Addressing Sleep Pattern Issues in an Age of Electronics

Kavita Fischer, MD, FAPA, Regional Medical Director
April 6, 2017
Outline

- Why do we need sleep?
- Sleep cycles and unique issues for adolescents
- Let’s add electronics!
- Clinician resources/tips
What is sleep?

• Sleep is a rapidly reversible state of reduced responsiveness, motor activity, and metabolism
Why do we sleep?

• Nobody knows!

• Several theories:
  – Restoration
  – Energy conservation
  – Memory consolidation
A Good Night’s Sleep is Important

- Emotionally
- Cognitively
- Behaviorally
- Performance
- Family dynamics
- Influence on health
The Biology of Sleep

- Circadian system:
  - Photoreceptors in the retina sense light and dark
  - Signal our brain and align circadian rhythm to the external day-night cycle
  - Morning alertness and bedtime
  - BUT, light also comes from electronics!

© 2017 Community Care Behavioral Health Organization
The Biology of Sleep

• The human circadian rhythm is slightly longer than 24 hours and must be set or entrained to match our daily schedules

• Light, physical activity, and melatonin are the most potent “entrainers” (zeitgebers)
  – These can work to favor or oppose sleep
The Biology of Sleep

• **Darkness** causes the body to produce more *melatonin*, which signals the body to prepare for sleep

• **Light** decreases *melatonin* production and signals the body to prepare for being awake
Stages of Sleep

• NREM sleep
  – ~75% of total sleep time in children and adolescents

• Three discrete stages based on EEG
  – N1: lightest and often initial stage of sleep
  – N2: largest percentage of total sleep time in a normal middle-aged adult, typically 45%–55% of the night; BDZs work here
  – N3: deep NREM sleep with high arousal threshold (previously scored as stages 3 and 4)
Stages of Sleep

• REM sleep
  – Similar on EEG to wakefulness in some ways
  – Decreased muscle tone
  – Bursts of rapid eye movements
  – Most dreaming occurs here

• Most deep sleep occurs early, most REM occurs late
## EEG Sleep Patterns

<table>
<thead>
<tr>
<th>State</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awake</td>
<td>Low Voltage, Random, Fast</td>
</tr>
<tr>
<td>Drowsy</td>
<td>8-12 Hz, Alpha Waves</td>
</tr>
<tr>
<td>Stage 1</td>
<td>3-7 Hz, Theta Waves</td>
</tr>
<tr>
<td>Stage 2</td>
<td>12-14 Hz, Sleep Spindles and K-Complexes</td>
</tr>
<tr>
<td>Stage 3/4</td>
<td>0.5-2 Hz, Delta Waves, High Voltage, Slow Waves</td>
</tr>
<tr>
<td>REM</td>
<td>Low Voltage, Random, Fast with Sawtooth Waves</td>
</tr>
</tbody>
</table>

© 2017 Community Care Behavioral Health Organization

http://www.aacap.org/aacap/Resources_for_Primary_Care/CAP_Resources_for_Medical_Student_Educators.aspx
Sleep in Adolescence

• Complex interplay of physiologic and social factors results in insufficient sleep and sleepiness
  – About half of teens report daytime sleepiness at least weekly

• Normal changes in adolescent sleep physiology
  – Delayed melatonin release results in later sleep onset
  – Sharp decline in deep and restorative slow wave sleep
  – REM latency declines
  – These changes may result in increased sleepiness
Sleep in Adolescence

• Social and societal factors
  – Academic, extracurricular, and employment demands
  – School start times result in significantly less sleep (~1hr)
  – Social demands and peer and parental relationships
Maturation of Sleep Architecture

- Sleep times gradually decrease from infancy through adolescence

- *Sleep times for children in the United States tend to be shorter* than those in Europe and Australian series, especially on weekdays

- In a survey of adolescents in the United States, *more than 60% reported sleeping less than seven hours* on weekday nights, substantially less than the 8.5 – 9.5 hours recommended by the CDC
## Sleep Consensus Statements: AASM

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Hours of Sleep Per 24 Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toddlers</td>
<td>11</td>
</tr>
<tr>
<td>Preschoolers</td>
<td>10</td>
</tr>
<tr>
<td>School-aged</td>
<td>9</td>
</tr>
<tr>
<td>Teenagers</td>
<td>8</td>
</tr>
<tr>
<td>Adults</td>
<td>7-9</td>
</tr>
</tbody>
</table>

© 2017 Community Care Behavioral Health Organization

American Academy of Sleep Medicine practice standards. Aasmnet.org
<table>
<thead>
<tr>
<th>Age Group</th>
<th>Hours of Sleep Per 24 Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborns (0-3 mos)</td>
<td>14-17</td>
</tr>
<tr>
<td>Infants (4-11 mos)</td>
<td>12-15</td>
</tr>
<tr>
<td>Toddlers (1-2 years)</td>
<td>11-14</td>
</tr>
<tr>
<td>Preschoolers (3-5 years)</td>
<td>10-13</td>
</tr>
<tr>
<td>School-aged (6-13 years)</td>
<td>9-11</td>
</tr>
<tr>
<td>Teenagers (14-17 years)</td>
<td>8-10</td>
</tr>
<tr>
<td>Younger Adults (18-25 years)</td>
<td>7-9</td>
</tr>
<tr>
<td>Adults (26-64 years)</td>
<td>7-9</td>
</tr>
<tr>
<td>Older adults (65+)</td>
<td>7-8</td>
</tr>
</tbody>
</table>
Sleep Consensus: AASM

• Improvements in following:
  – Attention
  – Behavior
  – Learning
  – Memory
  – Emotional regulation
  – Quality of life
  – Mental and physical health

© 2017 Community Care Behavioral Health Organization
Sleep Consensus: AASM

• Sleeping *fewer* than recommended hours:
  – Association with attention, behavioral, and learning problems
  – Higher risk of accidents, injuries, HTN, obesity, DM, and depression
  – In teens: increased risk of self-harm, SI, and SAs

• Sleeping *more* than recommended hours:
  – Association with HTN, DM, obesity, and mental health problems
Healthy Sleep Requirements

AASM
• Adequate duration
• Appropriate timing
• Regularity
• Absence of sleep disturbances or disorders
• Good quality

NSF
• Good quality of sleep (NSF):
  – Being asleep for at least 85% of the time you spend in bed
  – Taking 30 minutes or less to fall asleep (or up to 60 minutes if you’re 65 or older)
  – Not waking up more than once per night for more than five minutes (or twice a night for five minutes for those 65 or older)
  – Spending less than 20 minutes total awake after initially falling asleep
Insufficient Sleep Public Health Issue

• Insufficient sleep in adolescents was recognized as a serious health risk in 2010 in a jointly sponsored AMA/AASM resolution acknowledging the problem.

• Objectives for sleep health, a new topic in Healthy People 2020, specifically includes reducing adolescent sleep loss:
  – “SH-3: Increase the proportion of students in grades 9 through 12 who get sufficient sleep” (defined as ≥8 hours)
Case 1: Teen Can’t Get Up for School

- 14-year-old male
- Cannot fall asleep until 2AM
- Unable to awaken for school
- Many absences and late days
- Poor grades and sleeping in class
- Family has had it
- No problems during vacations or on weekends
- Drinks caffeine during the day
- On no medications
- Exam is normal

- Sleep history:
  - Poor hygiene
  - No snoring
- Sleep logs:
  - Late bedtime, occasional nap
  - Late wake time on weekends
- Recommendations:
  - Counseling
  - Sleep hygiene
  - Morning daylight
Delayed Sleep Phase Syndrome

- Delayed sleep-wake phase disorder
  - Involves a circadian rhythm disturbance characterized by a shift in sleep and wake time relative to the patient's desired or required sleep schedule
  - It is particularly common among adolescents and young adults, and results in complaints of difficulty waking in the morning and difficulty initiating sleep at the targeted time
Delayed Sleep Phase Syndrome

• Darkness causes the body to produce more melatonin, which signals the body to prepare for sleep

• Light decreases melatonin production and signals the body to prepare for being awake

• Melatonin, taken several hours before bedtime, is not regulated or approved by the U.S. FDA but may, in some circumstances, help to realign the circadian rhythm in severe delayed sleep-wake phase disorder
Case 2: Let’s Add Electronics

• Difficulty waking up in morning

• Sleepy teen – reported to fall asleep on bus

• Sleepy in first period and after lunch

• Naps when comes home

• In bedroom by 9-10pm but → →
Today’s adolescents and young adults have grown up in an electronic age.

According to the National Sleep Foundation’s 2006 Sleep in America poll, almost all adolescents had at least 1 media electronic device in their bedroom.
Electronics!

- NSF recent poll: 95% of people surveyed use electronic devices immediately prior to sleep
  - People under age of 30 especially

- College students/postgrads (19-29): 67%

- Young adults (12-18): 72%
## Electronics!

<table>
<thead>
<tr>
<th>Electronic in bedroom</th>
<th>Electronic sometimes left on at night</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parents</td>
</tr>
<tr>
<td>Television</td>
<td>62%</td>
</tr>
<tr>
<td>Computer (laptop or desktop)</td>
<td>26%</td>
</tr>
<tr>
<td>Tablet or smartphone</td>
<td>45%</td>
</tr>
<tr>
<td>Video game</td>
<td>13%</td>
</tr>
<tr>
<td>MP3 or other music player and/or radio</td>
<td>36%</td>
</tr>
</tbody>
</table>

National Sleep Foundation. 2014 Sleep in America® Poll. Sleep in the Modern Family.

© 2017 Community Care Behavioral Health Organization
# Electronics!

<table>
<thead>
<tr>
<th>Generation</th>
<th>Number of Texts Within the Hour Prior to Sleep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baby Boomers (born 1946 to 1964)</td>
<td>5</td>
</tr>
<tr>
<td>Gen-Xers (born 1965 to 1976)</td>
<td>15</td>
</tr>
<tr>
<td>Gen-Yers/Millennials (born 1977 to 1995)</td>
<td>42</td>
</tr>
<tr>
<td>Gen-Zers (born 1996 and later)</td>
<td>56</td>
</tr>
<tr>
<td>Average</td>
<td>21</td>
</tr>
</tbody>
</table>

National Sleep Foundation. © 2017 Community Care Behavioral Health Organization
How Electronic Media Disrupts Sleep

- Directly displaces sleep
- Electronic media allow for greater interaction between individuals
- Suppressing melatonin even with relatively low-intensity light
- Increasing mental, emotional, and physiologic arousal
Electronics!

• In the Children in the Community Study in 1976, adolescents who were watching 3 or more hours of television had DFA and SCD and difficulties with their sleep later in adolescence and young adulthood.

• Calamaro, et al. found that after 9:00 pm, 34% of adolescents in the study sample were text messaging, 44% were talking on the phone, 55% were online, and 24% were playing computer games.

• In another study of Belgian teenagers, 62% of the subjects used their phones after the lights were turned off, and phone use at this time was associated with increased daytime tiredness the next day.
Electronics!

• School hours – 7 a.m. is like 4 a.m. for adults
  – American Academy of Pediatrics issued a recommendation in 2014 that middle and high schools delay start time to 8:30 a.m. or later

• Increased sensitivity in teens to melatonin levels
  – Even when exposed to just 1/10 as much light as adults were, teens actually suppressed more melatonin than the older people
So what can we do?
Blue Light

• Sunlight contains ROY G BIV light rays

• Combined, this spectrum of colored light rays creates what we call "white light" or sunlight

• Sources of blue light include mainly sun but also significant amount from fluorescent and LED lighting, flat screen televisions, display screens of computers, electronic notebooks, smartphones, and other digital devices
Electronics!

• Blue light is especially good at preventing the release of melatonin, a hormone associated with nighttime.

• During adolescence, the circadian rhythm shifts, and teens feel more awake later at night.
Electronics!

• FLUX
  – App that warms up colors on screen; now built into some devices (e.g., night mode, night shift)

• Light-emitting screens can be used at night without disrupting sleep cycles if you put some distance between your eyes and the device
  – e.g., placing tablet farther away or watching TV instead
Sleep Hygiene

- Have a consistent bedtime routine
- Try to keep sleep and wake times the same for weekdays and weekends
- Avoid daytime napping
- Have a relaxed bedtime setting (dim lights, calm environment)
- Get exercise daily; avoid high-intensity exercise within 3 hours of bed
- Fall asleep in your bedroom, not on couch

- Avoid caffeine after mid-afternoon and later
- Don’t smoke, don’t use alcohol, herbal products, or over-the-counter sleep aids to help you sleep
- Avoid media/electronics in bed
- Limit screen time before bed (avoid 1-2 hours before)
- Consult with a PCP about snoring or other sleep concerns
# Questions for Adolescents

<table>
<thead>
<tr>
<th><strong>BEARS</strong></th>
<th><strong>Questions for Adolescents 13–18</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bedtime sleepiness</td>
<td>Do you have any problems falling asleep at bedtime?</td>
</tr>
<tr>
<td>Excessive daytime sleepiness</td>
<td>Do you feel sleepy a lot during the day? In school? While driving?</td>
</tr>
<tr>
<td>Awakenings during night</td>
<td>Do you wake up often at night? Have trouble getting back to sleep?</td>
</tr>
<tr>
<td>Regularity and duration of sleep</td>
<td>What time do you usually go to bed on school nights? Weekends? How much sleep do you usually get?</td>
</tr>
<tr>
<td>Sleep-disordered breathing</td>
<td>Does your teenager snore loudly or nightly?</td>
</tr>
</tbody>
</table>
Sleep Log

FIGURE 23–1. Sleep log/sleep diary.
Resources

- [http://www.bettersleep.org/better-sleep/healthy-sleep/](http://www.bettersleep.org/better-sleep/healthy-sleep/)


- Sleep hygiene teens:
Final Thoughts

• Sleep is important for normal functioning

• Electronics affect sleep

• Sleep hygiene tips can help sleep

• Sleep hygiene should be evaluated and discussed by clinicians (prior to medications being prescribed)