

**Everything that you wanted to
know about sleep but were too
sleepy to ask.**

Neil Stanley PhD.

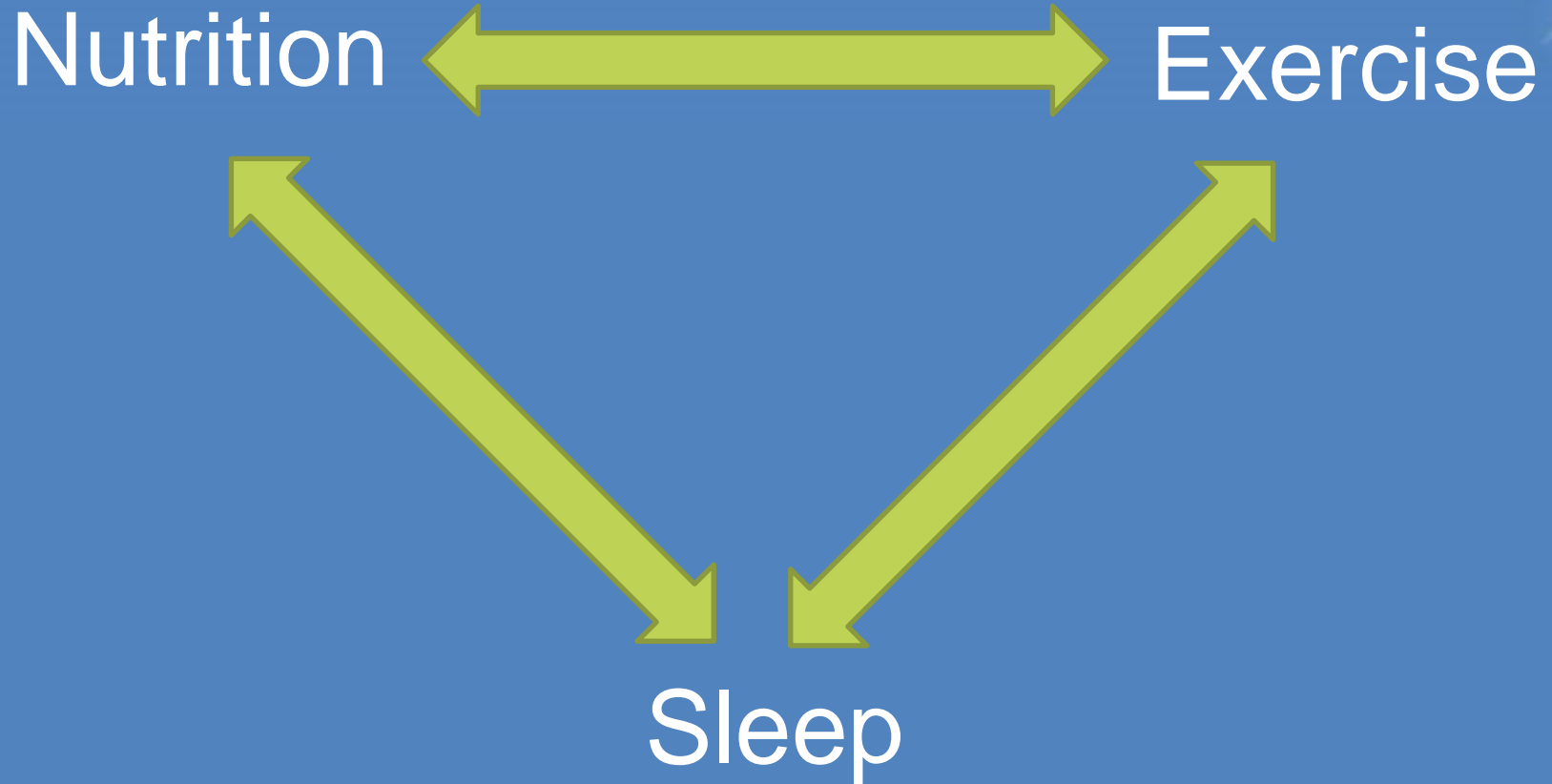
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Why is sleep important



- More people now actively attend to nutrition and exercise to promote good health, but fail to recognize the importance of sleep
- Sleep provides the foundation for optimal alertness and performance
- Sleep is critical to the health, wellness and longevity
- Sleep is vital physical need
 - -Required for survival like food, water, air

The well-being triangle



I'm safe at work so it doesn't matter if I'm sleepy?

False...being sleepy can cause:

- slower reaction time
- impaired judgements and decision making
- decline in attention
- decreased alertness
- increased moodiness and aggressive behaviour
- difficulty in remembering things

I can tell when I'm going to fall asleep

False....

- People do not know how sleepy they are
- The more tired you become, the less able you are to make a good judgement about your ability to remain awake

Drinking coffee cures sleepiness

False...

- Caffeine has a short term effect
- Caffeine should be used carefully as it will disrupt sleep
- Other measures such as opening windows and putting on the radio are not effective
- The only cure for sleepiness is to get some sleep

Why We Aren't Sleeping...

- Volitional sleep deprivation (work, lifestyle)
- Poor sleep habits
- Circadian factors (shift work)
- Environmental disruptions
- Untreated sleep problems/disorders
- **We don't take sleep seriously!!!**

Link Between Effective business performance and Getting Enough Sleep

- Four types of leadership behaviour are most commonly associated with high-quality executive teams:
 - operating with a strong orientation to results
 - solving problems effectively
 - seeking out different perspectives
 - supporting others.
- In all four cases is the proven link between sleep and effective business performance.

The prefrontal cortex

- The prefrontal cortex directs all the higher-order cognitive processes, such as
 - Problem solving
 - Reasoning
 - Organizing
 - Inhibition
 - Planning
 - Executing plans.
- all behaviour relies on at least one (and often more than one) of these executive functions

The prefrontal cortex and sleep


- Tasks that require planning, strategy, or a complex sequence of steps to complete are more difficult when one is sleepy. This general category of tasks (requiring motivation linked to abstract goals, delayed rewards/consequences, planning, strategy, and so on) involves abstract processing areas in the front of the brain (regions of the prefrontal cortex) that appear to be particularly sensitive to sleep deprivation.

Impact of poor sleep in the Workplace



- A high prevalence of sleep disorders in workers is associated with increased:
 - Accidents and injuries
 - Disability
 - Absenteeism
 - Presenteeism
 - Work productivity/work performance loss

Work Problems Due to Sleepiness



••••	Make errors	19%
••••	Late to work	14%
••••	Fall asleep at work	7%
••••	Stay home from work	4%
••••	Get injured	2%

Effects of Sleepiness on Work




When sleepy, people report having difficulty with:

●●●●	Concentration	68%
●●●●	Handling stress	65%
●●●●	Listening	57%
●●●●	Solving problems	57%
●●●●	Decision making	56%
●●●●	Relating to others	38%

What is sleep?





*“...for Sleepe is that golden
chaine that ties health and our
bodies together”.*

••• Thomas Dekker English dramatist (1609)

The importance of sleep



“ If sleep does not serve an absolutely vital function,
then it is the biggest mistake
the evolutionary process ever made¹ ”

How we fall asleep



1. Sun sets
2. Decline in the blue end of light spectrum
3. SCN (our biological clock) signals the Pineal gland to produce more melatonin
4. Melatonin level rises
5. We start feeling sleepy
6. We fall asleep.

Function of sleep

- Sleep remains a biological enigma
- Sleep is not negotiable- it is a biological imperative
- Needed for recuperation and restoration of physical and mental functioning.
- Sleep is important for optimal functioning of the endocrine, metabolic and immune system.
- Sleep affects all organs of the body.
- But primarily sleep is of the brain and for the brain.

Different States of Sleep

••• Non-REM (NREM) sleep (75-80%)

Increasing sleep depth & decreasing muscle tone, decreasing respiratory & heart rate & decreasing eye movement, physical rest & immune system. Memory and physiological rest.

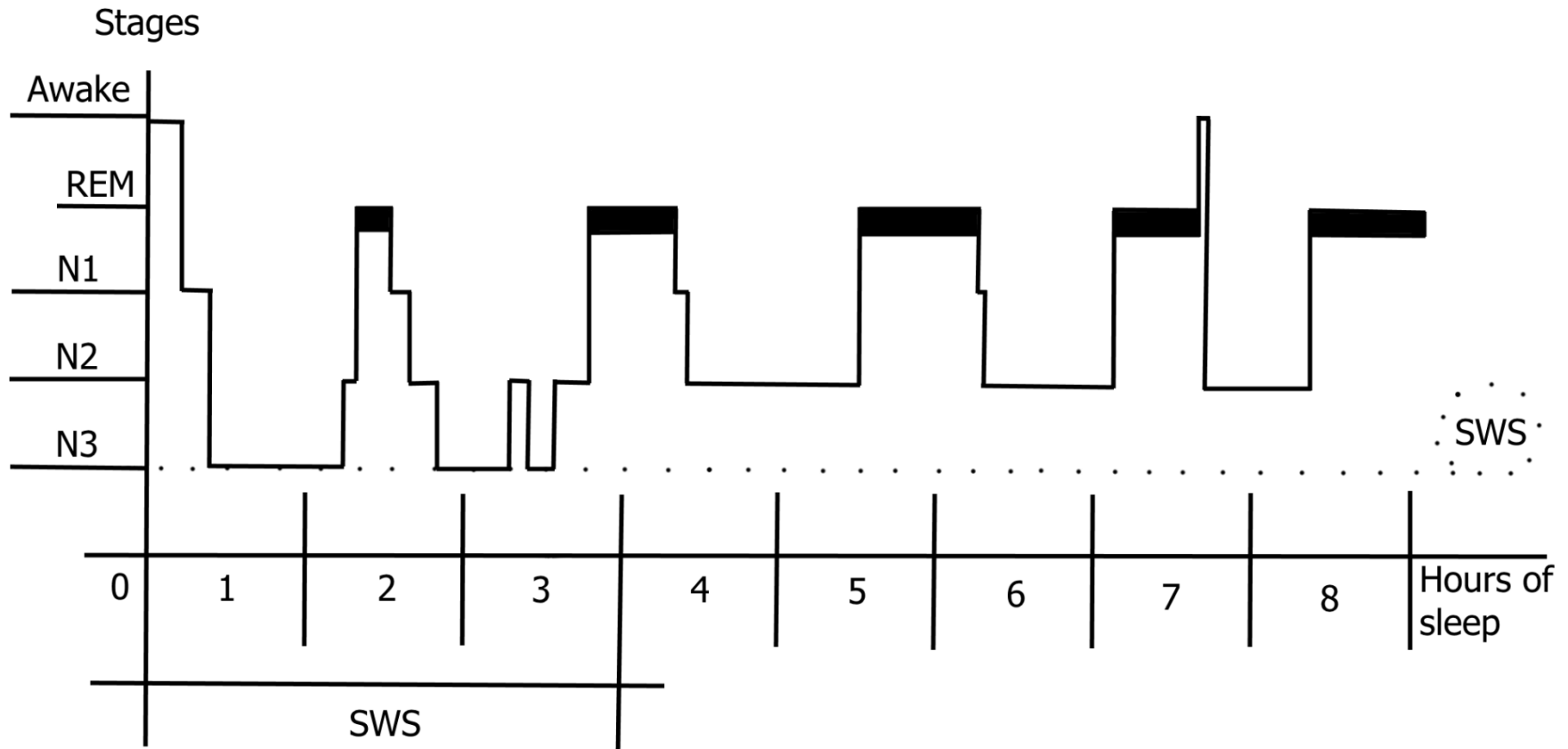
- Stage N1: transition from awake to sleep (1-5%)
- Stage N2: true sleep (45-50%)
- Stage N3: deep, slow wave sleep (SWS: 25-27%)

••• Rapid Eye Movement (REM) sleep (20-25%)

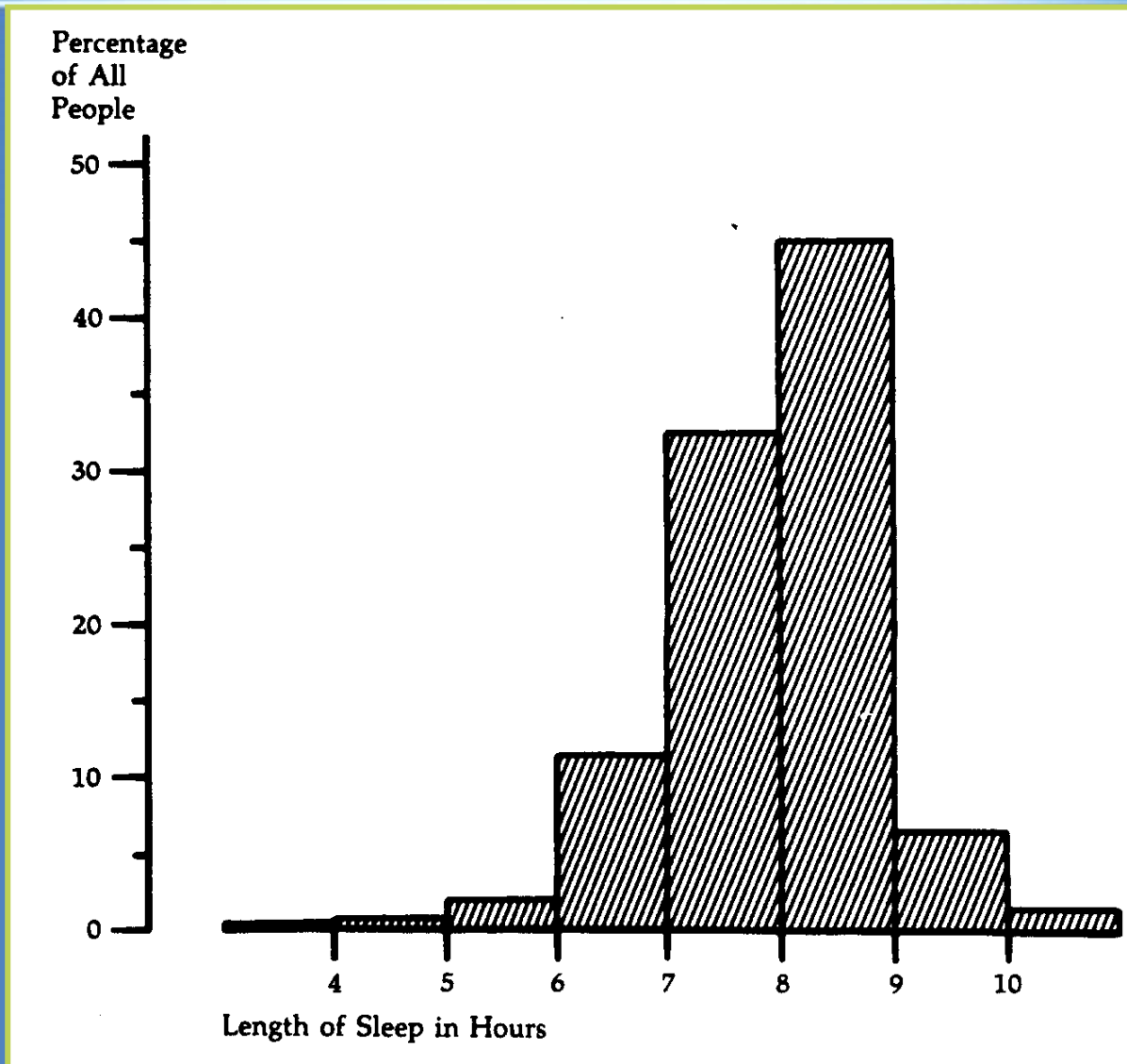
Irregular breathing and increased heart rate, very low muscle tone, vivid dreams

Psychological rest, emotional well-being & memory

'Normal' Sleep Hypnogram



Total Sleep Requirement



The Acute Effects of Sleepiness

- Involuntary “micro sleeps” occur
- Reaction times slower
- Attention becomes unstable
 - vigilance poor, lapses increase
 - short term memory suffers
 - unable to sustain performance
- Problem solving and judgement deteriorate
 - frontal lobe function particularly affected
 - inflexible behaviour (note industrial accidents)
 - sense of humour, moral judgement, risk taking

Signs of sleepiness

The signs include:

- not feeling refreshed after sleep
- difficulty keeping your eyes open and focussed
- greater tendency to fall asleep while at work
- more frequent naps during leisure hours
- extended sleep during days off
- increased errors and loss of concentration at work
- feeling irritable, restless and impatient

How sleepy are you?



Epworth Sleepiness Scale

- Use the following scale to choose the most appropriate number for each situation.
 - 0 = would never doze
 - 1 = slight chance of dozing
 - 2 = moderate chance of dozing
 - 3 = high chance of dozing

Epworth Sleepiness Scale

Sitting and reading?



Epworth Sleepiness Scale

Watching TV?



Epworth Sleepiness Scale

Sitting inactive in a public place (e.g., a theater or a meeting)?



Epworth Sleepiness Scale

As a passenger in a car for an hour without a break?



Epworth Sleepiness Scale

Sitting and talking to someone?



Epworth Sleepiness Scale

Sitting quietly after a lunch without alcohol?



Epworth Sleepiness Scale

In a car, while stopped for a few minutes in traffic?



Epworth Sleepiness Scale

Lying down to rest in the afternoon when
Circumstances permit?



Epworth Sleepiness Scale

- A score of ≤ 10 is considered normal
- A score of > 10 suggests excessive sleepiness

You would not turn up to work drunk so why did you turn up sleepy?

- If you are an 8hr a night person getting the following hours of sleep per night is similar to consuming:
 - 6 h sleep \approx 2 beers
 - 4 h sleep \approx 4 beers
 - 2 h sleep \approx 5 beers
 - 0 h sleep \approx 7 beers



Sleepiness leads to traffic accidents



- Fatigue thought to be involved in 16–60% of road accidents^{1),2)}
- Even moderate sleep deprivation is at least as dangerous whilst driving as low-level alcohol intoxication^{1),2)}
- Most vulnerable times for accidents are around 2–7am and in the mid-afternoon³⁾

1) Williamson & Feyer. *Occup Environ Med* 2000;57:649–655

2) Asplund. *Eur Urol Suppl* 3(6)2005:24–32

3) Horne & Reyner. *BMJ* 1995;310:565–567

Poor sleep kills!!!! (maybe)

●●● Poor sleep-associated reduced health:

- ↑ morbidity and mortality
- ↑ risk of falling, traffic and occupational accidents
- ↑ risk of cardiovascular disease
- ↓ immune response
- ↑ risk of Alzheimer's
- ↑ risk of depression
- ↑ healthcare costs
- ↑ suicidal behaviour
- ↑ risk of obesity/diabetes

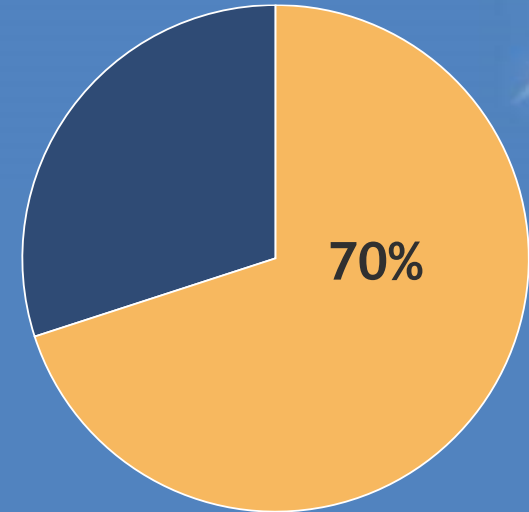
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Sleep and mental health

- The complaint of disturbed sleep is characteristic of patients with mood disorders.
- Most complain of insomnia (70%).
- People with insomnia are nearly **ten times** more likely to have clinically significant depression than people without insomnia.



70% of people with mood disorders also complain of insomnia.

Anxiety and insomnia

- Insomnia may also be a risk factor for developing an anxiety disorder, but not as much as it is for major depression.
- In a longitudinal study, sleep problems preceded anxiety disorders 27% of the time, while they preceded depression 69% of the time.
- But insomnia can worsen the symptoms of anxiety disorders and/or prevent recovery.

Anxiety - effects on sleep

- Patients with generalised anxiety disorder (GAD) frequently complain they cannot relax or stop worrying about their problems when they are in bed.
- *“All worry and vexatious circumstances should as far as possible be habitually excluded from the mind for a considerable time before the regular hour of retiring.”*

Corning, Brain Rest, 1885

Stress and sleep

- Stress is a normal part of life, but too much unmanaged stress can impact you physically and mentally.
- Anxiety and tension from stress make it more difficult to fall and stay asleep.
- Chronic stress, which occurs when your stress response is consistently triggered but isn't resolved, can prevent you from getting the good sleep each night.



Stress and sleep

Stress puts the body into a state of high alert, and so makes winding down and getting good sleep very difficult.

However sleep is one of the most effective ways of dealing with stress.

How can sleep catch us best?

- Sleep-promoting sleep environment
 - Dark, moderate temperature, quiet, well-ventilated
- Quiet mind and relaxed body
- Strong association between sleep & bed
- No direct efforts toward sleep
- Absence of regular thought process about sleep

Sleep is very important...

- Growth and physical development
- Learning & memory
- Mental & physical performance
- Mood and emotions
- Health and prevention of disease

Sleep in Infants: Newborns

- REM and NREM sleep states organized third trimester
- 3 sleep states in term newborns: active, quiet, indeterminate; enter sleep through REM
- Total sleep time newborns 16-20 hours / day; diurnal = nocturnal sleep amounts
- Sleep episodes 3-4 hours / 1-2 hours awake; breast-fed more frequent wakings

Sleep in Infants

- Critical sleep reorganization period at 8-12 weeks; establishment of diurnal cycle
- Development NREM sleep by 6 months; decreased REM amounts
- At 6 months: total sleep time 13-14 hours; sleep episodes 6-8 hours
- “Sleeping through the night”: 70-80% at 9 months

Sleep in Toddlers

- Total sleep time 12 - 14 hours
- Most give up 2nd nap at about one year
- Developmental issues: separation anxiety, night-time fears, mastery of independent skills, power struggles
- Sleep problems common (20-40%)
- Importance bedtime routines, transitional objects

Sleep in Pre-Schoolers

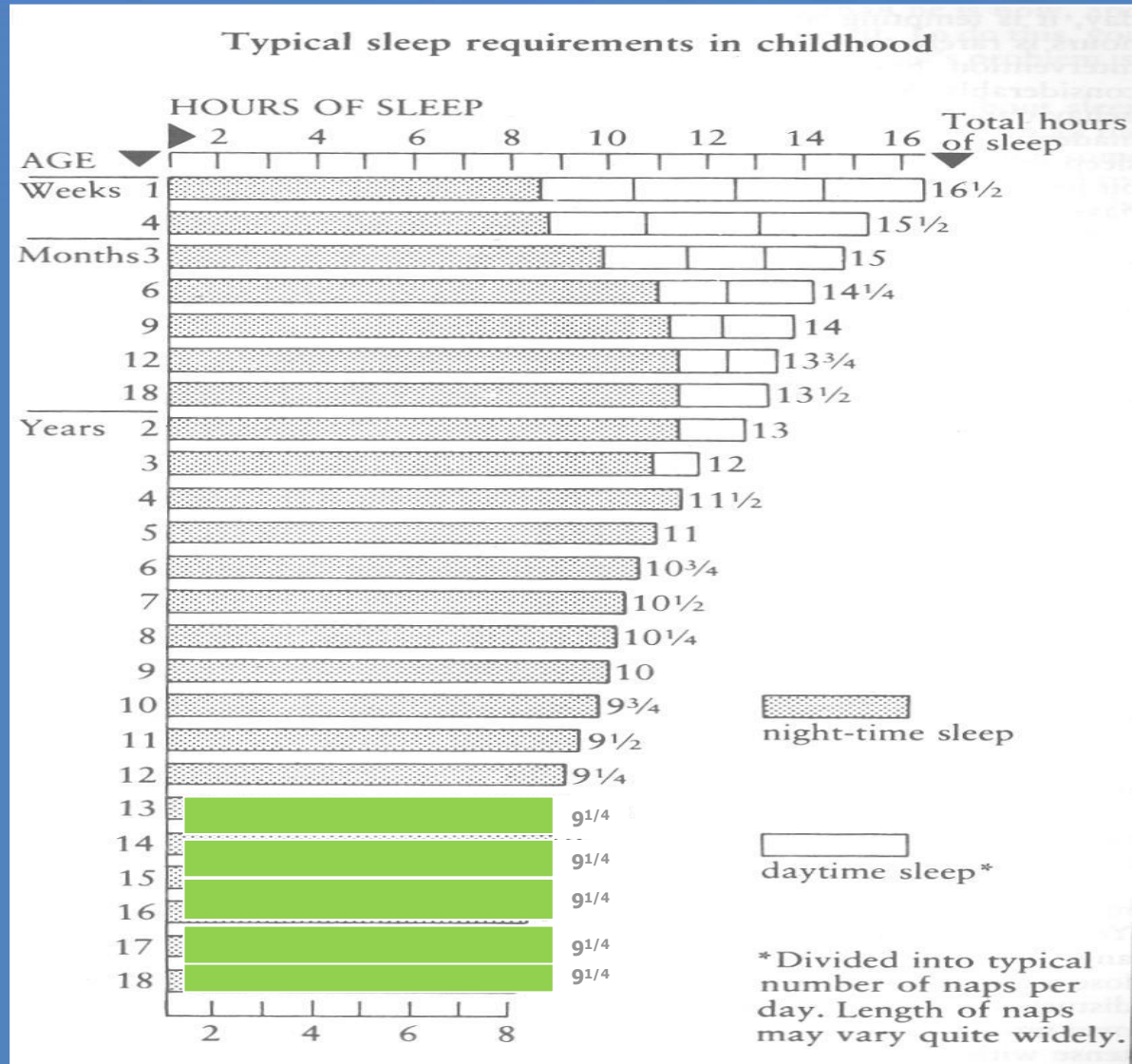
- Sleep cycles: REM/Non-REM 90 minutes
- Total sleep time: 11-12 hours per 24 hours
- By age 4-5, many children give up regular daytime naps
- “Signaled” night wakings occur frequently (up to 60%); role of parental reinforcement
- Sleep problems may become chronic

Middle Childhood (6-12 years old)



- Total sleep time: 9-11 hours
(10 - 11 hours in 6-7 year olds;
9 - 9 1/2 hours in early adolescence)
- Sleep pattern becomes more stable,
night-to-night consistency
- Low level of daytime sleepiness; naps rare
- School, lifestyle influences, later bedtimes, earlier
rise times, irregular sleep/wake schedules ?
= insufficient sleep

How Much





- **Teens need 8.5-10 hours of sleep per night!**
- ***9.25 hours is optimal for most teens!***

Am I sleep deprived? Yes/No

- I need an alarm clock to wake up for school.
- It's a struggle to get out of bed in the morning.
- I hit the snooze bar several times to get more sleep.
- I feel tired, irritable and stressed out during the week.
- I have trouble concentrating and remembering.
- I feel slow with critical thinking, problem solving and being creative.
- I often fall asleep in boring classes or warm rooms.
- I often fall asleep within 5 minutes of getting into bed.
- I often sleep extra hours on weekend mornings.
- I often need a nap when I get home from school.
- I have pink circles around or dark circles under my eyes.

College Students are very sleepy

- Average significantly less sleep (6-7 hours).
A 2hr sleep debt each night!
- Most experience excessive daytime sleepiness on a regular basis (50-70%)
- Report twice as many sleep problems as the general population



Why?

••• The obvious:

- Academic workload

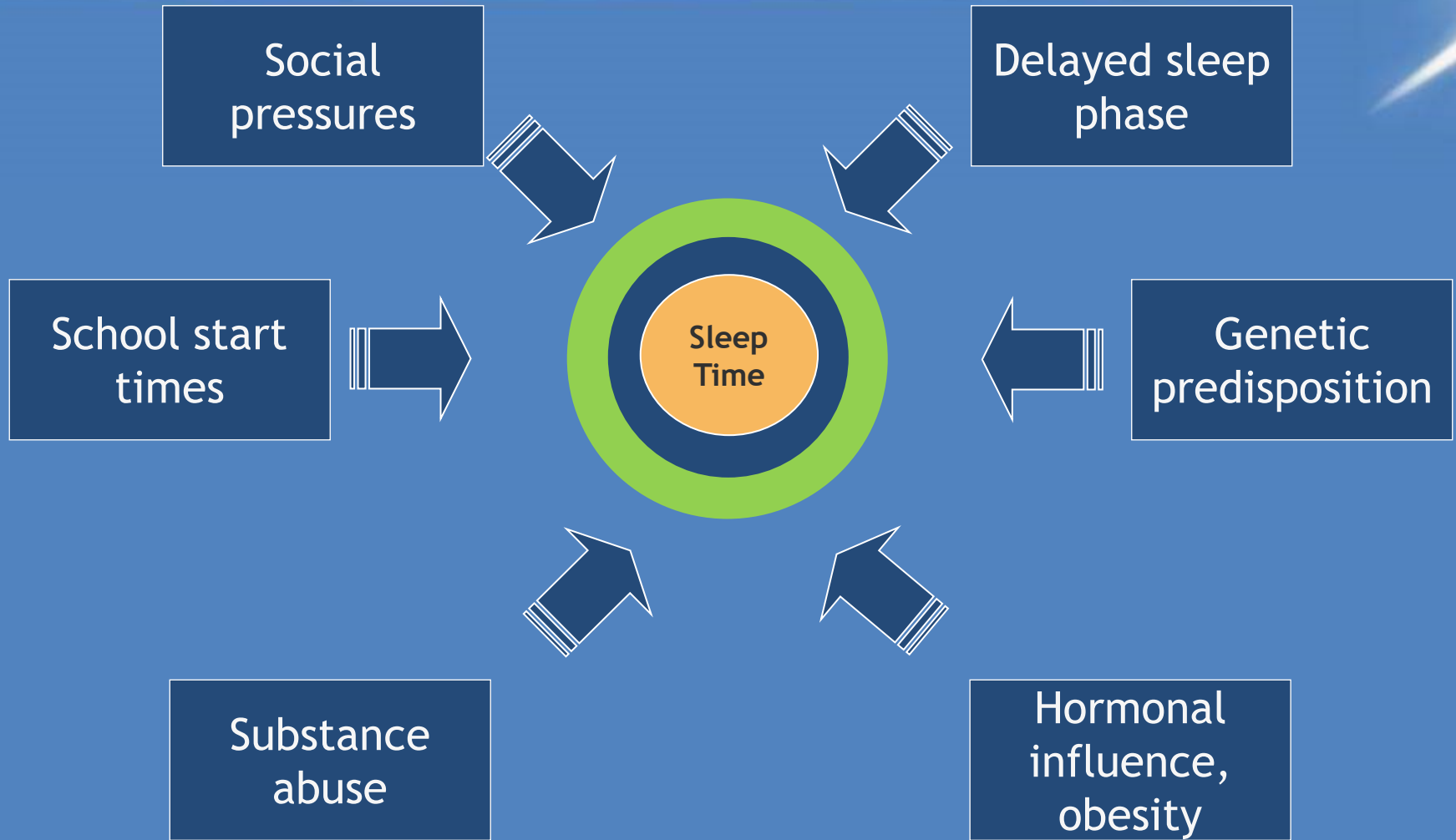


••• The less obvious:

- Social activities, after school activities
- Travel time
- Computer / internet / TV / mobiles
- Excessive caffeine use
- Delayed sleep phase and irregular sleep/wake schedules



Insufficient Sleep Syndrome



Sleep Changes in Adolescence

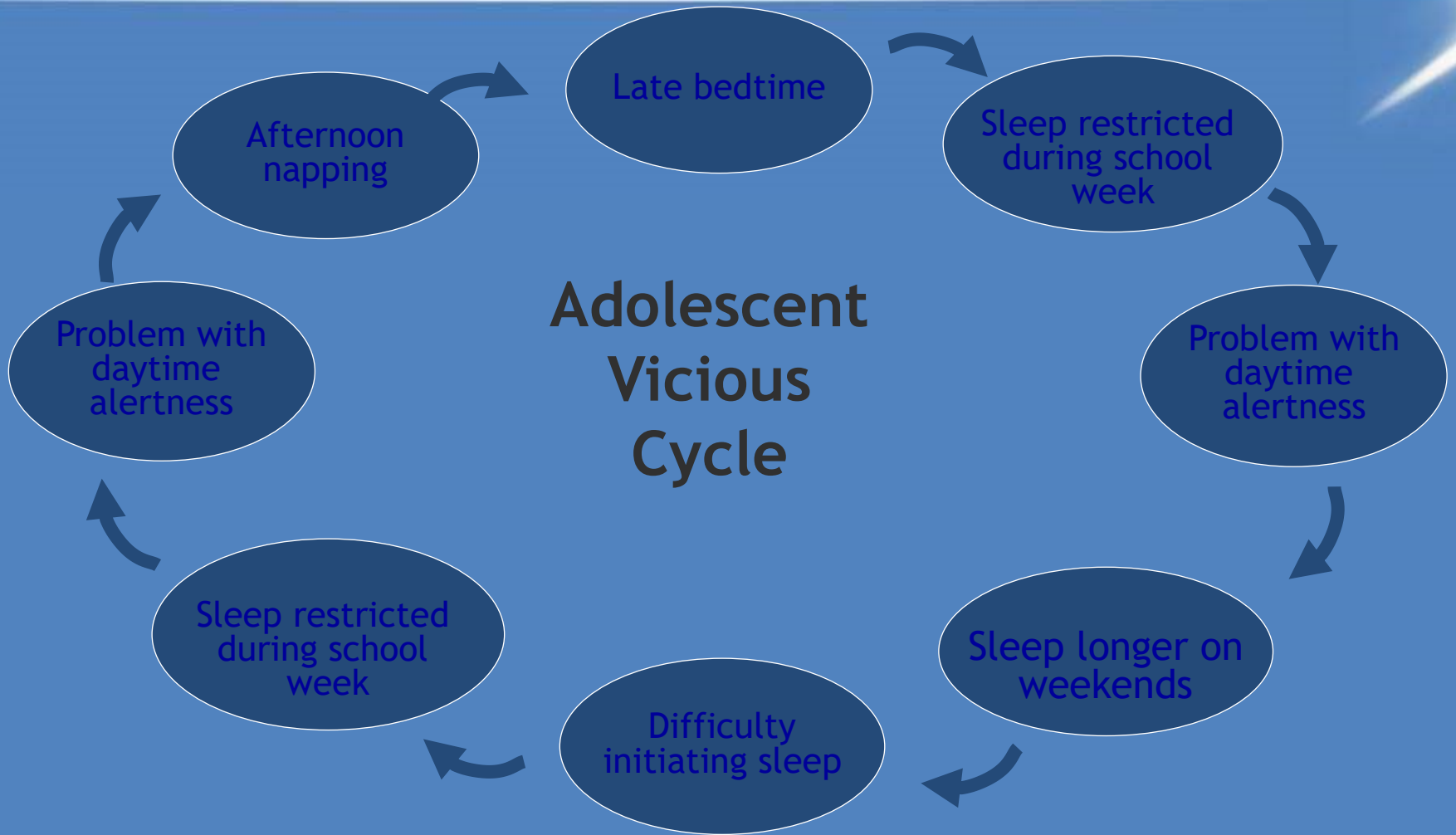


- Delayed sleep onset
 - Circadian: relative phase delay at puberty
 - Environmental factors
- Advanced wake times (sleep offset)
 - Earlier school start times

Sleep Changes in Adolescence (cont.)

- Decreased sleep / wake regularity:
 - Discrepancy weekday / weekend sleep cycle
- ↓ Daytime alertness
Daytime sleep tendency at mid-puberty
- ↓ Parental protection of sleep time

Trying to Get Enough Sleep



Teens experience a biological shift to a later sleep-wake cycle

The biological clock of children shifts during adolescence, because of the timing of Melatonin secretion.

- 11 pm: Teens generally ready to fall asleep
- 8 am: Teens generally ready to wake up

This “delayed phase syndrome” conflicts with early school start times.

Sleep Changes in teenagers

••• Delayed sleep onset

- Environmental factors
 - Teenagers have a lot more going on in their lives that compete for sleep (phone, TV, jobs, social activities, school sports and more homework)
 - Sleep is low on the priority list.
- Earlier school start times

Sleep Changes in teenagers

- 24hr rhythm: relative phase delay at puberty
 - Teenagers bodies actually want to fall asleep later so they find it hard to get to sleep at the old bedtime (melatonin delay)
- Early wake times
 - Earlier school start times

Sleep Changes in Adolescence



- Delayed sleep onset
 - Circadian: relative phase delay at puberty
 - Environmental factors

- Advanced wake times (sleep offset)
 - Earlier school start times

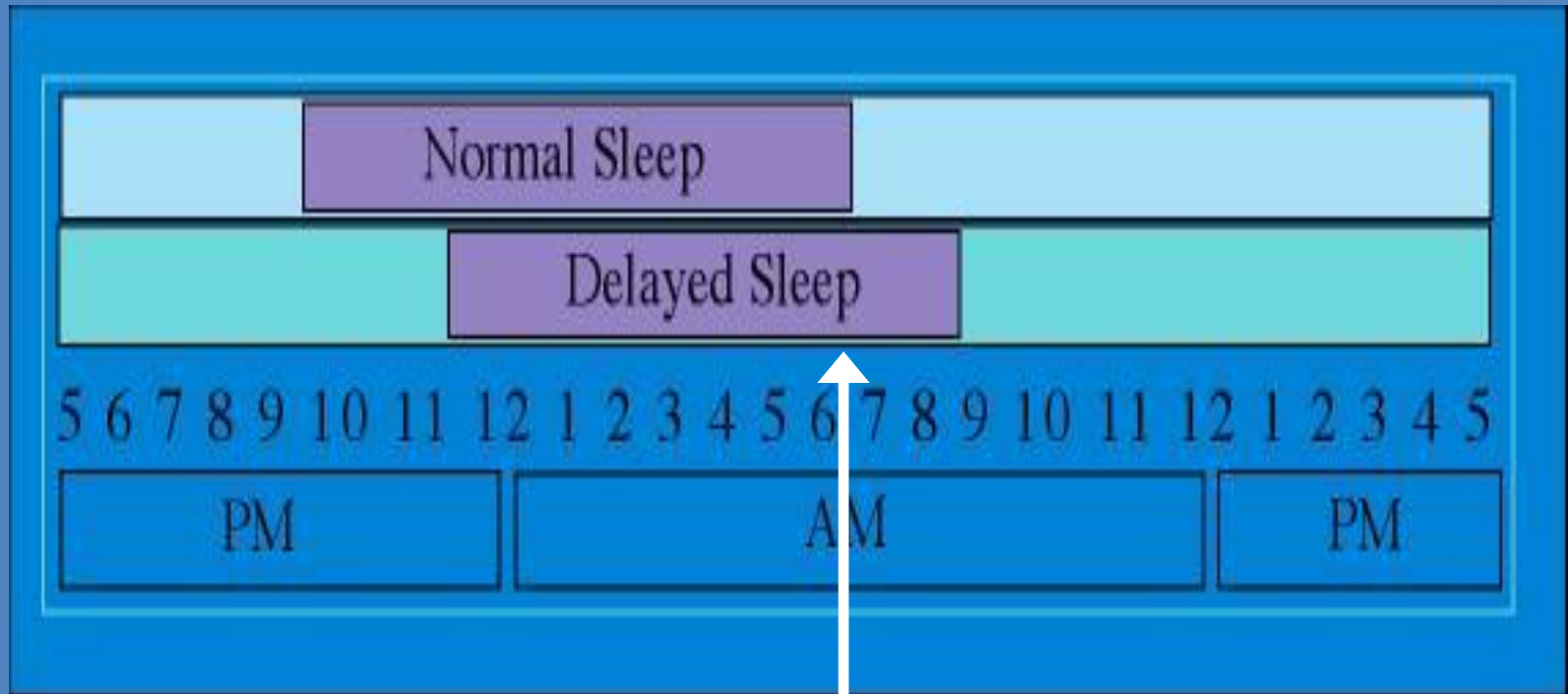
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- Parental protection of sleep time


Delayed Sleep Phase Syndrome

- Excessive Daytime Sleepiness or typically as the sum of its complications
- Patients complain of inability to get to sleep until the early morning hours, but little difficulty sleeping once asleep

Delayed Sleep Phase Sleep Schedule



In order to get to classes on time, many students must wake early and shorten their sleep time.



“Sending kids to school at 7 a.m. is the equivalent of sending an adult to work at 4 in the morning.”

William Dement, M.D., Sc.D., Ph.D.,

Effects of Sleep Debt

- Increased criminality
- Increased caffeine consumption
- Increased health-risk behaviors
- Cigarette use
- Marijuana use
- Alcohol use
- Sexually active
- Feeling sad or hopeless
- Seriously considering attempting suicide



Effects of Poor Sleep

- Increased death and injury caused by accidents
- Poor grades and school performance.
- Increased anger, fear and sadness.
- Decreased ability in controlling emotions and behaviour.
- Decreased ability to focus, sit still, and complete work.
- Increased use of stimulants - especially caffeine (i.e. energy drinks, coffee) and nicotine.

Poor Sleep = Poor performance

- Teen **athletic** performance is lowered.
 - Concentration and focus are required for optimal physical effort.
 - Athletes require quick reaction times.
 - A rested recovered body will perform best.
 - Good athletic performance requires good attitudes.
 - Optimal performance requires rehearsals.
 - Optimal performance requires energy!

On Education

- Sleep disorders = poor learning = lower IQ
- Falling behind – loss of self esteem
- Increased risk of grade retention = frustration
- Increased risk of premature school leavers
- Decreased employment opportunities

Poor Sleep = poor performance



- Teen **academic** performance is lowered.
 - Memory and learning require sleep.
 - Concentration and focus are required for optimal mental effort.
 - A rested mind will perform at its best.
 - Good academic performance requires good attitudes.
 - Optimal performance requires rehearsals.
 - Optimal performance requires energy!

Sleep and College Performance



- Study at St Lawrence Univ.
 - Studying at night = lower exam marks
- Study at Stanford Univ.
 - Academic and athletic performance in basketball players improved with longer sleep.
- Study in South Korea
 - Staying up late associated with poorer academic performance

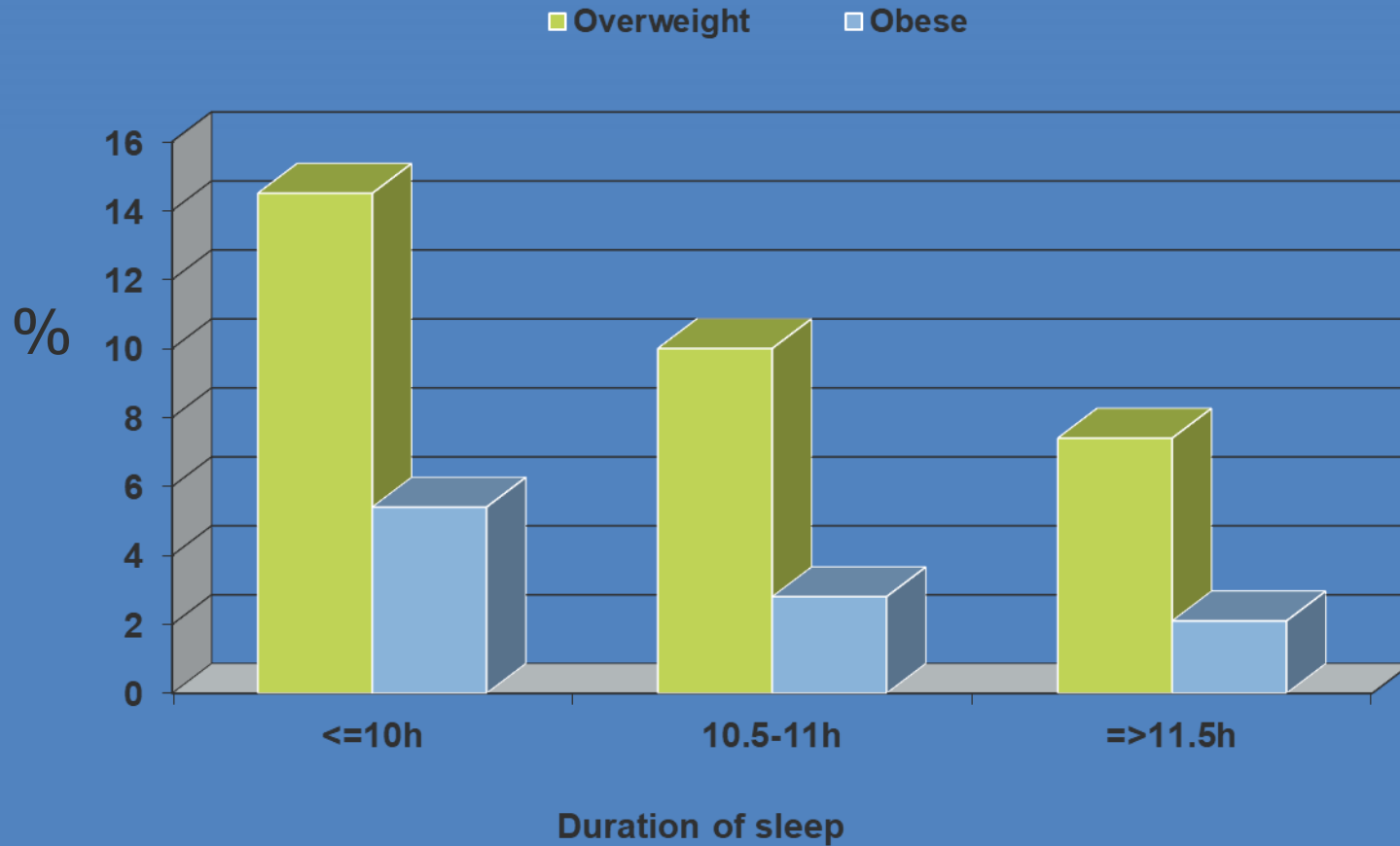
On Behaviours

- Motor co-ordination = ↓ participation in sport ↑ clumsiness and accidents
- Somatic behaviours = ↓ school attendance
- Withdrawal = ↓ decreased social skills
- Lower frustration tolerance = ↑ aggression
- Hyperactivity (symptoms of ADHD)

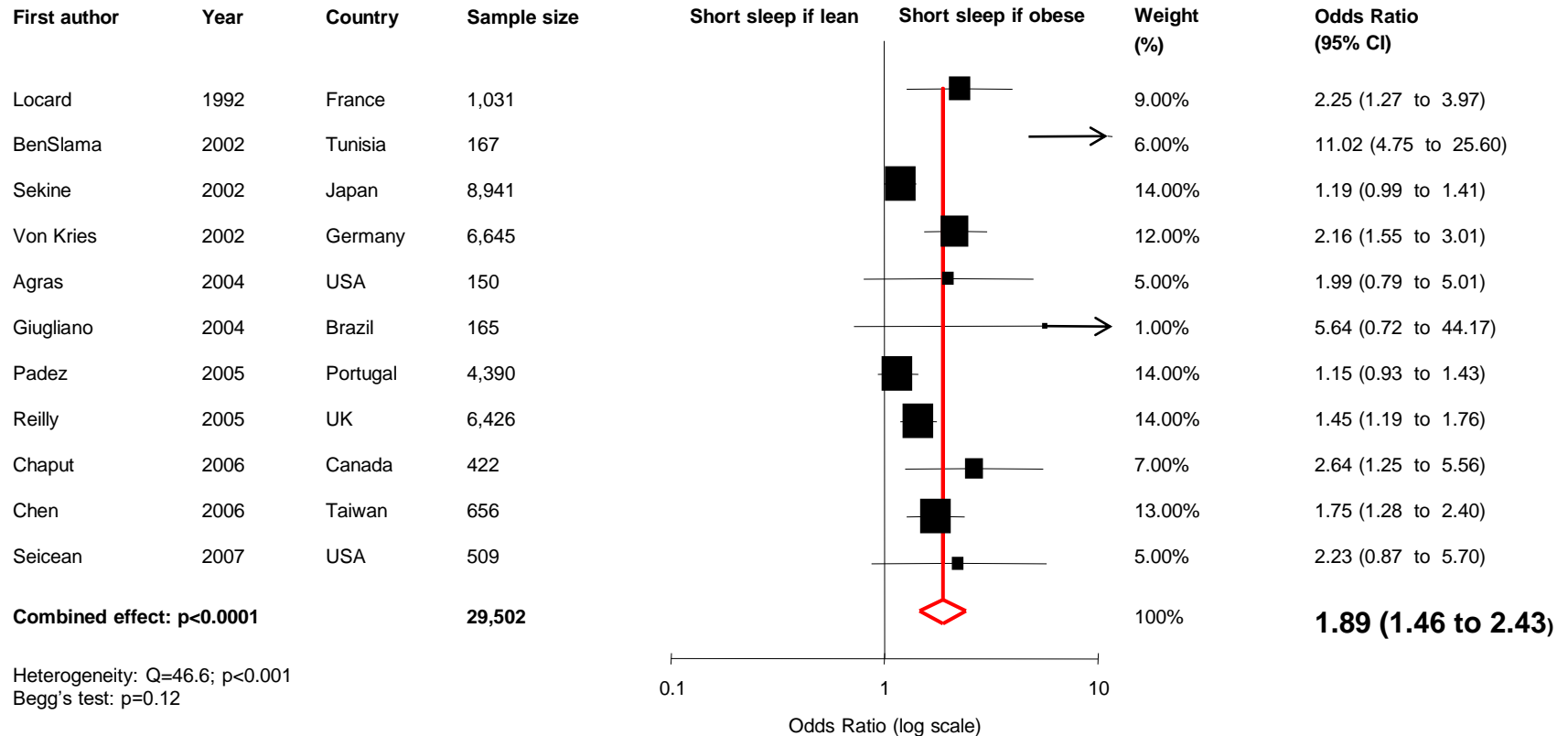
Sleep and Dietary Choices

- Teens who slept less than 7 hours per night (compared to teens who slept more) were:
 - More likely to consume fast food two or more times per week
 - Less likely to consume fruits and vegetables
 - Despite race, gender, SES, physical activity and family structure

Sleep duration and obesity in 6,862 children (age 5-6 years)



Short duration of sleep and obesity in children age 2 to 20 years



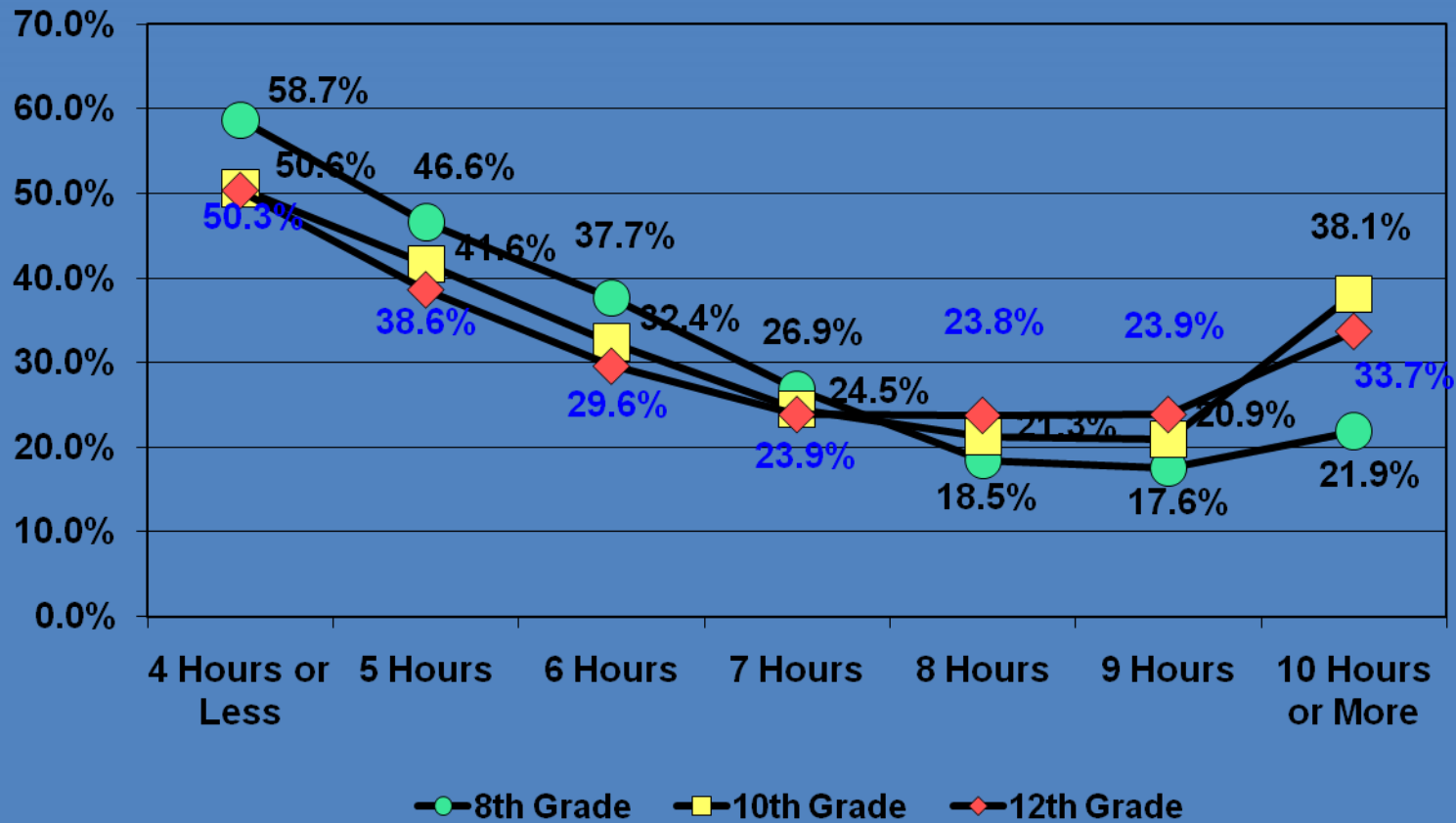
Sensitivity analysis: from 1.61 (1.33 to 1.96) to 2.07 (1.54 to 2.79)

Psycho-social benefits



- Parents overwhelmingly said that their teen-agers were “easier to live with”.
- Parents note that they now have a “connection time” over breakfast.
- Later start has not negatively affected participation rates in after school sports and extra-curricular activities.
- Principals reported fewer discipline incidents in the halls and in the lunchroom.

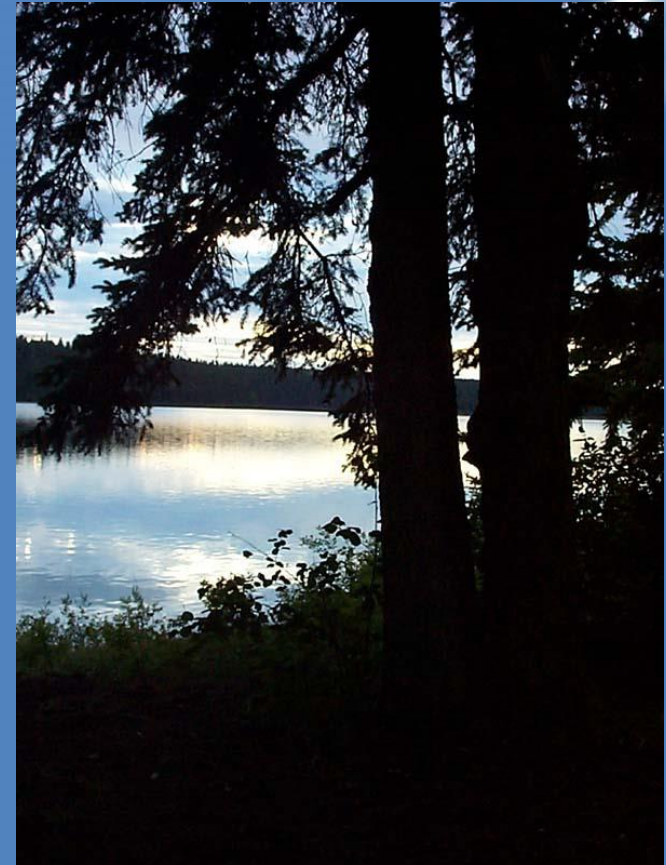
Depression by average number of hours of sleep on a school night



Source: Fairfax County Department of Neighborhood and Community Services, 2009, Youth Survey

Early bed-times are possible!

- Even with delayed melatonin levels, you **can** resist the biological urge to stay up late
 - Keep your body clock maintained.
 - Be consistent with your sleep patterns.
 - Avoid bright lights before retiring.
 - The absence of light signals melatonin release.
 - Engage in calming activities before going to bed



Nine easy ways to get good sleep



#1

Maintain regular bed-times and rising times.



Everynight I go to sleep late

And in the morning I realize it was a bad idea



#2

*Be aware of
your personal
body clock*



#3

*Limit caffeine
after 2:00 p.m.*



#4

Limit exciting activities 1-2 hours before bedtime.

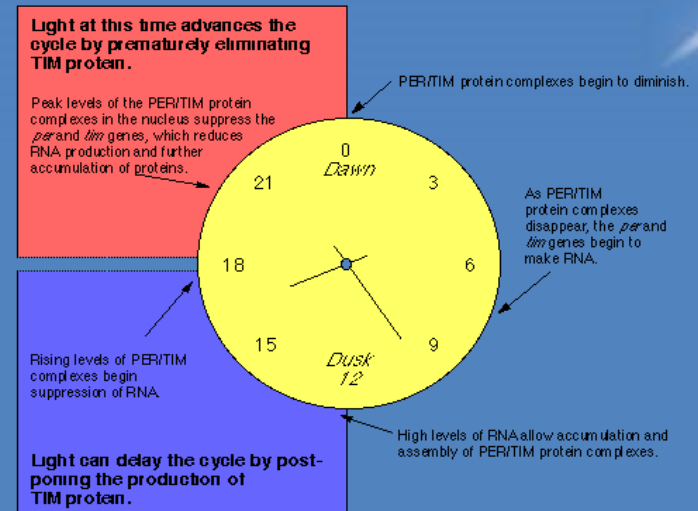
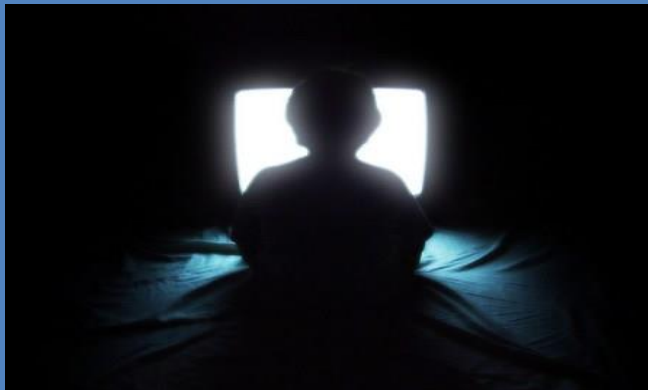
(Avoid TV, video games, exercise, phone, etc. before bed.)



#5

Limit light an hour before bed.

NB That includes TV, video games, phone, computer, etc.



#6

*Keep your sleeping area **for sleep**- not other activities!*



#7

*An hour before bed,
relax*



#8

Expose yourself to bright light in the morning to help waking.



#9

Avoid naps or sleeping during the day!



When I want to go to sleep.



Should schools start later?

- Because of the shift in their biological rhythms, teenagers' natural sleep cycle can put them in conflict with school start times.
- Most high school students need an alarm clock or a parent to wake them on school days and they seem to find it inordinately difficult to drag themselves from their bed and actually 'get up and go'.
- Because they are sleep deprived, they are sleepy all day, having difficulty paying attention in class and not performing academically, or athletically, at their best.

Should schools start later?

- It may come as a surprise that there is no good reason for why the school day starts when it does, the actual origin of the early start goes back to a time when a child's education was also combined with the need to be useful labour on the farm.
- There is good evidence from America that starting school later can improve grades, attendance and behaviour. Parents and teachers report that teens are more alert in the morning and in better moods; they are less likely to feel depressed.

Should schools start later?

- Most of the American research says that it is start times before 0830, as is common in the US, which are the problem.
- However, in the UK schools start around 0900 and so it should be less of a problem.
- Opponents to moving school start times later claim that this would just mean that students went to bed even later but research has shown that this is not the case, students do not go to bed later, but actually got one hour more of sleep per school night.

Should schools start later?

- If we really cared about our children's education and their health we should perhaps consider later school start times and if for whatever reason this was not possible then at least schools should be encouraged to sensibly timetable 'academic' lessons and examinations later in the day.

Academic outcomes



- Pre-post (early vs. late start) outcomes on state tests over three years reveal students scoring proficient or advanced in math increased from 76% to 83%.
- Students scoring proficient or advanced in English increased from 86% to 90%.
- Percentage of students needing improvement dropped from 19% to 13%.



Thank you

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