The Sleepy Teen
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Our goals today

1. Learn about the structural reasons for sleep deprivation in teens
2. Learn about medical causes of sleepiness in teens and treatment
3. Explore ways to advocate for better sleep in your community.

A teenager walks into the office. . .

Jason's mother brings him in because he is having difficulty getting out of bed in the morning. He's a 16 year old junior who gets decent but not stellar grades. He’s been less interested than previously in hanging out with his friends. When asked why, he says he’s “too tired”. However, he stays up late every night gaming with his friends. His grades are a bit lower than last year.

He’s also a new driver and had a minor fender bender last week.

Are you worried about this kid? Why?
Sleepiness vs. Fatigue

- Both are common. They can travel together.
- **Sleepiness**: the propensity to fall asleep
- Fatigue: Lack of energy.
- Mood disorders
- Anemia, thyroid, Lyme
- Chronic fatigue syndrome

What does sleepiness look like?

- Can’t get out of bed
- Falling asleep on short car trips/bus rides
- Falling asleep in school
- Inattention
- Poor grades

Evaluating Sleepiness

- HISTORY
- Diaries
- Timing of sleep/wake
- Questionnaires
- Testing

Pediatric Sleep Diary

<table>
<thead>
<tr>
<th>Date and Day</th>
<th>Bedtime</th>
<th>Wake Time</th>
<th>Time minutes to fall asleep</th>
<th>You get and try to get</th>
<th>Last time waking up at night etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/03 Tuesday</td>
<td>8 PM</td>
<td>7:15 AM</td>
<td>30 min</td>
<td>9:10 AM</td>
<td>10/04 (7pm Teds)</td>
</tr>
</tbody>
</table>

"Dreaming the days away" by Cadence Lee
What causes sleepiness in teenagers?

- Excessive Daytime Sleepiness
  - Insufficient Sleep
  - Fragmented Sleep
  - Excessive sleep drive
  - Circadian Rhythm Disorders
  - Narcolepsy
  - Delayed sleep phase syndrome

- Excessive sleep drive
- Circadian Rhythm Disorders
- OSA, PLMD; found on sleep studies
Disorders of Sleep
Fragmentation

- Normal(ish) duration of sleep
- Restless sleep
- Loud snoring (OSA)
- Leg pain (restless leg syndrome)
- Nocturnal awakenings

Sleep studies help with diagnosing these disorders

Obstructive Sleep Apnea

Sleep disordered breathing is a continuum of disorders characterized by increasing airway resistance

50% of snoring, obese kids have OSA
Periodic Limb Movements of Sleep

PLMI > 5 abnormal in kids

Sarah, age 10: “What I drew was saying that my top part of my body is relaxed and calm, but the bottom wants to run really bad.”

Pediatric Restless Leg Syndrome has a prevalence of 1.5-2%

1. Urge to move the legs +/- unpleasant sensation
2. Worse with inactivity or rest e.g. lying down or sitting
3. Partial or total relief with movement
4. Worse in the evening or night
5. Not accounted for by other disorders

Must be described in the child’s own words
PLM > 5/h in child or relative; RLS in 1st degree relative

Treatment: Iron (to raise ferritin to 50-75), clonidine, gabapentin, ropinerole

Circadian disorders

Picchetti DP, Sleep Medicine 2013
Melatonin signals the end of the wakefulness drive

Delayed Sleep Phase Syndrome is a common and under-recognized condition in teenagers

Melatonin and light exposure are the treatment of choice for circadian disorders. Their effect is time dependent.

Earlier sleep onset:
Morning light exposure/exercise
Melatonin several hours before bedtime

Later sleep onset:
Onset of Puberty
Evening light exposure
Evening exercise
Treating Adolescent Delayed Sleep Phase Syndrome
- Bright light exposure/exercise in the morning
- Darkness in the evening
- Pharmacologic treatment in the evening
  - Melatonin: 0.5 mg 4-5 prior to bedtime onset, 3-5 mg 30 min prior to bedtime
  - Hypnotics
- Chronotherapy
- CONSISTENT WAKE TIMES

Disorders of increased sleep drive
- Normal quantity of sleep
- Increased daytime sleepiness
- Defined by decrease in sleep latency (time to fall asleep) on multiple sleep latency testing

Disorders of Increased Sleep Drive

PEDiATRIC SLEEP LOG

Your name: ____________________________

Example: I'm bed at 10PM, slept until 4AM, woke up but stayed in bed, out of bed at 6AM

Time: 2AM 4AM 6AM 8AM 10AM 12PM 2PM 4PM 6PM 8PM 10PM

Mark the period when you were asleep.
Mark time you got up or the period with decreased activity.

CONSISTENT WAKE TIMES
Narcolepsy

- Intrusion of sleep and REM sleep into wakefulness
  - Cataplexy
  - Sleep Attacks
  - Hypnagogic hallucinations
  - Sleep paralysis
- Treatment includes stimulants, napping, and sodium oxybate

Cataplexy

https://youtu.be/iRVQMPaoY_Q?t=38s

https://youtu.be/zTS-xbm1vWY

https://youtu.be/k-oi9bdoMwE?t=26s

Narcolepsy Incidence by Age

Data from Silber et al 2002

<table>
<thead>
<tr>
<th>Stage of Development</th>
<th>Mean Sleep Latency</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tanner I</td>
<td>18.8</td>
<td>1.8</td>
</tr>
<tr>
<td>Tanner II</td>
<td>18.3</td>
<td>2.1</td>
</tr>
<tr>
<td>Tanner III</td>
<td>16.5</td>
<td>2.8</td>
</tr>
<tr>
<td>Tanner IV</td>
<td>15.5</td>
<td>3.3</td>
</tr>
<tr>
<td>Tanner V</td>
<td>16.2</td>
<td>1.5</td>
</tr>
<tr>
<td>Older adolescents</td>
<td>15.8</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Why are teenagers so tired?

- Chronic sleep deprivation: 95%
- OSA: 5%
- Narcolepsy: 1%

What percentage of teenagers get an adequate amount of sleep on weeknights? (8.5-9.5 hours)

- 10%
- 25%
- 50%
- 75%
- All of MY patients

Less than 10% of teens get adequate sleep.

There are many serious consequences to chronic sleep deprivation.
As students proceed through high school, they become more and more sleep deprived

Are we in a “Great Sleep Recession”?

Sleep declines with age, and has reduced over time

Why are teens so sleep deprived?

1. Circadian biology
2. Maladaptive behaviors
3. Screens
4. Homework
4. School start times
The circadian wakefulness drive keeps you awake in the late PM.

Teens have a physiologic delay in their circadian clocks even as school gets earlier.

Long naps reduce sleepiness at bedtime.
Electronics are corrosive to sleep

Sleeping in on weekends can reduce drive for sleep on Sunday night

Percent who don’t sleep well because of technology

Where do you keep your cell phone at night?
A brief guide to teenager's excuses about their smartphone

<table>
<thead>
<tr>
<th>Excuse</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>It's my alarm clock!</td>
<td>Here's a brand new Dream Machine!</td>
</tr>
<tr>
<td>I can't fall asleep without music</td>
<td>Here's a brand new Dream Machine!</td>
</tr>
<tr>
<td>I watch Netflix to fall asleep</td>
<td>Well that is a problem and you need to stop</td>
</tr>
<tr>
<td>You do it too!</td>
<td>I'm going to stop also</td>
</tr>
<tr>
<td>We've always done it this way!</td>
<td>I'm concerned about the health effects</td>
</tr>
<tr>
<td>People didn't always know smoking was</td>
<td></td>
</tr>
<tr>
<td>bad either</td>
<td></td>
</tr>
</tbody>
</table>

If using a computer/device for school work...  

[justgetflux.com](https://justgetflux.com)

Homework
Consequences of Chronic Sleep Deprivation in Teens

- Health
- Behavioral/Mental
- Academic

Drowsy Driving and Auto Accidents

- The peak age for fall-asleep driving accidents is 20
- Drivers under 30 account for 2/3 of drowsy-driving crashes.
- The only “fixes” are naps and caffeine.

Safety: Distribution of Age of Driver in Fall-Asleep Crashes

When does school start in the US?

In 2014, the American Academy of Pediatrics recommended that high school start times be no earlier than 8:30 AM.

School Start Times are TOO EARLY

- "...if you knew that in your child's school there was a toxic substance that reduced the capacity to learn, increased chances of a car crash and made it likely that 20 years from now he would be obese and suffer from hypertension, you'd do everything possible to get rid of that substance and not worry about cost. Early start times are toxic."

Judith Owens, Director of Sleep Med, Boston Children's Hospital
### Structural vs. Individual Roots of the Adolescent Sleep Epidemic

<table>
<thead>
<tr>
<th>Individual</th>
<th>Structural</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sleep Hygiene</td>
<td>• Institutions (e.g., school hours, homework, extracurricular demands)</td>
</tr>
<tr>
<td>• Sleep Disorders</td>
<td>• Environment (e.g., ban use of electric lighting!)</td>
</tr>
<tr>
<td></td>
<td>• Social norms/attitudes (e.g., celebrating sleep deprivation)</td>
</tr>
</tbody>
</table>

Addressing individual roots will have limited impact if structural roots remain unaddressed.

### So, why focus on school hours?

Of all these factors, only school start time has been shown to play both a major – and remediable – role.

Let Them Sleep: AAP Recommends Delaying Start Times of Middle and High Schools to Combat Teen Sleep Deprivation

**Doctors’ orders: Start school days later**

Many schools have managed to change

- 1996: Edina, MN
- 1997. Minneapolis Public Schools
- 2003. Wilton, CT.
- 2015. Approximately 1,000 schools in 70 districts

Wahlstrom, 2014; Owens et al., 2014
Summary: Mitigating sleep problems in teens

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circadian biology</td>
<td>You are stuck with it</td>
</tr>
<tr>
<td>Maladaptive behaviors</td>
<td>Limit napping. Sleeping in no more than 1-2 h later on weekends</td>
</tr>
<tr>
<td>Screens</td>
<td>Out of bedroom by 9 t.lux/f.lux for computers</td>
</tr>
<tr>
<td>Homework</td>
<td>10 min/night per grade level</td>
</tr>
<tr>
<td>School start times</td>
<td>Advocate for change</td>
</tr>
</tbody>
</table>

To Summarize

- Most teens are sleep deprived
- Sleep hygiene and later school start times are the best ways to help them
- Sleep deprivation is toxic to kids (and parents)
- Kids with non-restorative sleep, snoring, or suspected medical issues should be evaluated