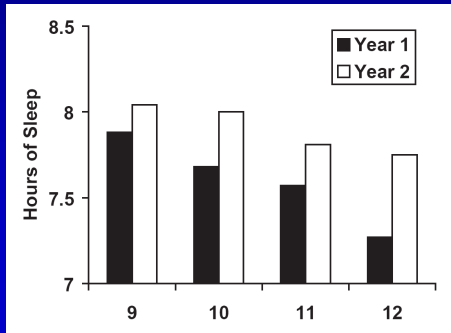


(Wahlstrom, 2002)

Advocate:

Address societal barriers

Start shift 7:30 - 8 → 8:30 - 9 in Fayette Co, KY.



(Danner & Phillips, 2008)

Set the stage

Intervene

Advocate

as the Solution

S
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(This could be you)

(and you)
as the Solution

Thank You!

Funding:

- Cincinnati Children's Research Foundation
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- Mark DiFrancesco, Ph.D.
- Sean Drummond, Ph.D.
- Jeff Epstein, Ph.D.
- Lisa Meltzer, Ph.D.
- Michelle Perfect, Ph.D.
- Tori Van Dyk, Ph.D.

