



Evaluating & Managing Sleep Disorders

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Washington, D.C.

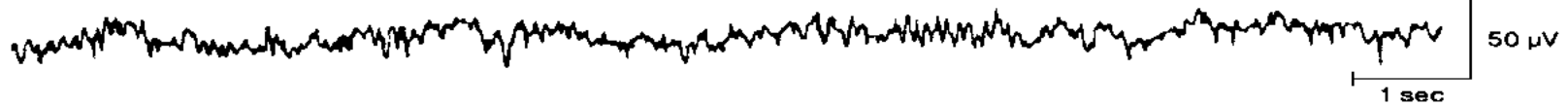
Future of Pediatrics, 2019

Topics

- Basics about sleep
- Effects of insufficient sleep
- Common sleep problems and disorders:
signs symptoms and treatment

Awake

Awake: low voltage – random, fast



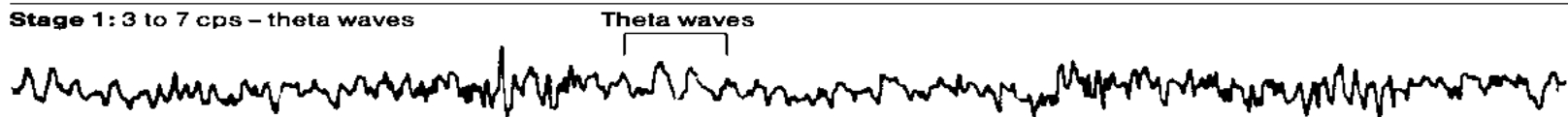
Drowsy

Drowsy: 8 to 12 cps – alpha waves



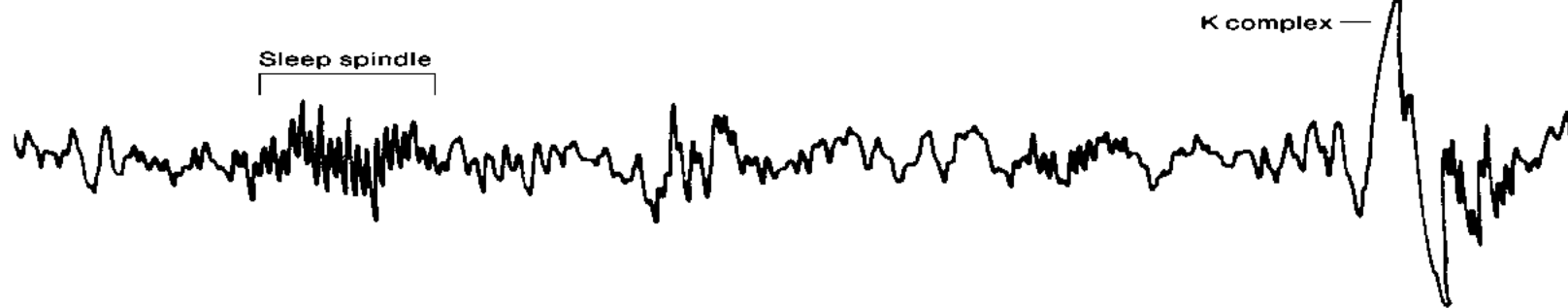
Stage 1

Stage 1: 3 to 7 cps – theta waves



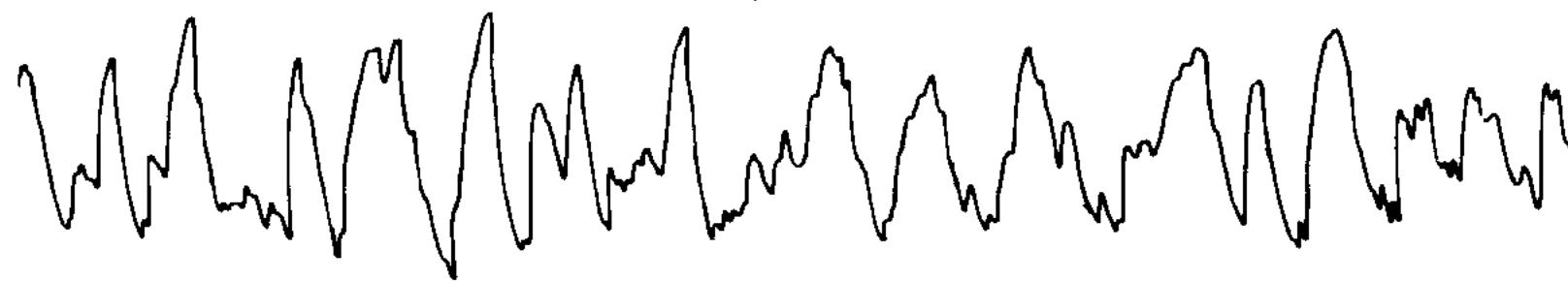
Stage 2

Stage 2: 12 to 14 cps – sleep spindles and K complexes



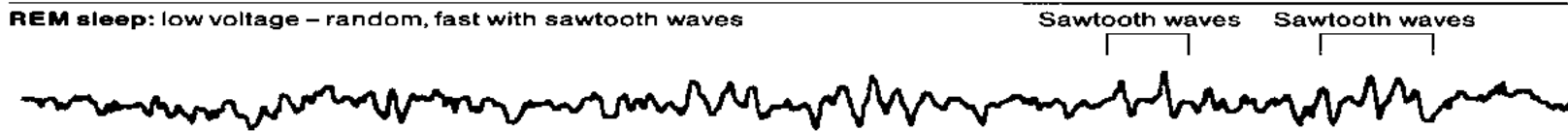
Stage 3

Delta sleep: (stages 3 and 4) $1\frac{1}{2}$ to 2 cps – delta waves $>75 \mu$ V



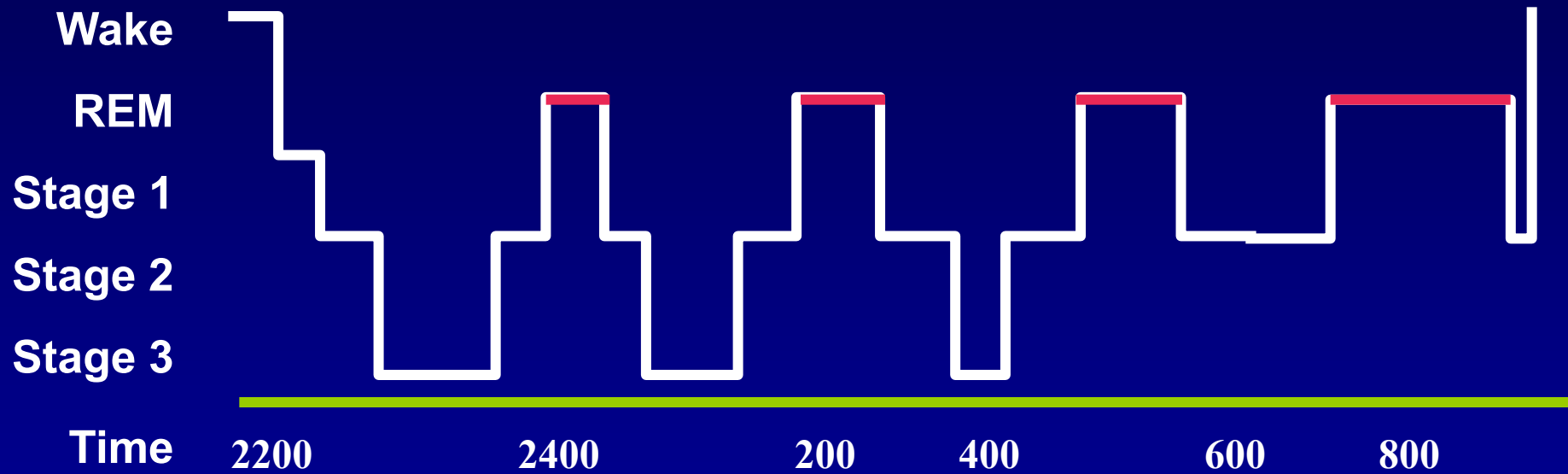
Stage
REM

REM sleep: low voltage – random, fast with sawtooth waves



Hypnogram

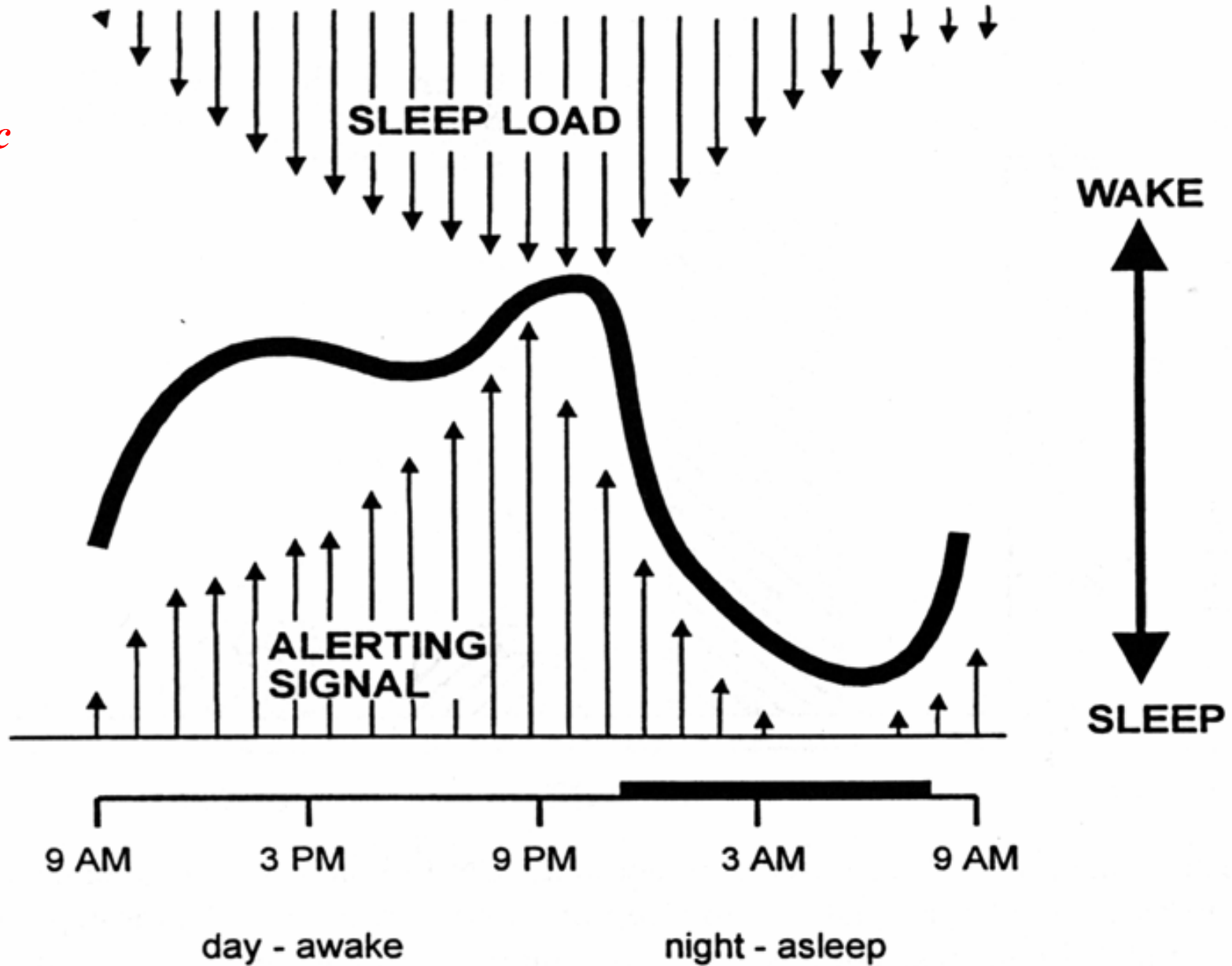
Sleep Stage Distribution



- ✦ NonREM Stage 3 is dominant during the first half of night
- ✦ Sleep stage REM is dominant during the second half of night

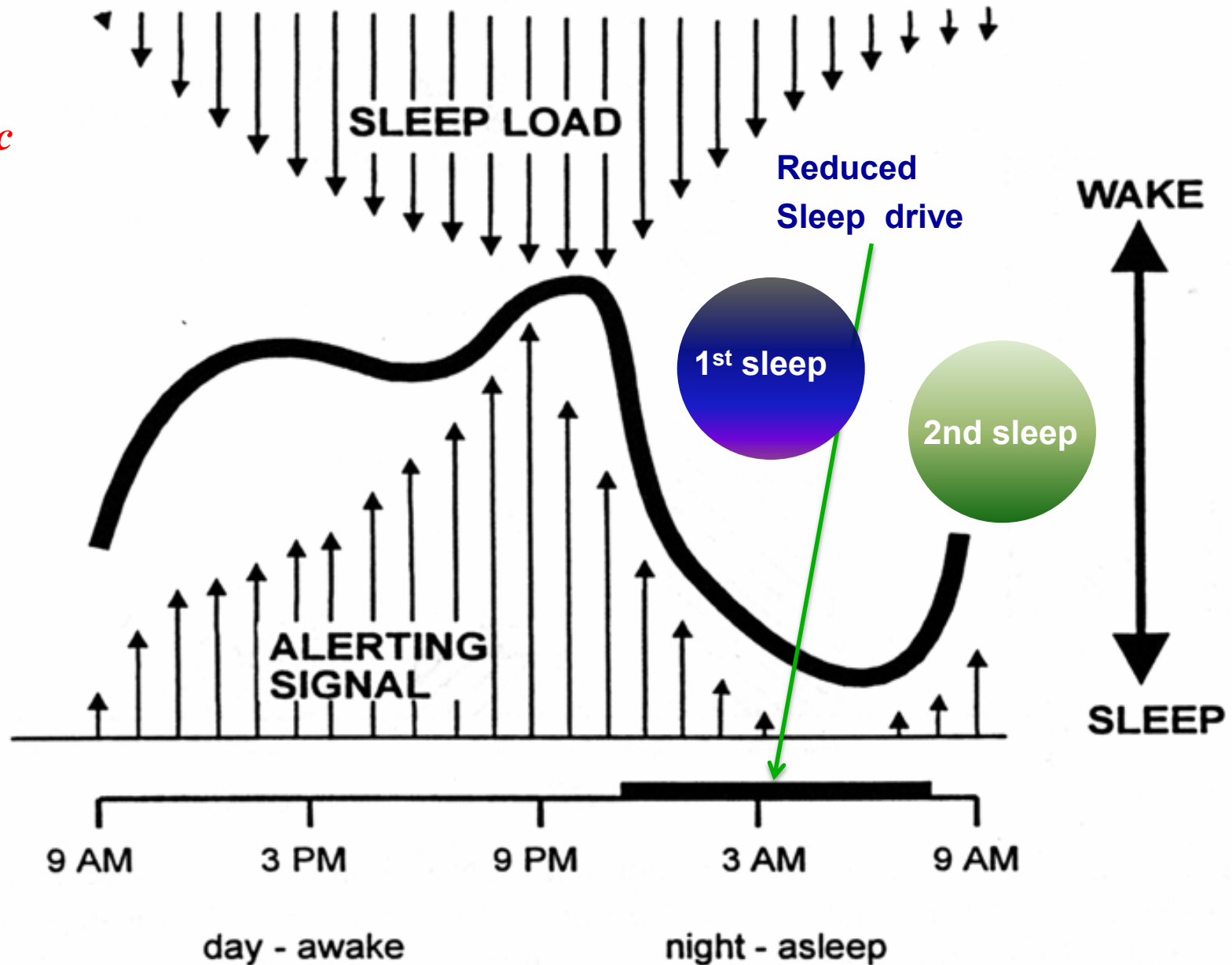
Process S
Sleep
Homeostatic

Process C
Circadian



Process S
Sleep drive
Homeostatic

Process C Circadian





Scientific Background Discoveries of Molecular Mechanisms Controlling the Circadian Rhythm

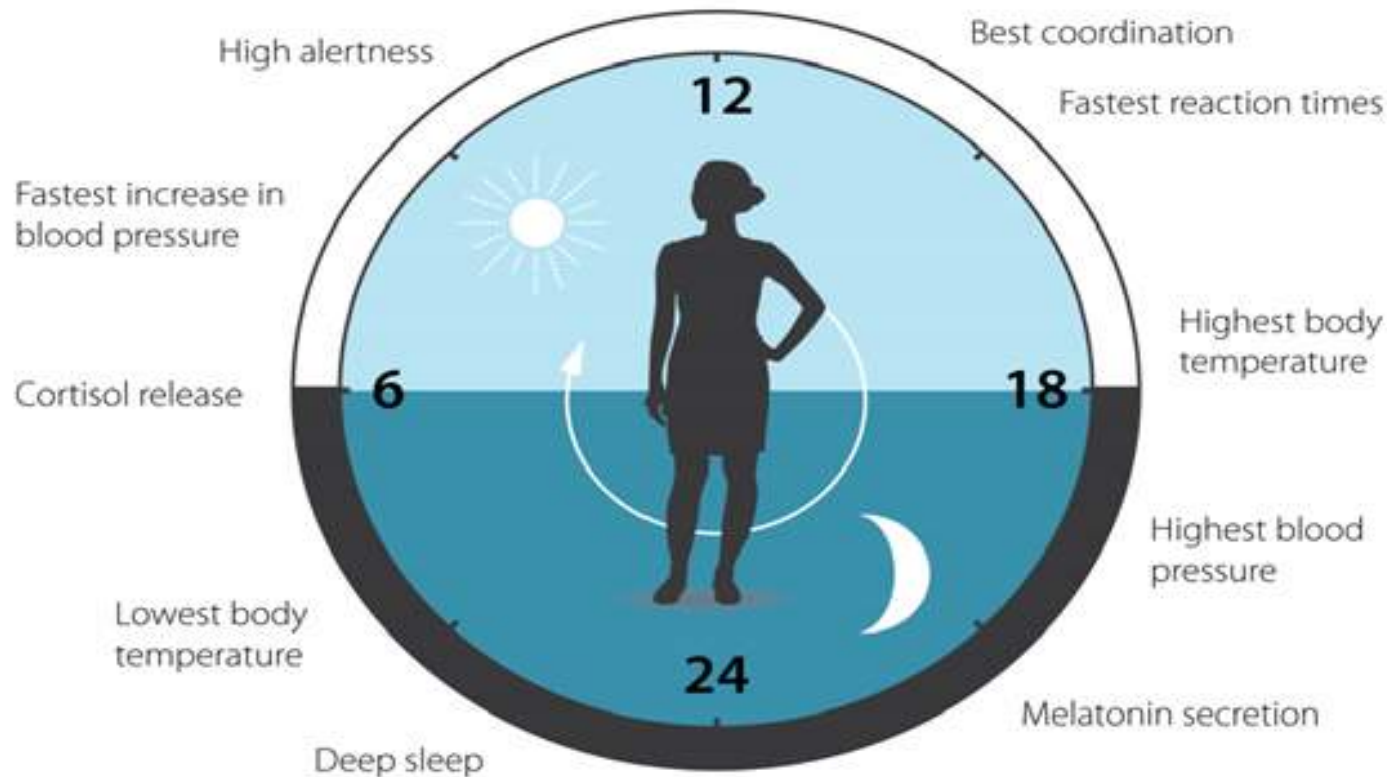
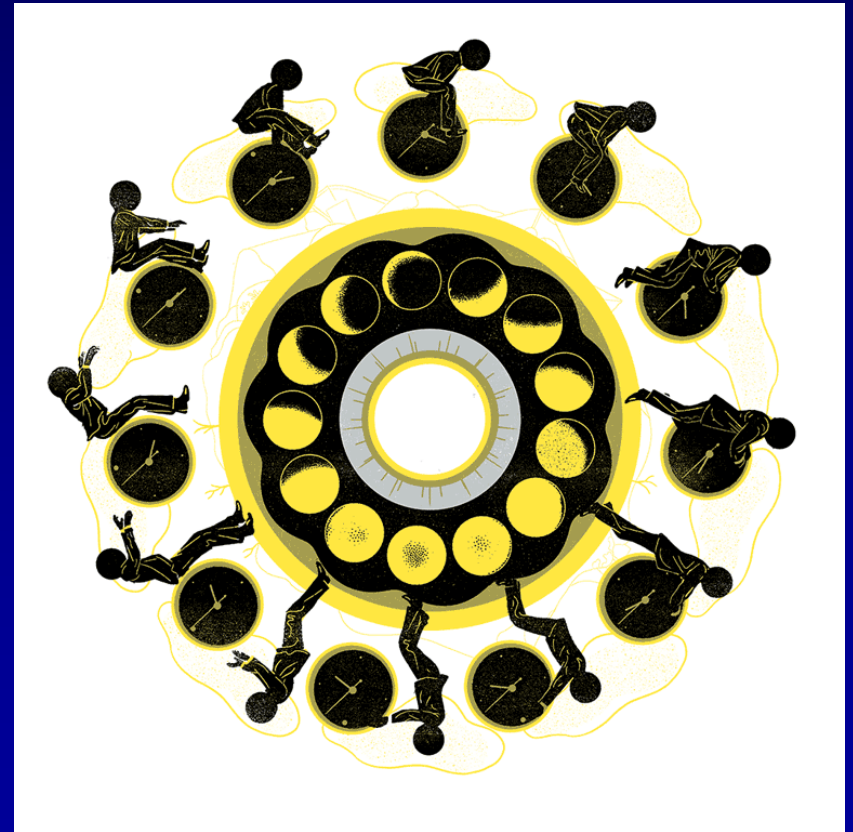
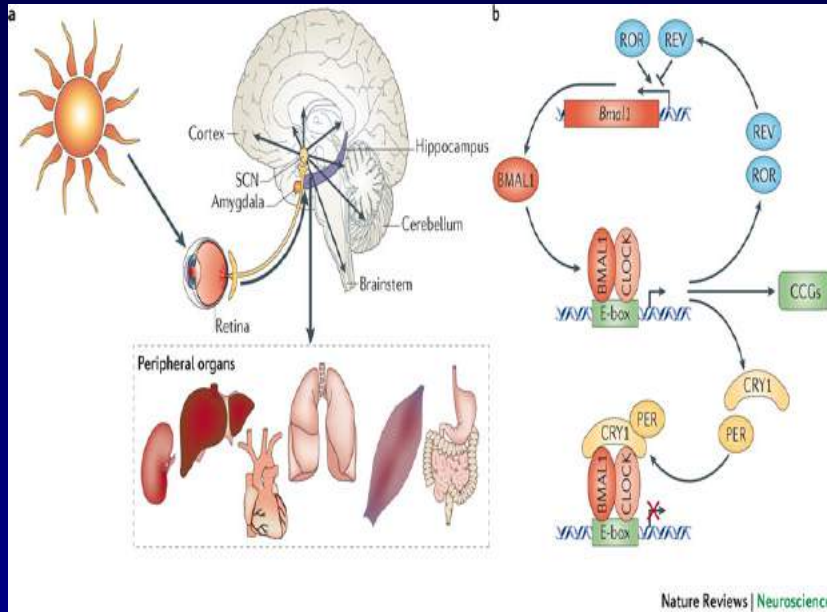


Figure 3. The circadian clock has an impact on many aspects of our physiology.

This clock helps to regulate sleep patterns, feeding behavior, hormone release, blood pressure and body temperature. A large proportion of our genes are regulated by the clock.

Sleep Time and Timing



| Age Group | Age | Duration (24hr) | Timing | Nap |
|---------------------------|-------|-----------------|----------------|-----|
| Infant 1-12 Months | 4-6m | 16-14 | 6pm-6am | 2-5 |
| | 7-12m | 16-12 | | 2-3 |
| Toddler 1-2 Years | 1-2 | 14-11 | 6pm-7am | 1-2 |
| Pre-School 3-5 Years | 3-4 | 13-11 | 6:30p-7:30am | 1 |
| | 5 | 11-12 | | |
| School-Age 6-12 Years | 6-7 | 12-11 | 7:30pm-8:00am | 0-1 |
| | 8-12 | 11-10 | 8:00pm-8:30am | |
| | 12 | 10.5-9.5 | 8:30pm-8:30am | |
| Adolescent 13-18 Years | 13-14 | 10-9.5 | 9:30pm-8:30am | CN |
| | 15-16 | 10-9 | 10:00pm-9:00am | |
| | 17-18 | 9.5-8 | 10:30pm-9:00am | |
| 19-25 | | 8-7 | 10:30pm-9:00am | CN |
| 26-65 | | 8-6.5 | 10:00pm-7:00am | CN |
| 65+ | | 8-6.5 | 9:00pm-7:00am | CN |

Sleep and Circadian Health Effects

- Metabolism regulation and energy expenditure
- Physical restoration
- Tissue repair
- Neuronal recalibration
- Memory consolidation

The Sleep Habits Assessment

| B edtime | E _{DS} (Excessive Daytime Somnolence) | A wakenings | R egularity | S nororing |
|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none">▪ Routine▪ Resistance▪ Fears | <ul style="list-style-type: none">▪ Hyperactivity▪ Irritability▪ Difficulty waking | <ul style="list-style-type: none">▪ Call outs▪ Partial Arousal▪ Restlessness | <ul style="list-style-type: none">▪ Schedule▪ Age | <ul style="list-style-type: none">▪ Volume▪ Pauses▪ Periodicity |

Adapted from: Mindel, JA, & Owens. A Clinical Guide to Pediatric Sleep: Diagnosis and Management of Sleep Problems. Lippincott, Williams & Wilkins. Philadelphia (2003)

Outline

I. Evaluating & Managing obstructive sleep apnea (OSA)

- Clinical assessment of OSA
- Who, when, where and how to refer or order sleep study
- Polysomnographic assessment
- Therapeutic approaches

II. Evaluating & Managing Other Sleep Disorders:

- Sleep - wake mechanisms
- Diagnostic tools
- Pediatric Sleep Disorders Assessment and Treatment

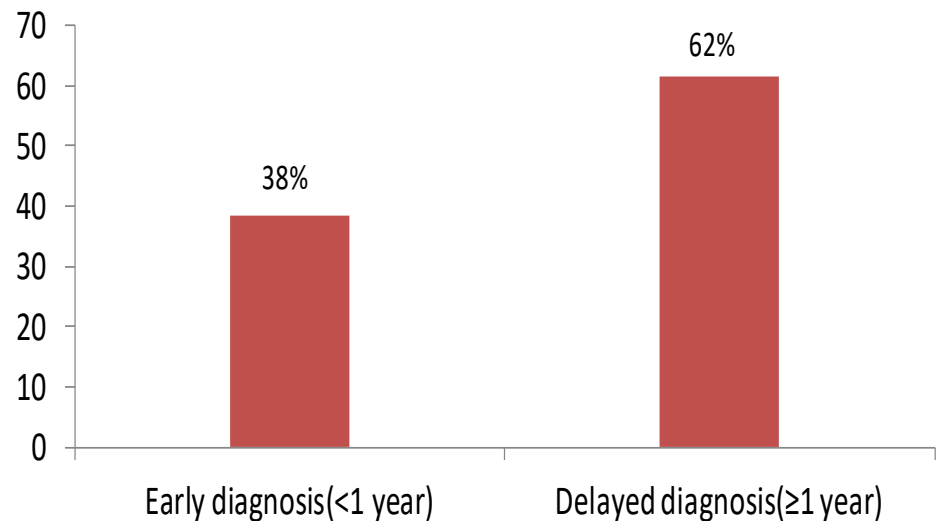
Evaluating & Managing Sleep Obstructive Sleep Apnea (OSA)



Julia Aziz, MD
jaziz@childrensnational.org

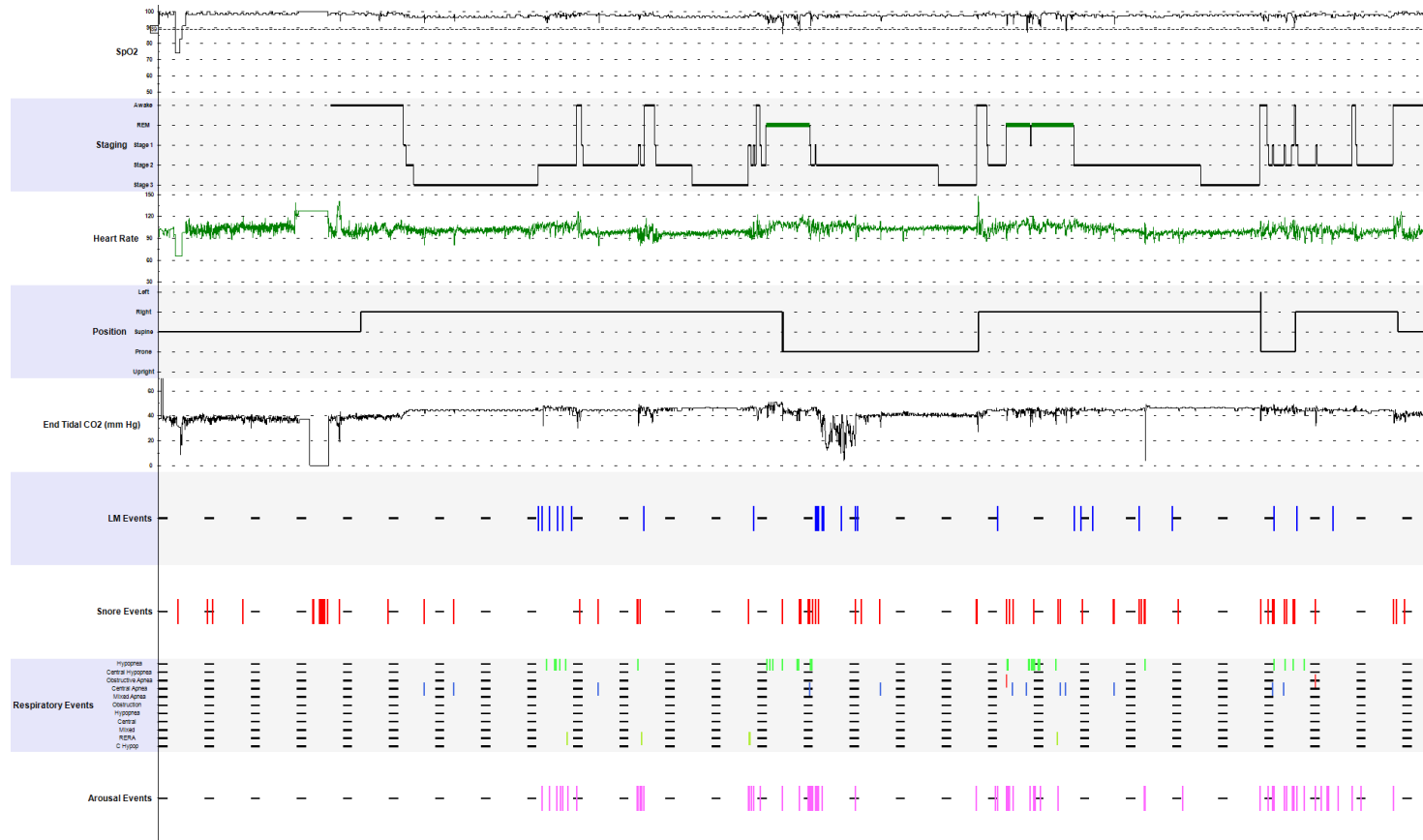
Obstructive Sleep Apnea is a common and treatable condition

- OSA affects 3-5% of children
- Early diagnosis and management may prevent serious sequelae
 - Neurocognitive
 - Growth
 - Cardiovascular
- >60% of children with severe OSA had >12 months of symptoms prior to diagnosis

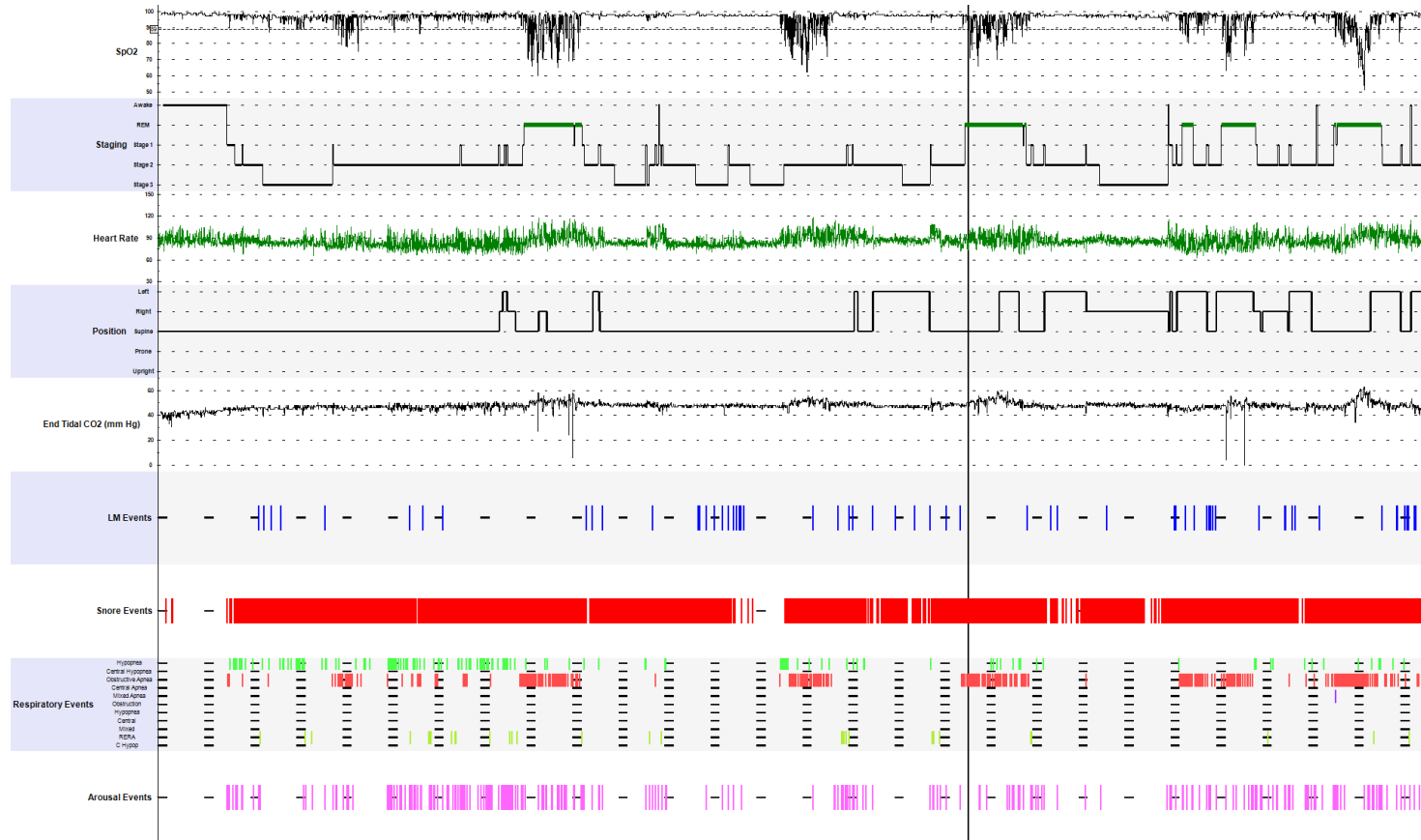


Kilaikode et al. Am J Respir Crit Care Med; American Thoracic Society Meeting, Washington, DC. May 2017

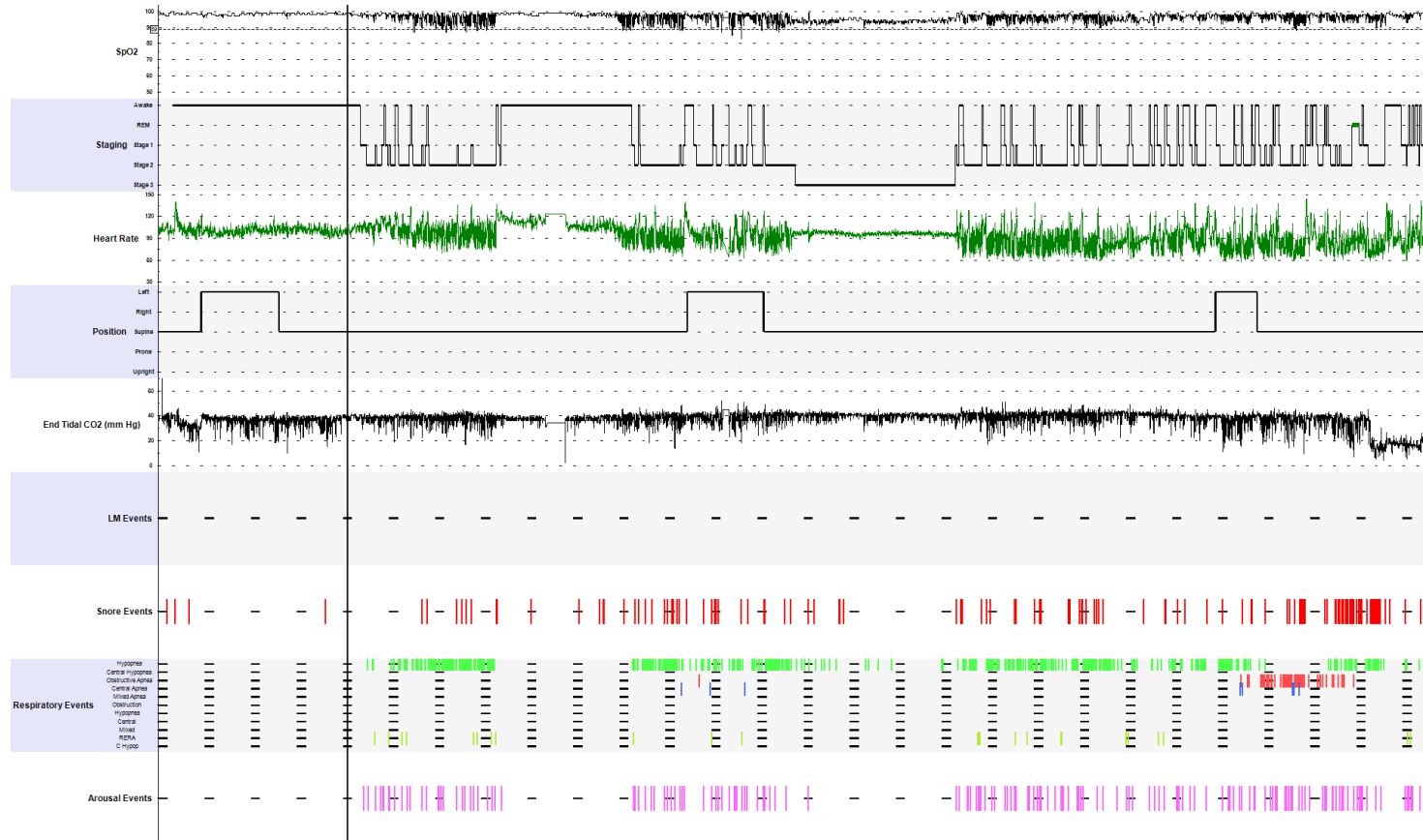
How serious is OSA in children? : Moderate



Severe OSA with desaturations to 50's



Severe OSA with Sleep Fragmentation



Many barriers to picking up these kids...

- Limited visit time, impossible to do everything recommended
- Your to-do list vs parents to-do list
- Patient's with OSA often have many complaints/symptoms
- Vs parents may not even mention snoring
- Where to send the child?
 - ENT? Pulm? Sleep? (Don't they just do sleep studies?)
- WAITING for the appointment or sleep study!
- Missed appointments/sleep studies
- Child won't cooperate with the study (rare)
- Worth it if the parents don't want surgery?

Clinical assessment of sleep breathing disorders



Sleep breathing disorders (SBD)

Risk Factors

- Genetic (Trisomy 21, Achondroplasia, Prader Willi, others)
- Obesity
- Failure to thrive
- Obstructed/narrow airway (Pierre Robin, tonsils)
- Respiratory reserve ↓ (BPD, asthma, sickle cell)
- Systemic and Pulmonary HTN
- Brainstem (Arnold Chiari II)
- Dystrophy and other Neuromuscular diseases

Sleep breathing disorders (SBD)

Daytime Symptoms

- Excessive daytime sleepiness (EDS)
- Napping
- Hyperactivity/ADHD-like
- Moodiness/Irritability
- Poor school performance
- Mouth breathing
- Dry mouth
- Nasal congestion
- Morning headaches

Sleep breathing disorders (SBD)

Nighttime Symptoms

- Snoring
- Gasping/coughing/choking arousals
- Witnessed apnea
- Paradoxic breathing
- Frequent night awakening/restless sleep
- Parasomnias
- Diaphoresis
- Enuresis
- Teeth grinding
- Infants: noisy breathing, stridor, poor feeding, growth

Sleep breathing disorders (SBD)

Physical Exam

Nose

- Swollen nasal mucousa
- Deviated septum
- Nasal atrophy

Face

- Maxillary hypoplasia
- Mandibular hypoplasia
- Micrognathia/retrognathia



Sleep breathing disorders (SBD)

Physical Exam

- **Adenoid Facies**

- Open mouth
- Thin upper lip, larger lower lip
- Elongated face
- Pinched nostrils
- High arched palate
- Depressed nasolabial furrow



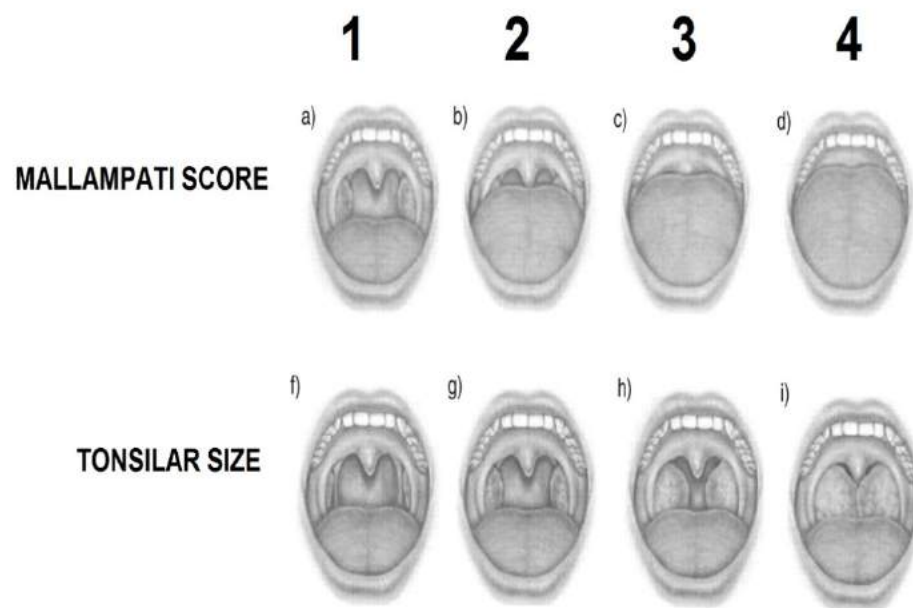
<http://www.e4health.com.au/>

Sleep breathing disorders (SBD)

Physical Exam

Mouth

- Tonsillar hypertrophy
- High-arched palate
- Cross-bite/Overbite
- Crowded oropharynx
- Macroglossia
- Glossoptosis

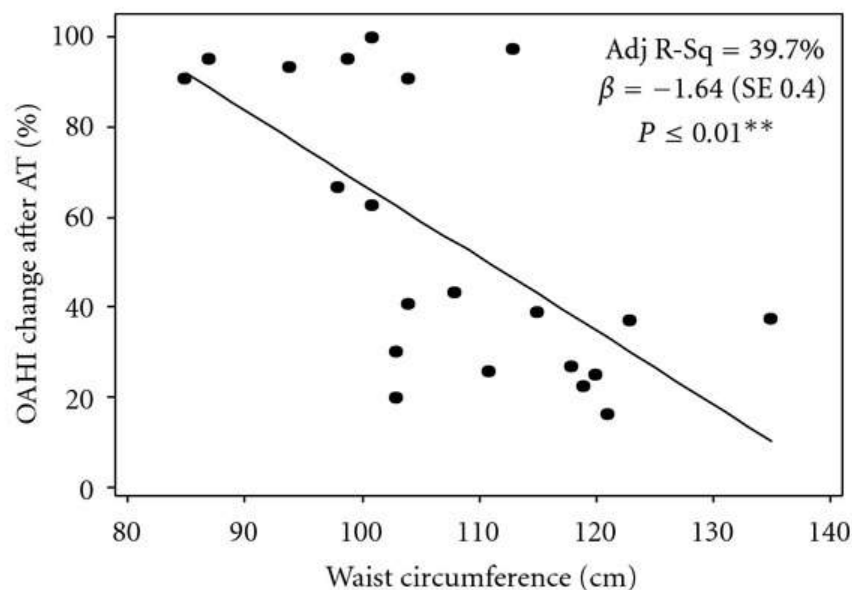


Sleep breathing disorders (SBD)

Physical Exam

Obesity

- BMI
- Neck circumference
- Waist circumference
 - Penn State Child Cohort
 - CHAT study



Nino et al. Pulm Med. 2012: 351037.

Take home pearls: What to do in your visit

Any of the risk factors (GO FOR SBD)

OR

Complaining of any daytime symptoms

OR

Complaining of any nighttime symptoms

OR

Any of the exam findings

=

SCREEN for OSA!

How to screen for OSA

- Minimum: Does your child snore?
 - Caveat: parents don't always know/aren't awake
- Ideal: Ask about all the other signs/symptoms
- Reality – In between?
- Positive screen: Snoring +1

What next?

- A. Order PSG yourself and follow up results
- B. Refer to sleep medicine for CLINIC appointment
- C. Refer directly to ENT

- If primary concern is Insomnia/night waking, parasomnias, excessive sleepiness without snoring etc refer to sleep medicine (no sleep study)

****We review all sleep study orders and may request patient come to clinic first if this is most appropriate****

How to refer to clinic:

- Same as any clinic referral
- Should be to SLEEP MEDICINE (not just pulmonary)
- Can specify behavioral sleep medicine or medical sleep clinic




Specialty Referral Request Form

| Date Requested: _____ | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------|-------------|
| Fax Form To: 202-476-7653 | | | |
| Patient Information | | | |
| Patient Name: | | Patient Date of Birth: | |
| Patient Address: | | Patient City, State, Zip: | |
| Parent Name 1: | | Parent Name 2: | |
| Home Phone: | Cell Phone: | Home Phone: | Cell Phone: |
| Work Phone: | | Work Phone: | |
| Email: | | Email: | |
| Referring Physician Information | | | |
| Referring MD Name: | | Practice Name: | |
| Practice Address: | | | |
| Please indicate your preferred follow-up communication method(s) | | | |
| <input type="checkbox"/> Office Phone: _____ | | <input type="checkbox"/> Cell Phone: _____ | |
| <input type="checkbox"/> Office Fax: _____ | | <input type="checkbox"/> Email: _____ | |
| Requested Specialty Consultation (to be completed by referring provider) | | | |
| Specialty Department: | | Preferred Specialist: <small>First Available</small> | |
| Priority: <input type="checkbox"/> Priority <input type="checkbox"/> Routine | | Preferred Location: <small>First Available</small> | |
| <small>Routine appointment requests are usually available within a month. Priority appointments are available for medically necessary only.</small> | | | |
| Brief History, Symptoms, Pertinent Lab Results, Working Diagnosis, Special Needs: | | | |
| | | | |
| Reason for Referral (please check all that apply) | | Preferred Role (please check all that apply) | |
| <input type="checkbox"/> Clarify or establish diagnosis | | <input type="checkbox"/> Resume full management after consultation | |
| <input type="checkbox"/> Advice on management | | <input type="checkbox"/> Co-manage patient with specialist | |
| <input type="checkbox"/> Diagnostic or therapeutic procedure | | <input type="checkbox"/> Transfer on-going care of patient to specialist | |
| <input type="checkbox"/> Other: _____ | | <input type="checkbox"/> Decide roles after consultation | |

Full consultation note will be available at ChildrensNational.org/Gateway

How to order a sleep study:

 **Children's National Medical Center**
PEDIATRIC SLEEP DISORDERS LABORATORY
SLEEP STUDY REQUEST FORM
Phone: (202) 476-2022 Fax: (202) 476-2981

PATIENT INFORMATION: (may attach demographic sheet)
Name _____ Age _____ Y _____ M _____ Sex: ☐ M ☐ F
Last First MI DOB
Insurance Carrier and ID # _____ Must send copy of insurance card ☐ Dose
Parent's name _____ Address _____
Contact Information: Telephone (Home) _____ (Work) _____ (Mobile) _____ Email _____
Referring Physician _____ Specialty _____ Phone # _____ Fax# _____
Primary Care Physician _____ Ph # _____ Fax# _____
Ordering Physician Signature _____ Date _____

REASON FOR SLEEP STUDY REFERRAL: _____

NOTE: PLEASE ATTACH A COPY OF THE PATIENT'S MOST RECENT CLINICAL ENCOUNTER DOCUMENTING DETAILS OF THE SLEEP HISTORY, PHYSICAL EXAM AND REASON FOR REFERRAL.

PRESENTING COMPLAINTS: (Check all that apply)

| | | | | |
|---------------------------------------------------|-----------------------------------------------|--------------------------------------------------|----------------------------------------------------|------------------------------------------------------|
| <input type="checkbox"/> Loud snoring | <input type="checkbox"/> Night terrors | <input type="checkbox"/> On CPAP/BIPAP | <input type="checkbox"/> Bedtime resistance | <input type="checkbox"/> Restless leg symptoms |
| <input type="checkbox"/> Choking/gasping arousals | <input type="checkbox"/> ALTE | <input type="checkbox"/> Daytime sleepiness | <input type="checkbox"/> Difficulty falling asleep | <input type="checkbox"/> Sleep walking |
| <input type="checkbox"/> Observed apnea in sleep | <input type="checkbox"/> Apnea of prematurity | <input type="checkbox"/> Mood/behavior problems | <input type="checkbox"/> Night awakenings | <input type="checkbox"/> Sleep terrors |
| <input type="checkbox"/> Restless sleep | <input type="checkbox"/> On O2 | <input type="checkbox"/> Attention problems/ADHD | <input type="checkbox"/> Insufficient sleep | <input type="checkbox"/> Circadian rhythm disruption |
| <input type="checkbox"/> Nocturnal diaphoresis | <input type="checkbox"/> On ventilator | <input type="checkbox"/> Academic concerns | <input type="checkbox"/> Inadequate sleep hygiene | <input type="checkbox"/> Nocturnal seizures |
| <input type="checkbox"/> Emaciation | <input type="checkbox"/> Tracheostomy | <input type="checkbox"/> Other | <input type="checkbox"/> Other | <input type="checkbox"/> Other |

RISK FACTORS/MEDICAL CONDITIONS: (Check all that apply)

| | | |
|-----------------------------------------------------|---------------------------------------------------|-------------------------------------------|
| <input type="checkbox"/> Anatomical (the hypotonia) | <input type="checkbox"/> Gastroesophageal reflux | <input type="checkbox"/> Cystic Fibrosis |
| <input type="checkbox"/> SP T&A Date | <input type="checkbox"/> Craniofacial anomalies | <input type="checkbox"/> Prematurity/BPD |
| <input type="checkbox"/> Obesity/BMI | <input type="checkbox"/> Down syndrome | <input type="checkbox"/> Tracheostomy |
| <input type="checkbox"/> Allergies | <input type="checkbox"/> Neuromuscular disease/CP | <input type="checkbox"/> Seizures (type): |
| <input type="checkbox"/> Asthma | <input type="checkbox"/> Developmental delay/MR | <input type="checkbox"/> Other |
| <input type="checkbox"/> Family history OSA | <input type="checkbox"/> Sickle cell disease | |

Previous sleep studies: ☐ Yes ☐ CNMC lab? ☐ Other lab? (if yes, please attach previous sleep study results)

CURRENT MEDICATIONS: _____

POLYSOMNOGRAM REQUESTED: ☐ Elective ☐ Urgent ☐ Pre-op Surgery date _____

☐ PSG 95810 (95782 for < 6 yrs. old) ☐ PSG + CPAP/BIPAP titration (initial) 95811 (95783 for < 6 yrs. old)

☐ PSG + MSLT 95810 + 95805 ☐ PSG + CPAP/BIPAP titration (repeat) 95811 Current settings: _____ (or 95782)

☐ PSG + Saturation montage 95830 or 95782 (or 95783)

☐ PSG + Other (Ventilator, O2, Tracheostomy) 95810 or 95782 (requires referral by a pediatric pulmonologist)

FOLLOW UP (please check one): ☐ CNMC Sleep Clinic ☐ Referring physician ☐ PCP ☐ Other: _____

SPECIAL INSTRUCTIONS: _____

Area Below For Sleep Laboratory Use Only

☐ Sleep Study Request reviewed and approved by Gustavo Nino, MD, Medical Director ☐ Not approved ☐ Approval pending

Comment: _____ Signature: _____ Date: _____ Rev 3/31/15

Form on our website:
<https://childrensnational.org/departments/sleep-medicine>

Treating Children in the Sleep Laboratory

Children's Pediatric Sleep Laboratory performs overnight sleep studies on infants, children and adolescents. During a sleep study, EEG is measured, along with eye movement, to assess sleep stages. Physiologic parameters typically recorded during a sleep study include pulse oximetry, end-tidal carbon dioxide monitoring, nasal and oral airflow, chest wall, abdominal and limb movement, ECG, and other parameters as indicated. This testing evaluates the presence and severity of central apnea, obstructive apnea, and other respiratory events during sleep.

CPAP/BIPAP titration is performed for patients with obstructive sleep apnea who require non-surgical intervention. Sleep studies also are performed to evaluate the need for nocturnal oxygen in patients with lung disease and the need for nocturnal ventilator support in patients with neuromuscular weakness.

Children's sleep laboratory is a four-bed facility featuring testing equipment for diagnostic polysomnography and therapeutic application of CPAP/BIPAP. The lab is open Monday through Saturday and conducts overnight sleep studies and daytime multiple sleep latency tests by appointment. More than a thousand pediatric sleep tests are performed annually.

For appointments, complete our [Sleep Study Order Form](#). To see what information we'll need as you prepare for a visit to our sleep clinic, review our [questionnaire](#).

Helpful Websites on Sleep Medicine



Things to know when ordering a sleep study

- PLEASE HIGHLIGHT ANY KNOWN SYNDROMES OR BEHAVIOR CONCERNS

- Autism, Down syndrome etc
- Mark here and/or include prominently in note.

- Important so they are scheduled for 1:1 tech

- Also 1:1 for children 3.5 years and under

DETAILS OF THE SLEEP HISTORY, PHYSICAL EXAM AND REASON FOR REFERRAL
PRESENTING COMPLAINTS: (Check all that apply)

| | | | | |
|---------------------------------------------------|-----------------------------------------------|----------------------------------------------------|----------------------------------------------------|------------------------------------------------------|
| <input type="checkbox"/> Loud snoring | <input type="checkbox"/> Cyanosis/hypoxia | <input type="checkbox"/> On CPAP/BiPAP | <input type="checkbox"/> Bedtime resistance | <input type="checkbox"/> Restless legs symptoms |
| <input type="checkbox"/> Choking/gasping arousals | <input type="checkbox"/> ALTE | <input type="checkbox"/> Daytime sleepiness | <input type="checkbox"/> Difficulty falling asleep | <input type="checkbox"/> Sleepwalking |
| <input type="checkbox"/> Observed apneas in sleep | <input type="checkbox"/> Apnea of prematurity | <input type="checkbox"/> Mood/behavior problems | <input type="checkbox"/> Night awakenings | <input type="checkbox"/> Sleep terrors |
| <input type="checkbox"/> Restless sleep | <input type="checkbox"/> On O2 | <input type="checkbox"/> Attention problems (ADHD) | <input type="checkbox"/> Insufficient sleep | <input type="checkbox"/> Circadian rhythm disruption |
| <input type="checkbox"/> Nocturnal diaphoresis | <input type="checkbox"/> On ventilator | <input type="checkbox"/> Academic concerns | <input type="checkbox"/> Inadequate sleep hygiene | <input type="checkbox"/> Nocturnal seizures |
| <input type="checkbox"/> Enuresis | <input type="checkbox"/> Tracheostomy | <input type="checkbox"/> Other | <input type="checkbox"/> Other | <input type="checkbox"/> Other |

RISK FACTORS/MEDICAL CONDITIONS: (Check all that apply):

| | | |
|-----------------------------------------------------|---------------------------------------------------|-------------------------------------------|
| <input type="checkbox"/> Adenotonsillar hypertrophy | <input type="checkbox"/> Gastroesophageal reflux | <input type="checkbox"/> Cystic fibrosis |
| <input type="checkbox"/> S/P T&A Date | <input type="checkbox"/> Craniofacial anomalies | <input type="checkbox"/> Prematurity/BPD |
| <input type="checkbox"/> Obesity BMI | <input type="checkbox"/> Down syndrome | <input type="checkbox"/> Tracheostomy |
| <input type="checkbox"/> Allergies | <input type="checkbox"/> Neuromuscular disease/CP | <input type="checkbox"/> Seizures (type): |
| <input type="checkbox"/> Asthma | <input type="checkbox"/> Developmental delay/MR | <input type="checkbox"/> Other |
| <input type="checkbox"/> Family history OSA | <input type="checkbox"/> Sickle cell disease | |

Things to know when ordering a sleep study

- Almost always order PSG
 - If considering something else (MSLT, titration) should probably see us first
 - Seizure montage is extra leads but not a full EEG
- Follow up: Not automatic

POLYSOMNOGRAM REQUESTED: ☐ Elective ☐ Urgent ☐ Pre-op Surgery date _____

☐ PSG 95810 (95782 for < 6 yrs. old) ☐ PSG + CPAP/BiPAP titration (initial) 95811 (95783 for < 6 yrs. old)

☐ PSG + MSLT 95810 + 95805 ☐ PSG + CPAP/BiPAP titration (repeat) 95811 Current settings: _____
(or 95782) (or 95783)

☐ PSG + Seizure montage 95810 or 95782

☐ PSG + Other (Ventilator, O2, Tracheostomy) 95810 or 95782 (requires referral by a pediatric pulmonologist)

FOLLOW UP (please check one): ☐ CNMC Sleep Clinic _____ ☐ Referring physician ☐ PCP ☐ Other: _____

Things to know when ordering a sleep study

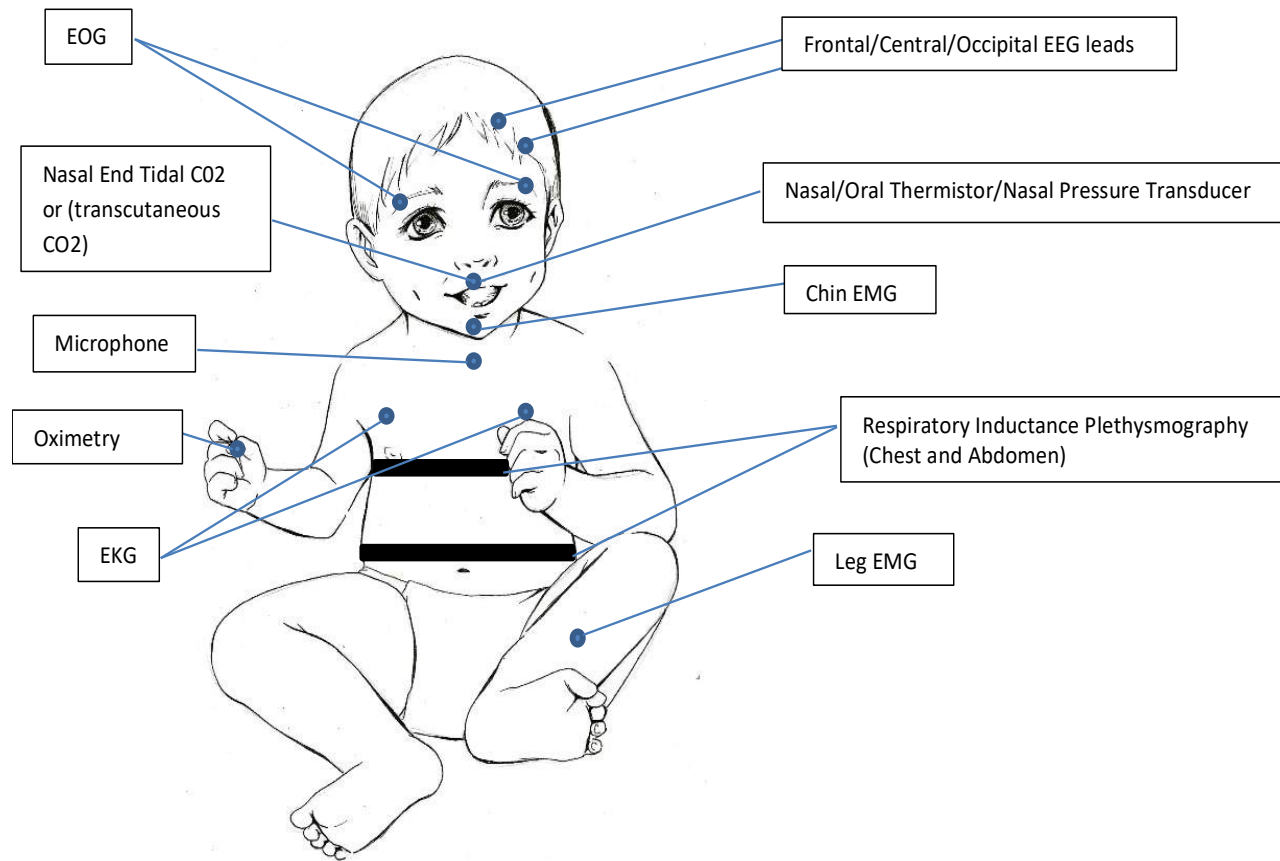
- Include last history and physical exam note
 - Cardiopulmonary issues
 - Behavioral issues
 - Bedwetting
 - Tonsils size/airway
 - T&A date
- Previous sleep study or EEG

What do I do with the results?

- You order PSG → You inform patient and act on results
 - Can always refer back to us (normal to severe)
 - If severe/urgent we will likely contact you, may arrange for patient to see us.
- We order PSG → We will follow up, refer to ENT, order CPAP etc.
- **Checking follow up at CNMC Sleep Clinic does not get them a follow up. They still need a referral and parents to call for an appointment.**

Polysomnographic assessment of sleep breathing disorders

Polysomnogram (PSG) leads



PSG is essentially a Respiratory Test

- Simultaneous multi-channel assessment of respiratory function...
 - Upper airway flow
 - Breathing effort (Chest/abd)
 - Gas-exchange (O_2/CO_2)
- ...In the context of sleep stages
 - Wake
 - Non-REM (NREM)
 - REM
- **Also EKG, limb movements, video, microphone**

Polysomnography: Key Results

Sleep Architecture and EEG

- sleep latency/total sleep time, stages, seizure activity
- One night snapshot (First night effect: REM often delayed)

Limb Movements

- $PLMI \geq 5/hr$ + CLINICAL SYMPTOMS = PLMD

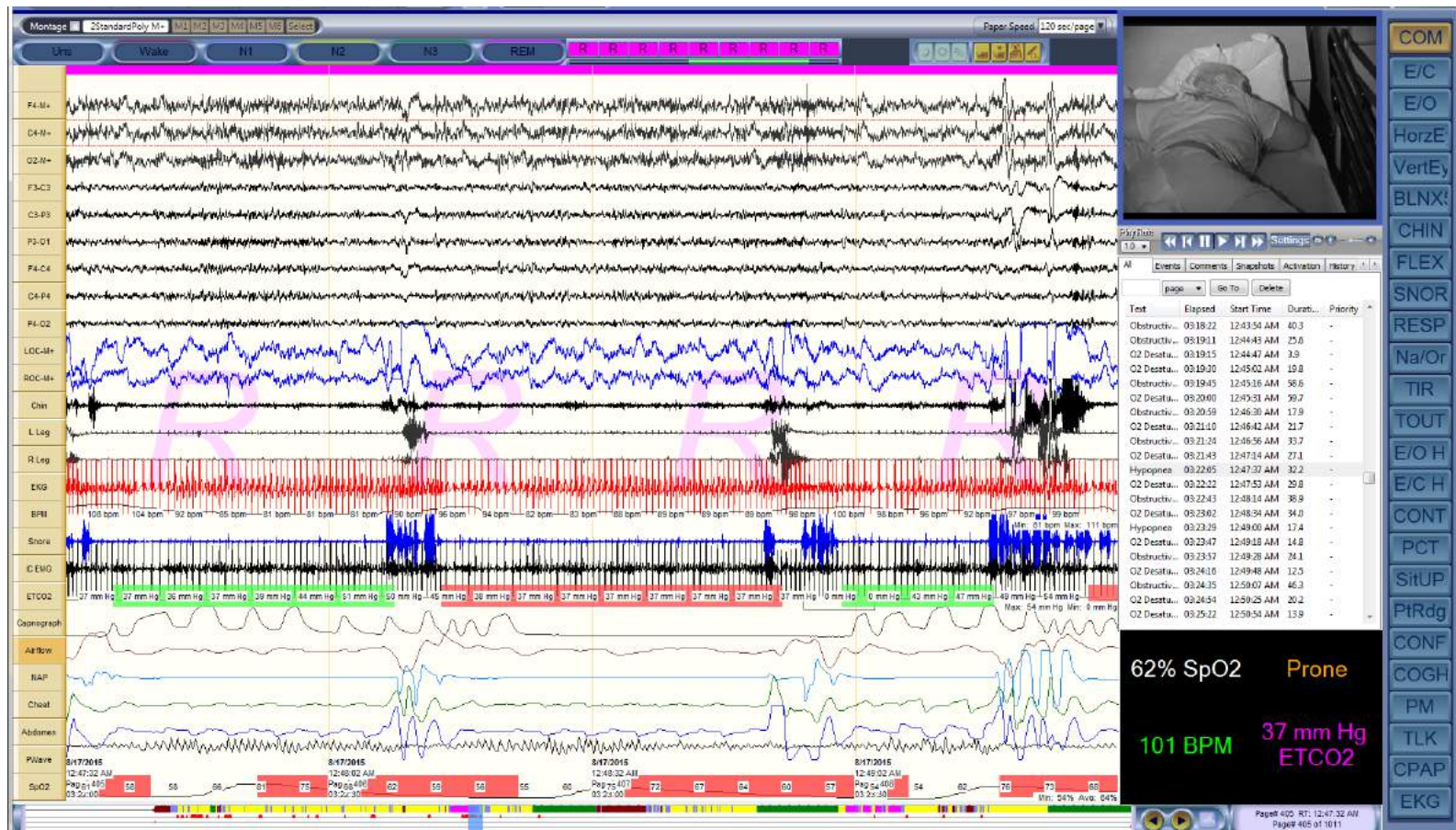
Obstructive apnea/hypopnea index (OAHl) - Pediatric

- 1.5/hr- 5/hr Mild OSA
- 5/hr-10/hr Mod OSA
- >10/hr Severe OSA
- Adult cut offs are different

Respiratory status:

- Pulse-oxymetry (% above 90%, nadir)
- Nocturnal hypoventilation ($CO_2 > 50mmHg$ >25%)

120 Sec Epoch Respiratory Events



PSG is not for:

- Insomnia
- Restless legs
- Normal parasomnias
- Nightmares
- Bedtime resistance
- Narcolepsy or idiopathic hypersomnia
- Telling if the patient has enough deep sleep or REM sleep

****All of these patients should come to sleep clinic instead!****

OSA therapeutic approaches

Snoring Child with OSA is AT necessary?

¹The Childhood Adenotonsillectomy Trial (CHAT)

- No difference in the attention and executive-function on Neuropsychological Assessment.

²No significant change in fasting glucose, insulin, lipids, CRP, BP or HR

- Greater improvements in the early-AT group than in the watchful-waiting group based on:
 - Behavioral and quality-of-life scores
 - Polysomnographic findings
 - Symptoms

1. Marcus et al. NEJM 2013
2. Quante et al. SLEEP. 2015

Snoring Child with OSA is AT necessary?

¹Complications (7%)

- 1.4% respiratory complications including pulmonary edema, hypoxemia and bronchospasm.
- 5.9% had non-respiratory complications, including dehydration (4.5%), hemorrhage (2.3%) and fever (0.5%).

²Spontaneous resolution (42%)

- Lower AHI, better oxygen saturation, smaller waist circumference, higher-positioned soft palate, smaller neck circumference, and non-black race

³ After AT weight gain may trigger obesity in overweight children

1. Konstantinopoulou et al. Int J Pediatr Otorhinolaryngol. 2015
2. Chervin et al. CHEST. 2015
3. Katz et al Pediatrics 2014

Is PSG necessary prior to AT?

- Increased risk of AT postoperative respiratory compromise:
 - SaO₂ nadir 80%, CO₂ peak ≥ 60 mmHg
 - OAHl ≥ 24 /hour
- Children at highest risk of persistent OSAS after AT:
 - Obese
 - High preoperative AHI (especially those with an AHI ≥ 20 /hour)
 - Children >7 years of age

Clinical Practice Guideline: Tonsillectomy in Children (Update)

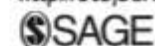
**Ron B. Mitchell, MD¹, Sanford M. Archer, MD²,
Stacey L. Ishman, MD, MPH³, Richard M. Rosenfeld, MD, MPH, MBA⁴,
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2019 Tonsillectomy Guidelines

- Ask about comorbid conditions that may improve after AT
 - Growth retardation, poor school performance, enuresis, asthma, behavioral problems
- Refer for PSG first if children are < 2 years old or have obesity, trisomy 21, craniofacial abnormalities, neuromuscular disorders, sickle cell disease or mucopolysaccharidoses
- Advocate for PSG prior to AT for children without above in whom need for AT is uncertain or there is discordance between PE and reported severity of OSA

2019 Tonsillectomy Guidelines

- Recommend tonsillectomy for children with OSA documented on PSG
- Explain that OSA may persist or recur after AT and may require further management
- Arrange for overnight inpatient monitoring for children < 3 years old or with severe OSA (OAHI > 10, nadir < 80% or both)

OSA Therapy Beyond Adenotonsilectomy

- **Severe or symptomatic OSA**
 - CPAP
 - Tracheostomy
- **Non-surgical options**
 - Nasal steroids (6 wks)
 - Leukotriene receptor antagonists (12 wks)
 - Rapid Maxillary Expansion and Oral Appliances
 - Effective in selective patients

Pearls for CPAP Therapy

- **Needs an office visit**
 - Do not just order “the machine”
- **Review and explain results**
- **Review treatment options, CPAP**
 - Need family buy-in
- **Assess readiness for CPAP**
 - Start CPAP now vs. titration
 - Mask fitting
 - Desensitization
- **Close follow up:**
 - Correct/adequate use
 - Titrate pressures



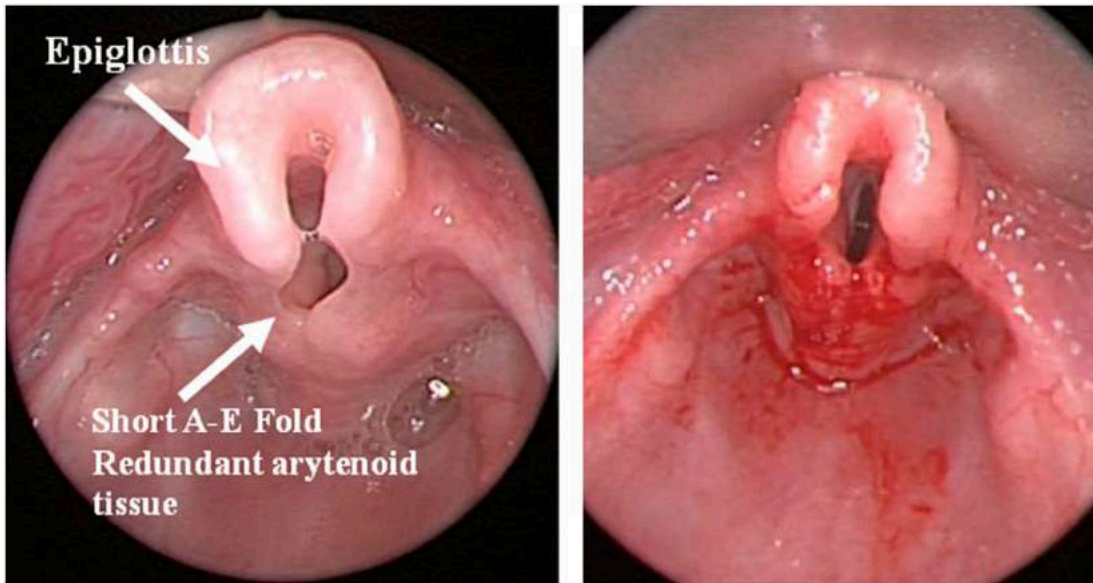
Patient is ready for CPAP titration

Snoring Child with OSA Therapy beyond AT

Rapid Maxillary Expansion



Severe OSA in Infants



Laryngomalacia and supraglottoplasty

Severe OSA in Infants



Pierre Robin (Retrognathia-Glossoptosis)

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Restless Legs Syndrome (RLS)

Periodic Limb Movement Disorder (PLMD)

- RLS is a clinical diagnosis involving uncomfortable sensations in the limbs that are relieved by movement.
 - In a referred sleep disorder sample of 538, 28% were diagnosed with RLS. Inattention was present in 25% and low serum ferritin below 50 was present 83%. Kotagal S., et al. Annals of Neurology. 56(6):803-7, 2004 Dec

RLS/PLMD Treatment

- When Ferritin <50 mcg/ml, Iron supplementation (3-6 mg/kg of elemental iron), ferrous sulfate or ferrous gluconate may be efficacious for the treatment of RLS/PLMD.
Simakajornboon N., et. Al. Sleep. 26(6):735-8, 2003

Behavioral Sleep Problems

- Sleep disorders that respond to interventions that are based on behavioral and psychological principles
- Sleep problems associated with life style or mental health issues that require assessment and treatment

Behavioral Insomnias of Childhood (BIC)

➤ Sleep Onset Association Disorder

- Sleep onset at bedtime or the middle of the night will not occur w/out cue

➤ Limit Setting Sleep Disorder

- Delayed bedtime
- Parents reinforce undesirable behavior at bedtime
- Inconsistent Limit setting
- Otherwise normal nocturnal sleep

American, S. D. A. (1997). The International Classification of Sleep Disorders Diagnostic and Coding Manual, Revised. Rochester, MN, American Sleep Disorders Association

Mindell, J. A. (1999). "Empirically supported treatments in pediatric psychology: bedtime refusal and night wakings in young children." J Pediatr Psychol 24(6): 465-81.

Date of Sleep Record: From _____ To _____

Core
24.0

2. Mark bedtimes with down arrows

| Day | Activity | Transition | Activity | Transition | Activity | Transition | Activity |
|------|----------|------------|----------|------------|----------|------------|----------|
| Mon | Sleep | ↑ | Nap | ↑ | Sleep | | |
| Tues | Sleep | ↓ | Nap | ↑ | Sleep | ↑ | Sleep |

4. Mark wake-up times with up arrows

| Day of Week | ↓ Midnight | | | | | | | | | | | ↓ Noon | | | | | | | | | | | | | |
|-------------|------------|----|----|----|----|----|----|----|----|----|-----|--------|-----|----|----|----|----|----|----|----|----|----|-----|-----|--|
| | 12a | 1a | 2a | 3a | 4a | 5a | 6a | 7a | 8a | 9a | 10a | 11a | 12p | 1p | 2p | 3p | 4p | 5p | 6p | 7p | 8p | 9p | 10p | 11p | |
| Sun | | | | | | | | | | | | | | | | | | | | N | N | | | | |
| Mon | | | | | | | | | | | | | | | | | | | | N | N | | | | |
| Tu | | | | | | | | | | | | | | | | | | | | N | N | | | | |
| We | | | | | | | | | | | | | | | | | | | | N | N | | | | |
| Th | | | | | | | | | | | | | | | | | | | | N | N | | | | |
| Fri | | | | | | | | | | | | | | | | | | | | N | N | | | | |
| Sat | | | | | | | | | | | | | | | | | | | | N | N | | | | |
| Sun | | | | | | | | | | | | | | | | | | | | N | N | | | | |
| Mon | | | | | | | | | | | | | | | | | | | | N | N | | | | |
| Tu | | | | | | | | | | | | | | | | | | | | N | N | | | | |
| We | | | | | | | | | | | | | | | | | | | | N | N | | | | |
| Th | | | | | | | | | | | | | | | | | | | | N | N | | | | |
| F | | | | | | | | | | | | | | | | | | | | N | N | | | | |

Special Observations and Notes: _____



Treatment

Behavioral Insomnias of Childhood

- Identify and eliminate cues that delay an independent wake-sleep transition
- Positive Routines
- Sleep hygiene training
- Establish appropriate bed times
- Establish appropriate bedtime routines

Insomnia: Essential Features

“Frequent and persistent difficulty initiating or maintaining sleep that results in general sleep dissatisfaction...despite adequate sleep opportunity”

International Classification of Sleep Disorders, 3rd Edition., American Academy of Sleep Medicine, Darien, Illinois (2014), p. 23

Cognitive Behavior Therapy for *Insomnia* (*CBTI*)

- Sleep Hygiene
 - Sleep related habits
- Sleep Education
 - Awakenings are normal
 - Optimal bedtimes and sleep duration
- Stimulus Control
 - Decrease wake time in bed
 - Get rid of clocks
- Cognition
 - Negative labels and predictions about sleep
- Sleep Restriction
 - Sleep time and timing - Set to specific hours.
- Relaxation Therapy
 - Tools to decrease physiological and cognitive activation

Sleep Hygiene

- Establish Sleep as a priority (time limited)
- Regular bed & wake times
- Regulate napping
- Eliminate or regulate caffeine habit
- Eliminate stimulating behavior before bedtime
- No electronic media use within a half hour of bedtime
 - Negotiation point
- Quiet time & close time
- Establish an early evening worry time

Circadian Rhythm Disorder

Delayed Sleep Phase Syndrome

- Definition:
A shift of the sleep phase to a later period that conflicts with academic and work schedules & social norms
- Prevalence:
affects 7% of adolescents

Morning Vs. Evening Chronotype

Morbidity

| | Evening Chronotype |
|-------------------------|--------------------|
| Psychological Disorders | OR=1.9, |
| Diabetes | OR=1.3, |
| Neurological Disorders | OR=1.3 |
| GI/Abdominal | OR=1.2 |
| Respiratory | OR=1.2 |

Mortality

| | Evening Chronotype |
|------------------------|--------------------|
| All cause | OR=1.1 |
| Cardiovascular disease | OR=1.04 |

Kristen L. Knutson & Malcolm von Schantz (2018) Associations between chronotype, morbidity and mortality in the UK Biobank cohort, Chronobiology International, 35:8, 1045-1053, DOI: 10.1080/07420528.2018.1454458

Case Study: Brandon

- 16-year-old boy
- Presenting complaint
 - Missed 30+ days of school, scheduled truancy hearing
 - Does not get up for school
 - Cannot fall asleep at night
- Medical History
 - Unremarkable
- Psychiatric History
 - Long history of academic problems
 - Possible history of depression

TWO-WEEK SLEEP RECORD

PATIENT'S NAME _____ PARENT'S NAME _____
 PATIENT'S DATE OF BIRTH _____ ADDRESS _____
 DATE OF SLEEP RECORD: FROM _____ TO _____ TELEPHONE NUMBER _____

INSTRUCTIONS:

| | | | |
|-----------------------------------------------------------|-----------|-------------------------------------------------------------------------------------------------|-----------|
| Leave blank the periods your child is awake. | | Mark your child's bedtimes with downward-pointing arrows, ↓ | |
| Mon | ↓ sleep ↓ | ↓ nap ↓ | ↓ sleep ↓ |
| Tue | ↓ sleep ↓ | ↓ nap ↓ | ↓ sleep ↓ |
| Fill in the times your child is asleep with shaded boxes. | | Mark the times your child gets up in the morning and after naps with arrows pointing upwards, ↑ | |

4/17

| Day | Midnight | 2:00 | 4:00 | 6:00 | 8:00 | 10:00 | Noon | 2:00 | 4:00 | 6:00 | 8:00 | 10:00 | Midnight |
|-------|----------|------|------|------|------|-------|------|------|------|------|------|-------|----------|
| SUN | | ↓ | ↑ | ↓ | ↓ | ↓ | ↓ | ↑ | ↓ | ↓ | ↓ | ↓ | ↑ |
| MON | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↑ |
| TUES | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↑ |
| WEDS | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↑ |
| THURS | ↑ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↑ |
| FRI | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↑ |
| SAT | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↑ |
| SUN | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↑ |
| MON | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↑ |
| TUES | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↑ |
| WEDS | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↑ |
| THURS | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↑ |
| FRI | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↑ |
| SAT | | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↑ |

SPECIAL OBSERVATIONS AND NOTES: _____

A-6c

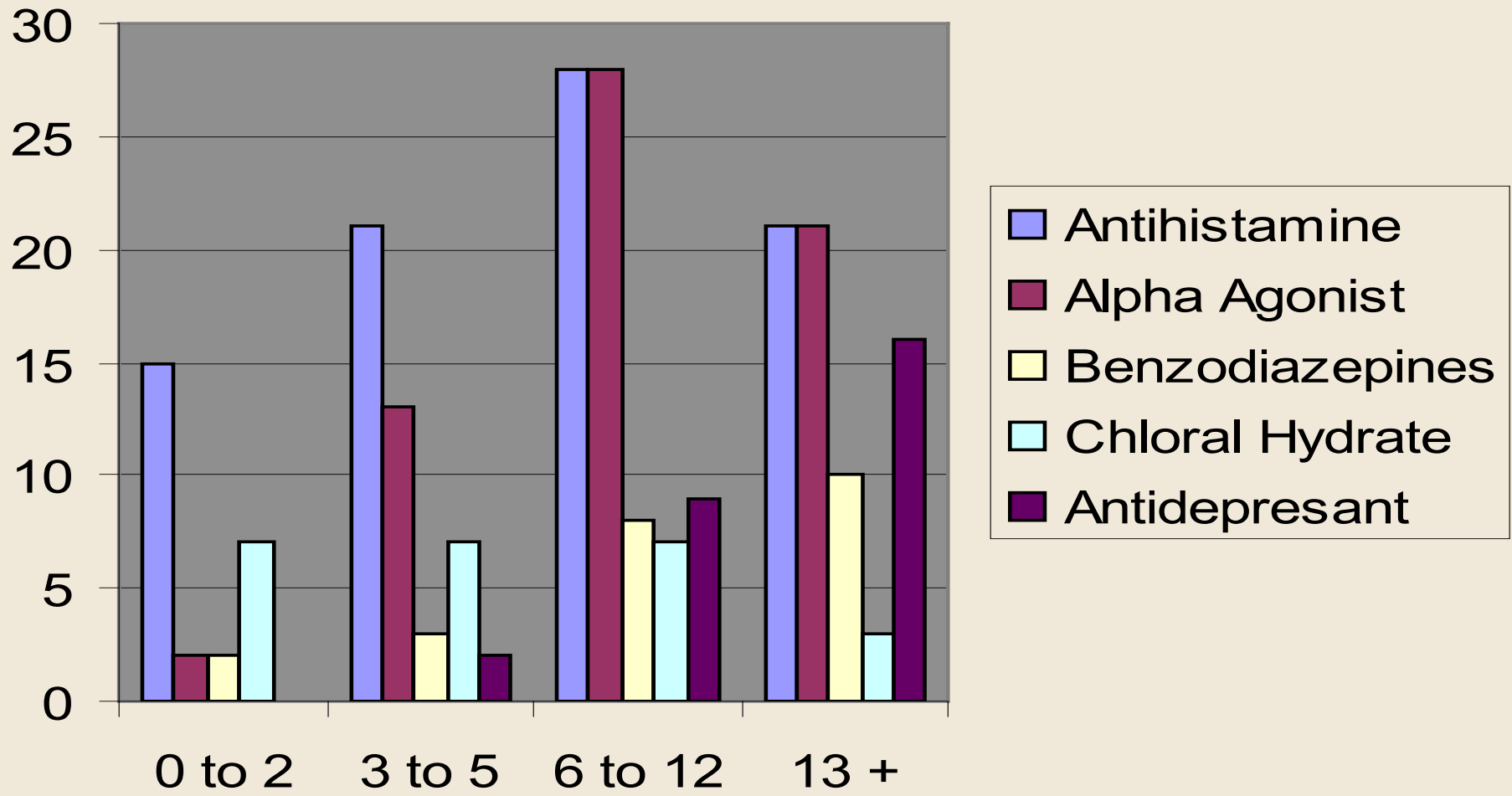
225
87



Delayed Sleep Phase Treatment

- Motivation???
- Gradual wake time advance
- Melatonin (4-5 hours before bedtime)
- Light
- Temperature

Percentage of Physicians Prescribing Specific Medications for Sleep Problems



Owens, Rosen, Mindell 2002

Indications For Use of Sedative Hypnotics in Pediatric Populations

- Pain
- Acute trauma
- Major life stressor
- Severe developmental disability
- Recurrent high risk parasomnias
- ?Short term use in treatment resistant insomnia?



100% Natural Melatonin

WORLDWIDE LABS

Pure, 100% Natural Melatonin

Melatonin

Pure, 100% Natural Melatonin

100% Natural Melatonin

Daniel S. Lewin, Ph.D., D.ABSM
Children National Medical Center, Washington, DC
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THANK YOU

Pediatric Sleep Resources & Suggested Bibliography

- American Academy of Sleep Medicine - AASM.org
- National Institutes of Health - Starsleep.nhlbi.nih.gov
- National Sleep Foundation - Sleepfoundation.org
- A Clinical Guide to Pediatric Sleep: Diagnosis and Management of Sleep Problems (Jodi Mindell & Judith Owens)
- Sleeping Through the Night – Jodi Mindell
- Solve Your Child's Sleep Problems - Richard Ferber