Pediatric Sleep: Normal or Not and What to Do About It

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Psychiatry and Sleep Medicine
Objectives:

After participating in this session, attendees should be able to ...

... define and review with parents and kids what **target total sleep times and circadian rhythms** are at different stages from birth through teen years. Knowing the range of normal sleep across the pediatric population allows us to recognize what is not within normal limits.

... express why diagnosing OSA in toddlers to teens is important, use a screening tool, implement at-home testing and guide next steps.

... prescribe **practical solutions for insomnia** in kids who have Autism Spectrum Disorder.
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Total Sleep Time and Circadian Rhythm

Total Sleep Time (TST): the amount of time asleep over a 24-hour period

Circadian Rhythm:
- when on the clock is sleep happening
AASM TST Recommended Ranges Across Pediatric Ages

- **High End**
- **Low End**

<table>
<thead>
<tr>
<th>Age</th>
<th>4-12 months</th>
<th>1-2 years</th>
<th>3-5 years</th>
<th>6-12 years</th>
<th>13-18 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours per day</td>
<td>16</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>10</td>
</tr>
</tbody>
</table>

The graph shows the recommended ranges for sleep time (TST) in hours per day across different age groups, with bars indicating the high and low end of the recommended range.
Circadian Rhythm

Evidence for rhythms in activity in utero

From birth to 2 months of age there are minimal circadian markers

About 2 months of age melatonin, cortisol patterns, and body temperature variation begins

The Children’s ChronoType Questionnaire (CCTQ) is a 27 question survey to help determine a child’s chronotype (i.e. early bird or night owl)

Light is the primary zeitgeber (“time giver”) impacting the alignment and entrainment of the circadian rhythm

Circadian Rhythm and TST in Infancy and Toddlerhood

Infancy

0-6 weeks old: wake and sleep patterns are randomly distributed
6-8 weeks old: longest sleep period is more likely to occur at night
    Baby starts to produce melatonin and respond to light and
    activity entrainment
4 months old: longest wake period is more likely to occur during the
day
5 months old: baby can sleep a consolidated 5 hour stretch or
longer
6 months old: the longest sleep time immediately follows the
longest awake period
6-12 months old: circadian rhythm established with consolidated
wake periods and consolidated sleep periods
At 4-12 months of age babies should get 12-16 hours TST

Toddlerhood

Distinct daytime naps
Consolidated sleep
period at night
11-14 hours TST

Circadian Rhythm and TST in Childhood

Early Childhood (3-5 years old)
Gradual extinction of daytime naps
Consolidated sleep at night
10-13 hours TST

Childhood (6-12 years old)
Tendency to sleep during the day is at the lowest.
Irregular and occasional naps are within normal range.
Routine daytime napping may indicate an abnormal process causing excessive daytime sleepiness.
9-12 hours TST

Circadian Rhythm and TST in Adolescents

Adolescents

- **Delayed Phase**
- **Heavy Sleep Inertia**
- **8-10 hours TST**

*Later school start times, sleeping in on the weekend*

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Review of TST & Circadian Rhythm Across the Ages
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Diagnosis OSA in Toddlers to Teens

- *why* it is important
- use a *screening* tool
- in-lab versus *at-home testing*
- guide *next steps*
OSA Importance

- ADHD - disruptive behaviors
- poor growth and even failure to thrive (especially in infants and young children)
- hypertension - further weight gain due to hormone dysregulation
- altered cardiac morphology (ventricular hypertrophy)
- pulmonary hypertension - speech difficulties
- learning disorders / academic difficulty - enuresis
- headaches - mood dysregulation - anxiety
Screening Tool – You!

Roughly 5% of typically developing children will have OSA.

There is not a great standardized screening tool with both high positive predictive value and negative predictive value. A guideline is to be the screening tool yourself and have a low threshold to evaluate with a study if the history or physical exam suggest features of OSA.

Clinical History: snoring, apneas, choking noise, increased work of breathing, heavy breathing, mouth breathing (night or day), enuresis, restless sleep, excessive sweating, hyperextended neck, knees tucked under body (odd sleep position), frequent wake-ups, dry mouth, poor school performance, aggressive behavior, hyperactivity, daytime sleepiness, morning headache, age-inappropriate napping, difficult to wake-up, treatment-resistant depression, anxiety, headaches.

Physical Exam: obesity, failure to thrive, swollen mucous membranes, irritated uvula, deviated septum, adenoidal facies (infraorbital darkening, elongated midface, mouth-breathing), tonsillar hypertrophy, high arched palate, small lower jaw and recessed chin (micrognathia/retrognathia), crowded oropharynx, macroglossia, increased neck circumference, hypertension, loud P2 on cardiac exam, edema.

For insurance purposes, clinical documentation typically needs to include excessive daytime sleepiness, snoring, witnessed apneas.

Special populations: Down’s Syndrome/Trisomy 21 (60%+), cerebral palsy, genetic disorders with retrognathia, macroglossia, craniofacial abnormalities, neuromuscular disorders, sickle cell anemia, obesity.
9 MOST COMMON SYMPTOMS OF SLEEP APNEA

1. Disordered Breathing
   - Periods of normal breathing with subsequent pauses or breath holding can be a sign of sleep apnea.

2. Mouth Breathing
   - If an entry through the nose is blocked due to enlarged tonsils or adenoids, children may breathe only through the mouth.

3. Snoring
   - Noisy breathing or loud snoring during sleep may be a symptom of sleep apnea, although snoring can also occur in healthy children.

4. Bed Wetting
   - Noisy breathing or loud snoring during sleep may be a symptom of apnea, although snoring can also occur in healthy children.

5. Odd Sleep Positions
   - Sleeping in abnormal positions like with the neck arched backward could be a sign the child is trying to open the airway.

6. Frequent Infections
   - Chronic ear infections, tonsillitis, sleep apnea, and adenotonsillitis may all occur more frequently.

7. Night Terrors
   - These episodes involve screaming, flailing, and intense fear that occurs while children are still asleep.

8. Teeth Grinding
   - Grinding or clenching the teeth at night is referred to as bruxism and can lead to sore jaw muscles, sensitive teeth, and increased tooth decay.

9. Restlessness
   - Children may toss and turn all night long, only going into a deep state of sleep.

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SIGNS OF OSA DURING THE DAYTIME

1. Behavioral Problems
   - Irritability, aggression, difficulty listening, frustration, and anxiety can all be more common.

2. ADHD or Hyperactivity
   - Difficulty with listening and paying attention or periods of hyperactivity occur more frequently due to lack of concentration to the brain.

3. Growth Issues
   - Delayed growth and development can occur leading to a lack of weight gain, slow growth in height and failure to thrive.

4. Learning Disabilities
   - Children may experience problems with short and long-term memory, difficulty concentrating, poor problem-solving skills, and trouble paying attention.
in-lab versus *at-home testing*

**PSG in the lab: Traditional**

Advantages:
- Includes EEG, includes video

Disadvantages:
- Expensive, thousands
- Start and end times set by policy, time off work and/or school, may be more difficult to sleep (equipment, noise, unfamiliar)

**At home testing:**

Advantages:
- More comfortable
- More affordable, hundreds
- Schedule is flexible

Disadvantages:
- No EEG or video
- Insurance navigation

**Equivalent:** both are able to detect apneas and diagnose OSA (oxygen saturation, flow or PAT, microphone), both can have the option to include carbon dioxide monitoring and leg movements.
At Home Testing

**WatchPAT** - FDA approved for age 12 and older

**NoxT3** - FDA approved for age 2 and older

The American Academy of Pediatrics issued a practice guideline in 2012 that stated the following: “if polysomnography is not available, then alternative diagnostic tests or referral to a specialist for more extensive evaluation may be considered.” Reference is made to ambulatory polysomnography. The American Academy of Sleep Medicine stated in a 2017 position statement that “Use of a home sleep apnea test is not recommended for the diagnosis of obstructive sleep apnea in children. The ultimate judgment regarding propriety of any specific care must be made by the clinician, in light of the individual circumstances presented by the patient, available diagnostic tools, accessible treatment options, and resources.”
This is a fairly ideal split night study that exemplifies the benefit of treating OSA.

This is a teen individual, moderate intellectual disability as part of a PDD, overweight, snoring per parents but limited clinical history otherwise.

His pre-CPAP portion of the study showed an AH1 19 with SaO2 low 89% (shallow to moderate desaturations, not very low!).

With starting CPAP and increasing to 6 CWP (range is 4-20 CWP) he had resolution of breathing events even in REM supine and he had nice sleep architecture with REM rebound.
This is a 2-year-old child, pre and post tonsillectomy.
Guide Next Steps

1. Evaluate for a tonsillectomy and adenoidectomy
2. CPAP machine
3. Positional therapy with raising the head of the bed and non-supine
4. Consider discussing weight change if there is a path forward that is helpful and not negative
Review of TST & Circadian Rhythm Across the Ages

Review of Pediatric OSA

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Insomnia and Autism Spectrum Disorder

Screen for circadian phase shift
Stimulus control
Medication
Screen for Phase Shift

Children with ASD are more likely to have delayed circadian rhythms as well as blunted or absent circadian rhythm of melatonin.

What is perceived as trouble falling asleep / insomnia may be a delayed phase without a strong sleepy cue until later than is preferred.

For example, a child may be asked to go to bed at 8 pm to get enough sleep before waking up at 6 am for the morning routine and school. The child may not feel sleepy and may not fall asleep for 2+ hours. This same child may be able to fall asleep easily and sleep well if allowed to go to bed at midnight and get up at 10 am.

Behavioral Interventions

Sleep hygiene is necessary but *not* adequate to treat insomnia.

*Stimulus Control*

specific to the child so it creates a strong connection, unique to bedtime, consistent every night

- simple bed (or mattress on the floor)
- no toys or extra items in the room
- a few books, sound machine, projection night light, comfort item(s) (picture, stuffed animal, music box, etc)
Prescribed Medications QHS
- PRN, scheduled or alternating

trazodone (Desyrel, Oleptro) 25-150 mg
mirtazapine (Remeron) 7.5 - 15 mg
doxepin (Silenor) - 3-6 mg or 10-75 mg
amitriptyline (Elavil) - 25-75 mg
hydroxyzine (Vistaril, Atarax) 25-75 mg
ramelteon (Rozerem) 8-16 mg
clonidine (Catapres) starting at 0.1 mg
guanfacine (Tenex) XR 1-4 mg
Review of Pediatric OSA

PRESENT
PROBLEMATIC
TREATABLE

Review of TST & Circadian Rhythm Across the Ages

Review of Insomnia and Autism

Prescription
Behavioral Therapy, Sleep Stimulus Control
The End

Questions?
Extra slides?
Extra: Sleep Tips for Babies

• Entrainment with activity and light exposure vs dim light leading up to 6 weeks of age and continuing beyond.
  • baby wakes up, feed baby first, baby interacts/plays second, baby falls back asleep
  • light in the morning, dim or no light at night
• Sprinkle pacifiers or always keep a pacifier pile in one specific corner
Extra: Tips for Kids:

• Kids with ADHD and heavy sleep inertia, schedule PE first hour, consider Jornay
Extra: Tips for Teenagers:

- Phase shift (advance to an earlier bedtime) with melatonin and bright light
  - For example: sleepy bedtime at 2 am, natural melatonin secretion / dim light melatonin onset (DLMO) occurs at midnight with the pineal gland secreting 0.3 milligrams of melatonin, to phase advance give 0.1-1.0 mg exogenous melatonin at 6-8 pm
  - Bright light upon waking
- Heavy sleep inertia apps like Alarmy (do math problems, jumping jacks, picture of a sink, etc to turn the alarm off)
- Delayed school start time if possible
- Schedule PE first hour
- Insomnia: Doze app: Goodnight Mind for Teens by Dr. Colleen Carney