The Science of Adolescent Sleep

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UC Center Sacramento Webinar
Adolescent Sleep: From Brain to Social Policy
Adolescence is not simply defined by age, grade, or pubertal stage.
According to the National Sleep Foundation, adolescents get an insufficient amount of sleep.
Biological Reasons

- Puberty
- Sleep Phase Delay
- Brain Development

Social Reasons

- Media
- Family
- School
A surge of hormones instigate dramatic physical changes leading to sexual maturation.
Puberty

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As adolescents transition into puberty, their circadian rhythm shifts ~2 hours toward a “night owl” preference.
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More pubertally mature

Less pubertally mature

Hours asleep

Sadeh et al 2009
Puberty

A surge of hormones instigate dramatic physical changes leading to sexual maturation

Sleep Phase Delay

As adolescents transition into puberty, their circadian rhythm shifts ~2 hours toward a “night owl” preference

Brain Development

The adolescent brain undergoes significant development from puberty through the mid-20s
Why is sleep important for brain development?

- Learning systems depend on sleep to retain information
- Socioemotional systems respond differently following sleep deprivation
- Poor sleep disrupts maturing connections between brain regions
- Adolescents are more impacted by sleep loss than adults
The Social Context of Adolescent Sleep

Andrew J. Fuligni
Jane & Terry Semel Institute for Neuroscience and Human Behavior at UCLA

UC Center Sacramento Webinar
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Sleep \[\rightarrow\] Many Things

- BMI
- health
- motivation
- cortisol
- risk taking
- depression
- fatigue
- substance use
- happiness
- cognition
- anxiety
- GPA
- happiness
- cognition
- anxiety
Many things → Sleep

- SES
- Stress
- Conflict
- Violence
- Gender
- Studying
- School commute
- School start
- Media use
- Parent work
- Ethnicity
- Family cohesion
- Age
- Sleep by Konrad Michalik from the Noun Project
Ethnicity

Sleep Duration by Race

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Sleep Duration (minutes)</th>
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</thead>
<tbody>
<tr>
<td>Asian</td>
<td>393.20 (~6h 33m)</td>
</tr>
<tr>
<td>Black</td>
<td>358.43 (~5h 58m)</td>
</tr>
<tr>
<td>Latinx</td>
<td>394.14 (~6h 34m)</td>
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</tbody>
</table>

--- 95% Confidence Interval

Yip, et al., 2019
# Ethnicity

Table 3 Ethnic discrimination predicting sleep outcomes

<table>
<thead>
<tr>
<th>Actigraphic sleep measures</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>$b$</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Intercept</td>
<td>7.61***</td>
</tr>
<tr>
<td>Latino</td>
<td>-.14</td>
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<tr>
<td>Asian</td>
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<tr>
<td>Other</td>
<td>-.02</td>
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<tr>
<td>Gender</td>
<td>.32**</td>
</tr>
<tr>
<td>Parental education</td>
<td>-.01</td>
</tr>
<tr>
<td><strong>Ethnic discrimination</strong></td>
<td><strong>-.11</strong> *</td>
</tr>
</tbody>
</table>

Majeno, et al., 2018
School

\[ b = -0.053^{**} \]
\[ b = -0.081^{***} \]
\[ b = -0.136^{***} \]

9th Grade
10th Grade
12th Grade

Sleep Time vs. Study Time

Gillen-O’Neel, et al., 2013
Family Cohesion

$b = .11$ ***

Adolescent Sleep

Parent Sleep

Fuligni, Tsai, et al., 2015
Family

Fuligni, Tsai, et al., 2015
Many things → Sleep

- sleep disparities follow typical ethnic & economic differentials
- school demands strongly predict worse sleep
- sleep is closely tied to the family environment

* not always the adolescents’ fault
(Integrative) Developmental Science
developmental neuroscience (*integrated with*) developmental psychology, education, science of learning, public health, including social, clinical, affective and implementation sciences...policy
Sleep: Interactions *between* biology and social/behavioral factors

- Some developmental changes in sleep are linked to biological changes at puberty:
  - Increased Sleepiness
  - Circadian changes (tendency to prefer later bedtime and sleeping in later in the morning)

- Consider these biological changes in sleep tendencies, in earlier periods of human history...
Social factors in contemporary society contribute to LATE bedtimes/sleep onset times:

• Access to light, digital devices, and stimulating activities
• Interactions with peers, social activities, exploration
• Greater freedom to self-select bedtimes
• Stress/anxiety or excitement ⇒ difficulty falling asleep
• Major circadian shift on weekends/vacation
• Work, Sports, Homework, Projects,
Contribution Factors/Vicious Cycle

• “Catch-up” sleep on week-ends pushes circadian system to further delay
• Light (TV, computer, personal device screens) later at night; subjective darkness (eyes closed asleep) into the morning
• Use of stimulants (caffeine and nicotine) can contribute to Difficulty Falling Asleep
• Sleep and vigilance as opponent processes
• Stress and conflict contribute to emotional arousal; adolescence as a time of increased sensitivity to social evaluation (threat/vigilance)
A Small Set of Biological Changes at Puberty Can Lead to a Spiral of Negative Effects

• Late night/erratic schedules ⇒
  Sleep Deprivation and Social Jet Lag
  ⇒ erodes mood and motivation
  ⇒ greater stress and affective problems
  ⇒ interferes further w sleep/arousal regulation
  ⇒ greater difficulty falling asleep

• Social context that amplifies the biologic change ⇒ a negative spiral?
Clinical and Policy Implications: Beyond School Start Times...

• Evidence that school start time helps...
• Enhance with targeted education, behavior, and attitudes about sleep?
• Valuing sleep; regularity of schedules...
• Targeted early intervention/prevention:
  • in high risk groups;
  • In developmental windows of opportunity
Example 1: Sleep & Anxiety in Early Adolescence

Children with Anxiety disorders enter adolescence with several additional vulnerabilities that can amplify both the causes and consequences of sleep problems:

• increased vigilance,
• heightened physiological arousal,
• a predilection toward bedtime worries and ruminations
• sensitivity to social rejection

• Anxiety as a risk factor for depression
• Sleep deprivation as risk factor for depression
• Depression rates soar during adolescence
• CBT sleep intervention focusing on sleep in anxiety in 9-13 year olds
Transition into Adolescence (10 -13)

Puberty: sensation-seeking, social motivation, and sensitivity to social evaluation.

Learning: Social relationships, early-adult identity formation...

self/other (individual and social identity, sexual self and identity)

Belonging and feeling valued—"mattering"

Meaning, purpose, valued contributions ("mattering" by doing things that matter)

Learning that underpins heartfelt goals, priorities...

DIGITAL TECHNOLOGY...

Motivational/Goal Flexibility

Social / Affective Influences