Pillow Talk and Sleepy Days

Pediatric Sleep Disorders
By Diane Kemp
Pediatric Sleep Medicine Nurse Practitioner
My background led me to sleep ...

- GI- reflux, pain, and constipation with enuresis can interfere with sleep.
- Behavioral Pediatrics-
  ADHD: falling asleep takes focus, and stimulant medications often prevent sleep.
  Behavioral insomnia of childhood- limit setting, sleep association, and combined type
  Autism: often short sleepers
My background led me to sleep (cont.) ...

- Otolaryngology

  Oral anatomy: retrognathia, enlarged tonsils and adenoids, adenoidal regrowth, lingual tonsils

  Nasal pharynx anatomy: narrowing due to low lying palate, elongated uvula, nasal septum deviation, or soft tissue related to obesity

  Syndromes effecting the airway: asymmetry of the airway, large tongue, hypotonia, cleft palate, stenosis of the airway
Laugh and the world laughs with you; snore and you sleep alone.

Anthony Burgess
Sleep disorders in children
Snoring/Breathing Disorders

- **Obstructive Sleep Apnea**
  - Labored breathing (noisy), witnessed apneas, gasping for air, mouth breathing, unusual snoring pattern.
  - Occurs in 2% of children. Diagnosed by sleep study with AHI of 1-6 mild, 7-12 moderate, and above severe.
  - Presents differently in children, than adults. Often no snoring, but rather the noisy breathing.
  - Often associated with tonsil hypertrophy, airway narrowing or poor musculature.
  - 10% weight gain associated with 6-fold increase in risk of OSA.
  - The risk of morbidity associated with untreated sleep apnea such as difficulty in concentration, memory issues, poor school performance, irritability, temper tantrums and meltdowns, excessive daytime sleepiness or hyperactivity.
  - TX: most frequent/ 80% resolve with T&A in children. Repeat PSG if greater than moderate of low oxygen nadir (less than 80%). More options to be discussed such as airway surgical approaches, PAP therapy, oxygen therapy, for mild medications such as Flonase and Singulair.
Snoring/Breathing Disorders (cont.)

• Central Apnea
  • Cyanosis apnea, and apparent life threatening events
  • Diagnosed by sleep study with central above 1.5 occurrence/hr. Central apneas are natural occurring in infants until 18 months to 2 years of age at lower rates.
  • Tx: Supplemental oxygen, BIPAP, Diamox (5-7 mg/Kg) monitoring bicarbonate on Basic Metabolic Panel with goal in the low 20's.

• Hypoventilation
  • When ventilation is inadequate to perform needed gas exchange it causes an increased concentration of carbon dioxide (hypercapnia) and respiratory acidosis.
  • Many causes of hypoventilation including children with complex medical issues usually have a neurological condition, neuromuscular disease, deformity of the chest or spine, or are on medications that may reduce the drive to breathe. Obesity can also cause hypoventilation.
  • Diagnosed when 25% of sleep time maintains a CO2 (end tidal CO2 during a sleep study) above 50 mm Hg.
  • Tx: BIPAP, CPAP, supplemental Oxygen for mild hypoventilation. Weight loss if applicable. Pulmonary evaluation for chronic lung issues is recommended.
Nocturnal Arousals

- Greater than expected arousal during the night effecting sleep quality
- Causes:
  - Nighttime feeding until 6 months of age
  - Separation anxiety near 1 year of age
  - Co-sleeping increase risk of arousals
  - High risk population, lack of structured bedtimes, and irregular sleep habits
  - Extrinsic reasons such as medication side effects, medical conditions such as those with ADHD, CP, Autism, Developmental Delay, anxiety, and pain
- Tx: behavioral strategies will intervene in almost all cases. Understanding the nature of some of the medical conditions will assist in preventative strategies.
Parasomnias

• Sleep Terrors
  • Typical episode: sit up in bed, “blood curdling” scream or shout, may kick and thrash, eyes wide open looking like intense fear, racing heart. Children rarely bolt from bed
  • No response to voices, very difficult to wake, no memory of the occurrence. Recommend to not wake
  • Occurs in the first third of the night
  • Common (6.5% of children) for 4-12 year olds
  • Familial
  • Risks include keeping the child safe. Does not normally need Tx.
  • PSG indicated if obstructive symptoms present, because OSA can make symptoms worse.
Parasomnias (cont.)

• Confusional Arousals
  • Episode where you act in a very strange and confused way. You may have slow speech, answer questions with blunt responses or nonsensical answers.
  • Confused thinking. Thinking the closet is the toilet, getting out food from the refrigerator and leaving it on the table. Children “stare right through you” in confusion.
  • Ideal not to wake. They become agitated.
  • No memory of it in the morning.
  • Episodes generally last 5-15 minutes. Can be up to 45 minutes.
  • Increased with insufficient sleep, stress, OSA, PLMD, being forced to waken.
  • Harmless to the child (other than safety concerns with mobilizing) and often are a precursor to sleep walking in later teen years.
  • Occurs in the first third of the night, but can be later or with naps
  • Most Common Parasomnia (17% of children) for 1.5-5 year olds
Parasomnias (cont.)

• Sleep Walking
  • Episode of getting up from bed and walking around while asleep. Can involve other complex actions-running away from threat that is real or imagined, moving furniture around, usually moves to light, can involve sleep-talking.
  • No memory of the event
  • Can be violent when woken. So advised to guide back to bed without waking.
  • Increased with sleep deprivation, travel/unfamiliar surroundings, stress, OSA, PLMD, fever, premenstrual, light noise, side effect of some medications, being forced to waken.
  • Harmless to the child (other than safety concerns with mobilizing) and often associated with confusional arousals earlier in life.
  • Occurs in the first third of the night, but can be later or with naps
  • Most Common Parasomnia (17% of children) for 8-12 year olds. Can begin as soon as child walking. Incidence in boys and girls equally
  • Familial. Chances can double with one parent, or triple if both parents have history.
  • TX: not necessary but can with Anticipatory awakenings.
Parasomnias (cont.)

• Sleep Talking
  • talking during sleep without being aware of it. No memory of it in the morning.
  • can involve complicated dialogues or monologues, complete gibberish or mumbling
  • More common in males and children
  • Can increase in those with OSA or PLMD. So sleep study with repetitive occurrences may be warranted.
  • Not harmful, but can be embarrassing (discouraging sleep overs) or disruptive to others sleeping in the home.
Insomnia

• Sleep/Wake Disorders
  • Circadian Rhythm Disorders (delayed and advanced sleep phase)
    • This refers to what most think of as our “internal clock”
    • Circadian regulatory mechanisms become stronger and entrained by reoccurring environmental and social cues.
    • 70% infants have consolidated nighttime sleep by 3 months of age. 10% by 12 months of age.
    • Currently the most common concern with circadian problems is delayed phase in America’s teens. A combination of hormones leading to “night owl” effect, and more recently electronics in the room at night. Caution on perceived sleep VS. actual sleep.
  • TX: most often prescribed hypnotic/sedative OTC medications. If prescribed RX, then usually Trazodone.
    • However, of the few published randomized studies melatonin at all doses (0.05-0.15/kg) were found to advance sleep onset by 1 hour and decrease sleep onset latency by 35 minutes.
    • Natural Hormone found in body
    • Used with single dose or split dose (3 hours before at 0.1-0.3mg/kg and 1 hour before)
Behavioral Insomnia of Childhood (sleep association, limit setting, or combined type)

Unwillingness to go to sleep

For sleep association

1. Identify what needs to be in place for your child to fall asleep. This often needs to be recreated during the night with awakenings. If you make changes to sleep onset in the beginning of the night, it will carry over to night awakenings.
2. Timing is everything. If testing is recommended, we usually wait for it to be completed and treated before beginning. Once changes are started, it is important to continue so you are not giving your child the message that if they "fuss" these changes will go away. The timing needs to be good for you and your family to support. Make sure you have the resources to support the changes consistently.
3. Small changes are best. We will work with you closely to fit you and your child's needs. We also often involve other specialists to support your goals. If this is not the right time or a needed change within your family—please share that with us! We are wanting to support the family's goal. Many cultures or family traditions surround sleep and what is important to one household is not to others.

For limit setting

1. Similar to above. But to remove barriers such as needing extra hugs, water or bathroom break.
2. Use pass to limit times out of room with reward associated with cooperation.
3. Most importantly to have all family members committed to program.
Poor Sleep Hygiene

• Poor sleep habits can lead to insomnia, circadian sleep/wake problems, poor sleep quality, insufficient sleep, and more parasomnias can occur.

• Tx:
  • Consistent sleep and wake times. No more than 1 hour difference between weekend and school nights. Do not lay in bed in the morning for an extended period of time after waking up for the day.
  • Limit caffeine intake after 2 PM.
  • Limit personal electronic devices and TV to at least 30 minutes (60 minutes ideal) prior to bed. Remove all from the bedroom.
  • If unable to fall asleep within 20 minutes, get out of bed and do a non-stimulating activity such as reading, drawing until tired.
  • Avoid using bed for homework, watching TV or other activities.
  • Make sleep space comfortable with cool temperatures and dark to promote sleeping.
  • Do not allow pets in room or on bed while sleeping.
Narcolepsy/Cataplexy

- Extreme sleepiness with irresistible urge to sleep
- Often has dreamlike experiences while falling asleep or waking. Sleep paralysis
- Cataplexy
- Some Research shows lack of chemical in the brain, hypocrotin, located in hypothalamus. More recent, suggests for familial narcolepsy. Can be tested with spinal tap. Some genetic testing emerging also
- More common with Niemann-Pick and Prader-Willi syndromes

- Cataplexy
  - Loss of muscle control usually with extreme emotions such as anger or laughing. Most commonly in facial or leg muscles
  - 65-75% occurrence in those with Narcolepsy
  - Often first sign of Narcolepsy
  - Most common in Japan

- Tx: wake-promoting medications—stimulants, Modafinil, Nuvigil. Supplemented with planned naps
Hypersomnia

- Excessive daytime sleepiness
- Not well defined in research. Important to evaluate for good sleep hygiene, quantity and quality of sleep.
- Both Narcolepsy and Hypersomnia diagnosed with sleep study followed by MSLT (Multiple Sleep Latency Test). PSG needs to show normal results. Ideal to obtain actigraphy for 7-10 days leading up to study to ensure adequate sleep prior. The testing and findings will be discussed in Medical Testing slides.
- While Narcolepsy has standards for diagnosis. Hypersomnia is more subjective.
- Tx: wake-promoting medications—stimulants, Modafinil, Nuvigil. Supplemented with planned naps
Restless Leg Syndrome/Periodic Limb Movement Disorder

- Low serum ferritin levels have been shown to be associated with Restless Leg Syndrome (RLS). Start iron supplementation if ferritin level less than 50.

- **TX:**
  - Iron supplementation if ferritin level less than 50. Iron 2-2.5 MG per KG elemental iron per day.
  - If needed may use Klonopin, Gabapentin, Pramipexole
Sleep Related Eating Disorder (SRED)

Repeated episodes of compulsive binge eating and drinking after waking up in the night
- always “out of control”
- Partial/no memory
- If attempt to wake → anger/resistance
- 1 or more episodes every night
- Usually high-calorie foods, sweet foods

Can result in:
- Eating strange foods—raw bacon, coffee grounds, toxic cleaning solutions
- Excessive weight gain/obesity
- Stomach pain
- Eating foods allergic to

Occurrence: Women>men, average age onset >20-29 years of age
Tx: Topamax
Medical Evaluation

- Complete PE including oral structures, muscle tone, and body weight.
- Complete History including Behavioral, psychological and Family history.
- Laboratory testing
  - Serum iron and ferritin levels
  - Thyroid and other metabolites
  - Genetic testing
- Epworth Sleepiness Scale
Sleep Study Types:

- Baseline polysomnogram (PSG)- using end tidal CO2 Monitoring if possible
- Sleep study with MSLT (Multiple Sleep Latency Test)
  - Following normal baseline, 5 chances to nap every 2 hours for 20 minutes
  - Results: if 2 or more naps achieving REM and sleep latency less than 7 minutes can diagnose Narcolepsy
  - Results: if 3 or more naps achieving sleep within 7 minutes considered hypersomnia
- Sleep study with (PES) esophageal pressure
  - This is more sensitive to changes in the soft tissues of the throat that relaxes and narrows—Upper Airway Resistance Syndrome (UARS)
- Sleep study with parasomnia montage
- CPAP/BIPAP titration study
- Oxygen titration study
Medical Evaluation (cont.)

• Actigraphy
  • Evaluates insomnia, circadian rhythm sleep disorders, distinguishes conflict between real and perceived sleep. Used to ensure sufficient sleep prior to testing.
  • Watch-like tool that tracks sleep duration, patterns of sleep, and restlessness.
  • Can also be used to provide data on response to therapy/treatment.
  • Increasing research base since 2003. Not yet covered by insurance.

  • Cost about $2000.00 per watch
Sleep Study Preparation

CHILD LIFE

Brighton Center for Specialty Care
comfot ★ coping ★ education

Created September 2005
### Sleep Study Report

**Sleep Disorders Centers**

**Sleep Laboratory Report**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Date</th>
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<tbody>
<tr>
<td>Light-O-Stop (total sleep)</td>
<td>22:49-05:59:23</td>
</tr>
<tr>
<td>Total Recordings Time (HRY, min/HR)</td>
<td>690/30/00</td>
</tr>
<tr>
<td>Stage N1 Sleep</td>
<td>12.5</td>
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<tr>
<td>Stage N2 Sleep</td>
<td>25.0</td>
</tr>
<tr>
<td>Stage N3 Sleep</td>
<td>94.0</td>
</tr>
<tr>
<td>Stage R Sleep</td>
<td>5.0</td>
</tr>
<tr>
<td>REM Sleep</td>
<td>55.8</td>
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#### Pediatric Respiratory Analysis

<table>
<thead>
<tr>
<th>Apnea Classification Indices</th>
<th>Value</th>
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<tbody>
<tr>
<td>Respiratory Disturbance Index (RDI)</td>
<td>14.0</td>
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<tr>
<td>Obstructive Apnea Index (OA)</td>
<td>0.2</td>
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<tr>
<td>Central Apnea Index (CA)</td>
<td>0.2</td>
</tr>
<tr>
<td>Hypopnea Index (HI)</td>
<td>0.0</td>
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<tr>
<td>Number of Events</td>
<td>92</td>
</tr>
<tr>
<td>Apnea Hypopnea Index (AHI)</td>
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<tr>
<td>Obstructive Apnea</td>
<td>0.2</td>
</tr>
<tr>
<td>Central Apnea</td>
<td>0.2</td>
</tr>
<tr>
<td>Hypopnea</td>
<td>0.2</td>
</tr>
<tr>
<td>REM</td>
<td>0.2</td>
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</table>

#### Norms

- **Norms for Sleep Study**

  - **Light-O-Stop (total sleep)**: 22:49-05:59:23
  - **Total Recordings Time (HRY, min/HR)**: 690/30/00
  - **Stage N1 Sleep**: 12.5
  - **Stage N2 Sleep**: 25.0
  - **Stage N3 Sleep**: 94.0
  - **Stage R Sleep**: 5.0
  - **REM Sleep**: 55.8

#### Additional Notes

- **Respiratory Disturbance Index (RDI)**: 14.0
- **Obstructive Apnea Index (OA)**: 0.2
- **Central Apnea Index (CA)**: 0.2
- **Hypopnea Index (HI)**: 0.0

#### Pediatric Respiratory Analysis

- **Apnea Hypopnea Index (AHI)**: 0.2
- **Obstructive Apnea**: 0.2
- **Central Apnea**: 0.2
- **Hypopnea**: 0.2
- **REM**: 0.2

#### Normal Sleep

- **Light-O-Stop (total sleep)**: 22:49-05:59:23
- **Total Recordings Time (HRY, min/HR)**: 690/30/00
- **Stage N1 Sleep**: 12.5
- **Stage N2 Sleep**: 25.0
- **Stage N3 Sleep**: 94.0
- **Stage R Sleep**: 5.0
- **REM Sleep**: 55.8

**Medical Record**

- **Sleep Study Report**
### Sleep Analysis

<table>
<thead>
<tr>
<th>Lights Out/On (clock times)</th>
<th>22:08:25/06:08:25</th>
<th>Min</th>
<th>% of TST</th>
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<tbody>
<tr>
<td>Total Recording Time (TRT, min/hr)</td>
<td>480.0/8:0.0</td>
<td>Wake after sleep onset</td>
<td>58.5</td>
</tr>
<tr>
<td>Total Sleep Time (TST, min)</td>
<td>403.5</td>
<td>Stage N1 Sleep</td>
<td>20.0</td>
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<tr>
<td>Latency to sleep (min)</td>
<td>17.5</td>
<td>Stage N2 Sleep</td>
<td>231.5</td>
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<tr>
<td>REM Latency (min)</td>
<td>136.5</td>
<td>Stage N3 Sleep</td>
<td>94.0</td>
</tr>
<tr>
<td>Stage Shifts (#)</td>
<td>131</td>
<td>Stage N (other NREM) Sleep</td>
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<tr>
<td>Arousals (#)</td>
<td>207</td>
<td>Stage R Sleep</td>
<td>58.0</td>
</tr>
<tr>
<td>Arousals/hour of sleep</td>
<td>30.8</td>
<td>Sleep Efficiency</td>
<td>84.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stage R EMG Variance Score</td>
<td>16.6</td>
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### Pediatric Respiratory Analysis

<table>
<thead>
<tr>
<th>Apnea/Hypopnea Index † (AH1)</th>
<th>14.0</th>
<th>Respiratory Disturbance Index</th>
<th>14.0</th>
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<tbody>
<tr>
<td>NREM AHI</td>
<td>14.4</td>
<td>Obstructive Apnea Index</td>
<td>0.3</td>
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<tr>
<td>REM AHI</td>
<td>11.4</td>
<td>Central Apnea Index</td>
<td>0.3</td>
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<tr>
<td>Mean Sleep % SpO2</td>
<td>97</td>
<td>Hypopnea Index</td>
<td>13.4</td>
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<tr>
<td>Min % SpO2</td>
<td>89</td>
<td>RERA Index</td>
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<tr>
<td>% of Sleep Time with SpO2 ≤ 90%</td>
<td>0.1</td>
<td>Index = no./hour of sleep</td>
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### Number of events

<table>
<thead>
<tr>
<th>Apneic Episodes (#)</th>
<th>NREM</th>
<th>REM</th>
<th>Apneic Episodes ≥ 10 sec</th>
<th>92</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstructive apneas</td>
<td>2</td>
<td>0</td>
<td>Periodic Breathing:</td>
<td>No</td>
</tr>
<tr>
<td>Mixed apneas</td>
<td>0</td>
<td>0</td>
<td>Hypoventilation:</td>
<td>No</td>
</tr>
<tr>
<td>Central apneas</td>
<td>2</td>
<td>0</td>
<td>Snoring: Frequent. Moderate.</td>
<td></td>
</tr>
<tr>
<td>Hypopneas</td>
<td>79</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RERAs</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsure</td>
<td>0</td>
<td>0</td>
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### Position

<table>
<thead>
<tr>
<th>Prone</th>
<th>Supine</th>
<th>Left</th>
<th>Right</th>
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<tbody>
<tr>
<td># of apneas &amp; hypopneas</td>
<td>0</td>
<td>73</td>
<td>9</td>
</tr>
<tr>
<td>TST/pos. (min)</td>
<td>0.0</td>
<td>255.0</td>
<td>33.0</td>
</tr>
<tr>
<td>AHI</td>
<td>0.0</td>
<td>17.2</td>
<td>16.4</td>
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*REM normal > 20%*

*Snoring is *not a crime* — so normal if other findings NNL*

*Need supine, sleep for effective study*
### ECG Analysis

<table>
<thead>
<tr>
<th></th>
<th>Yes/No</th>
<th>Comment</th>
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<tbody>
<tr>
<td>Bradycardia</td>
<td>N</td>
<td>Wide complex tachycardia</td>
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<tr>
<td>Asystole</td>
<td>N</td>
<td>Atrial fibrillation</td>
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<tr>
<td>Sinus tachycardia</td>
<td>N</td>
<td>Other: N.A.</td>
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<tr>
<td>Narrow complex tachycardia</td>
<td>N</td>
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</table>

### Leg movement analysis

| Periodic limb movements (PLMs) during sleep (#) | 10 | PLM Index (PLMs per hour of sleep) | 1.5 |
| Periodic limb movements during sleep with arousal (#) | 3 | PLM Arousal Index | 0.4 |

**Normal up +5**
Once a diagnosis is made, a wide range of effective treatment strategies is available. The majority of sleep problems can be improved, controlled or eliminated.
Treatment Options

• Surgical options
• Positional therapy
• PAP therapy/oxygen via nasal cannula
• Mandibular advancing mouthpiece
  • More commonly used after jaw growth complete
  • Can cause shifting of teeth, TMJ. Not covered by insurance (approx.$1000.00)
• Medications
• Chronotherapy
• Behavioral strategies
• Anticipatory awakenings
Why is Sleep so Important? Lack of sleep effects...

- School performance, mood
- Overall health including growth, blood glucose, blood pressure, weight and metabolism
- Tendency to be accident prone, or clumsy
- Drowsy driving is responsible for:
  - 1,500+ fatalities per year
  - 40,000 injuries
How much sleep does a person need?
--About 5 more minutes--

• Newborns (0-3 months): 14-17 hours each day
• Infants (4-11 months): 12-15 hours
• Toddlers (1-2 years): 11-14 hours
• Preschoolers (3-5): 10-13 hours. Naps usually end around 3 years of age.
• School age children (6-13): 9-11 hours
• Teenagers (14-17): 8-10 hours
• Younger adults (18-25): 7-9 hours
• Adults (26-64): 7-9 hours
• Older adults (65+): 7-8 hours

• National Sleep Foundation 2015
How much sleep does a person need (cont.)

To be patient specific it is “best” to determine their natural pattern of sleep by using vacations (summer/weekends) for number of hours slept

This would be without an alarm or schedule

If able on this amount of sleep to function as they wish participating in the activities they choose without napping—then that is their goal sleep amount!
University of Michigan
Pediatric Sleep Medicine
Timothy F. Hoban, MD       Fauziya Hassan, MD
Geoffrey Rulong, MD       Diane Kemp, NP
Katrina Dawson, RN

Phone: 734-615-4302    Fax: 734-232-1213
Reasons to Refer to Sleep Medicine

- Snoring/obstructive breathing symptoms
  - During sleep labored breathing, witnessed apneas, gasping, open-mouth breathing, bending neck or head in unusual position
- Central apnea/pauses in breathing
- Hypoventilation
  - waking with headache or facial flushing
- Behavioral sleep issues
- Parasomnias
- Excessive daytime sleepiness
- Sleep/wake disorders
- Problems falling or staying asleep
- Restless sleeper
- Sleep issues with children having history prematurity, hypotonia, craniofacial abnormalities, oral crowding, stertor at rest
- Often helpful to evaluate medical reasons for sleep disorders and improve sleep hygiene before psych evaluation and/or medications that may have sleepiness as side effect. Also true for hyperactivity, behavior, or neuropsych evaluation.
Thank you for your attention to a topic I obviously love.

I hope you found some of the information helpful and interesting...

Some people talk in their sleep. Lecturers talk while other people sleep.

Albert Camus