

Pediatric Insomnia Across Development

Elizabeth Super, MD
 Assistant Professor, Department of Pediatrics
 OHSU Sleep Disorders Program

Disclosures

- No consultations to industry
- No present involvement on speaker's bureaus



Objectives

1. Frame issues for treatment of behavioral insomnia of childhood.
2. Increase familiarity with tools used to treat behavioral insomnia of childhood.
3. Identify Delayed Sleep Phase Syndrome in adolescents.
4. Discuss off label use of melatonin for pediatric insomnia.



- By age two: 9500 hours or 13 months
- Childhood and adolescence: 40% of the day
- Average 30 year old adult: 10 years

- Approximately **25%** of all children experience some type of sleep problem
- Most common problems are *bedtime resistance* and *night time awakenings*
- Sleep problems are more prevalent in children with chronic medical, neurodevelopmental and psychiatric conditions


Classification and Epidemiology of Childhood Sleep Disorders,
 Owens J: Primary Care: Clinics in Office Practice 35 (2008) 533-546

Age	Average Sleep	Sleep Patterns
Newborn	16-20 h	1-4 hr sleep periods, following 1-2 hr wake periods; Day=night sleep
Infants	14-15 hr @ 4 mo 13-14 hr at 6 mo	6-8 hr periods @ 4-6 mo Day/night differentiation develops between 6-12 wks 70-90% of babies "settle" (sleep through the night at 9 mo of age) Naps 2-4 h in two naps per day
Toddlers (1-3 years)	12 hr	Naps 1.5-3.5 hr
Preschool (3-6 years)	11-12 hr	Napping declines, most stop by 5 years
6-12 yr	10-11 hr	Low levels of daytime sleepiness
>12 yr	9 hr	Often irregular sleep schedule Circadian phase delay postpuberty

*Mindell JA, Owens JA. A Clinical Guide to Pediatric Sleep, Diagnosis and Management of Sleep Problems. Philadelphia, PA: Lippincott, Williams & Wilkins; 2004.

WHEN will they sleep through the night?


- 6 month olds: 20-30%
- 4 year olds: 70%
- Sleeping through the night is a milestone that is not always maintained once it has been reached



Moore T, Ucko C. Night waking in early infancy: Part I. Arch Dis Child 1957;32:333-42.
Adair RH, Bauchner H. Sleep problems in childhood. Curr Probl Pediatr 1993;23:147-70.


Consequences of Insufficient or Disrupted Sleep are Serious!

- Cognitive functioning
- Mood disturbance
- Inattention, hyperactivity, irritability
- Family disruption




*Fallone G, Owen JA, Deane J. Sleepiness in children and adolescents: clinical implications. Sleep Med Rev 2002;6 (4):287-306

Outline



- Sleep Basics
- **Behavioral Insomnia of Childhood**
- Delayed Sleep Phase Syndrome
- Off Label Use of Medication
- Screening Tools, Resources


Behavioral Insomnia of Childhood, Sleep Association Type




Difficulty falling asleep and returning to sleep in the absence of specific environmental conditions

Behavioral Insomnia of Childhood, Sleep Association Type:

- Excessive crying at bedtime or upon awakening if parents do not respond in the usual manner
- Quick sleep onset after the usual conditions are established



- Few universally "right" or "wrong" associations with sleep onset
- Association can be inadvertently reinforced by sleep deprived parents



Maladaptive Sleep Onset Association?



http://www.youtube.com/watch?v=sQ_FWrzKbr8

**Behavioral Insomnia of Childhood:
Limit Setting Type**

- Inadequate enforcement of limits at bedtime
- Child stalls and refuses to go to bed
- Sleep is delayed, resulting in inadequate sleep to meet child's needs



A problem when....

- Delayed sleep onset/frequent awakenings
- Increased attention needed to help child fall back asleep
- Changes in daytime mood/attention
- Parents losing sleep
- Parent-child relationship difficulties
- Unable to keep child in own room

Reframing the Issues for Parents

- Associations with falling asleep are learned
- A problem may exist if the associations involve the parent
- Awakenings during the night are normal
- New sleep-onset associations can be taught
- Education regarding importance of adequate sleep

Behavioral Insomnia: Treatment

- **Extinction**
 - Ignore until morning unless ill or in danger
 - Problem of post-extinction response bursts
- **Graduated extinction**
 - Popularized by Ferber
 - Extinction plus periodic parental checks
- **Extinction with parental presence**

All need routine bedtime with positive bedtime routine!

Kuhn and Elliott, J Psychosomatic Research, 54 (2003)

Extinction Procedures-Benefits

- They work!
- Improved parental stress & mood
- No harm to child
 - Emotional status
 - Parent-child relationship



Practice Parameters for Behavioral Treatment of Bedtime Problems and Night Wakings in Infants and Young Children. An American Academy of Sleep Medicine Report, Sleep 2006; 29 (10):1277-1281

Prevention:

1. Have a **bedtime routine** from day one of life!
2. Make middle of the night feedings boring and keep the lights dark.
3. Incorporate an attachment object in your bedtime routine.
4. At 6-12 weeks put your baby down **drowsy but awake**.

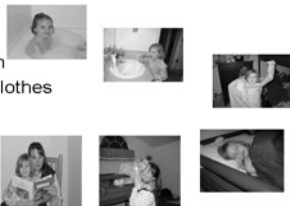
Behavioral Insomnia of Childhood, Limit Setting Type Treatment



- Firm limits with *consistency*
- Bedtime chart for both parents and children
- Use of Bedtime Pass
- Positive reinforcement for child
- Sleep logs for progress

Kara's Bedtime Routine

- Bath
- Teeth
- Nightgown
- Choose Clothes
- Story
- Kiss
- Sleep



For kids age 3-10



Two components:

- *Card exchangeable for one trip out of room
- ***Extinction**

JOURNAL OF APPLIED BEHAVIOR ANALYSIS 2006, 39, 423-428 NUMBER 4 (WINTER 2006)
TREATING BEDTIME RESISTANCE WITH THE BEDTIME PASS: A SYSTEMATIC REPLICATION AND COMPONENT ANALYSIS WITH 3-YEAR-OLDS
 KURT A. FREEMAN
CHILD DEVELOPMENT AND REHABILITATION CENTER OREGON HEALTH & SCIENCE UNIVERSITY

Sleep Diary

Name: _____ DOB: / / Health professional: _____ Unit #: _____
 Date started: / / Comments: _____
 List medications: _____

Day	Midnight												Wakeup					Comments							
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11		12	1	2	3	4	5	

THE MOST COMMON CAUSE OF SLEEPINESS IN THE ADOLESCENT IS LACK OF SLEEP.



Adolescent Sleep Changes

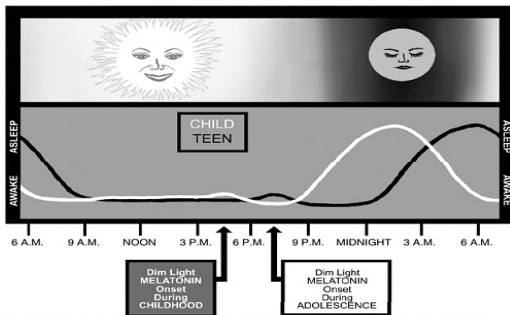
- Pre-adolescents need 10-11 hours of sleep.
- Adolescents entering puberty need 9-9.5 hours of sleep.



Adolescent Changes

- Two hour physiologic sleep phase **delay** in adolescents.
- In 1993, Carskadon demonstrated that circadian phase preference was **delayed** in association with more mature Tanner Stages in 6th grade girls.
- Offset time of melatonin secretion in the morning was significantly correlated with Tanner stage.

Terman, et al. The sleep of school children: its distribution according to age, and its relation to physical and mental efficiency. J Educ Psychol. 1913; 4:138-147.
Carskadon MA. Association between Puberty and delayed phase preference. Sleep. 1993; 16:258-262.



Teens aren't getting enough sleep...

- External factors of school start times, sports, work.
- Catch up sleep on weekends can exacerbate sleep problems.
- Among high school students, only 5% had a school-night bedtime set by their parents.



Wolfson. Sleep Schedules and daytime functioning in adolescents. Child Dev. 1998; 69:875-887.

Consequences of Inadequate Sleep

- Alertness and vigilance become unstable and unreliable.
- Cognitive capabilities slow down
- Emotional lability



TAKING A QUICK SLEEP HISTORY (.bears)

- Bedtime problems: ***?
- Excessive daytime sleepiness: ***?
- Awakenings during the night: ***.
- Regularity and Duration of sleep: ***?
- Sleep disordered breathing: ***?



HISTORY!

- Sleep environment: How many people are in the same room? How noisy is the room? Is there a TV in the room? Ipod? Cell Phone? Video Games?
- Bedtime routine: TV, time to fall asleep, reading?
- Sleep Behaviors: sleepwalking, nightmares, restless sleeping, bedwetting, frequent awakenings, snoring?
- Daytime Behaviors: unrefreshing sleep, difficulty waking? Naps? Caffeine? OTC meds.
- New stressors producing worries or fears? History of psychiatric trauma?
- Weekday vs. weekend schedules. KEEP ASKING!
- Changes in mood, school functioning, or cognitive abilities?

Delayed Sleep Phase Syndrome

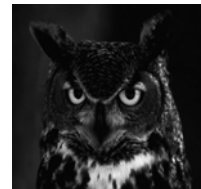
- Circadian based disorder in which patient's internal circadian pacemaker is not in synchrony with external or environmental time.
- Affected adolescents have difficulty in initiating and terminating sleep at "normal" time.
- Frequently occurs after long periods in which the sleep-wake cycle is delayed by more than two hours, such as during summer vacations.

Delayed Sleep Phase Syndrome

- Sleep onset is delayed, but sleep quality is normal on PSG.
- Signs of sleep deprivation become evident as the teen cannot readjust to normal sleep schedule.
- Headaches, daytime fatigue, irritability, emotional lability, and cognitive/attention deficits can be present.
- Diagnosis based on clinical history and sleep logs.

Delayed Sleep Phase Syndrome

- Major cause of insomnia in teens
- Thought that 7% of adolescents suffer from disorder.
- Incidence in general population estimated at 0.7% of middle age adults



Treatment Options

- Depends on **sleep onset times**:
- If sleep onset is *2-3 hours later* than the desired bedtime (that would produce the ideal 9 hours of sleep), attempt to move both bedtime and wake time **earlier** by 15 minutes every night.

Delayed Sleep Phase Treatment

- If teen cannot fall asleep until 1 am, but has been sleeping until 10 am:
- Move bedtime to 12:45, then 12:30, then 12:15, ect, with concurrent wake times of 9:45, 9:30, 9:15 until sleeping 11pm-8am.
 - Alternatively, enforce sleep restriction, with wake time at 8 am.
 - Ideally begin the process 2-3 weeks before start school.

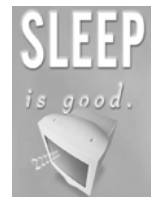
Delayed Sleep Phase Treatment

- If sleep onset is 3 hours or more that desired sleep time, **chronotherapy** is an option.
- Time and labor intensive for family.



SLEEP HYGIENE

- Must be enforced during treatment!
- Avoid bright light in the evening.
- Avoid all media 30 minutes prior to bedtime.
- Use the bed for sleep only.
- No napping!
- Sleep in dark, cool, quiet environment.
- Avoid eating prior to bedtime.
- Leave the bed after 20 minutes if not sleeping. May be beneficial to prescribe short term hypnotic.

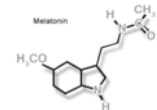


Delayed Sleep Phase Treatment

- Bright light for 30 minutes in the morning.
- Helps entrain circadian rhythm.



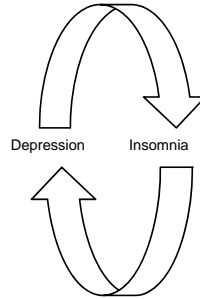
Melatonin



- Melatonin can be used as a chronobiotic, to shift the circadian phase.
- Given at low dose (0.3-0.5 mg) 5 hours prior to sleep onset. Adjust with moving bedtime.
- Continue for 6 weeks after goal bedtime has been reached.
- No true standardized approach

Major Depressive Disorder

- 6% to 8% of adolescents
 - 89% with sleep disturbances
 - Insomnia most common but high rates of hypersomnia
 - PSG: similar findings to adults
- Bidirectional relationship between emotional state and quality of sleep.
- Adolescents with anxiety disorders and mood disorders frequently have difficulty **establishing and maintaining** sleep on a regular basis.
- Puig-Antich, 1982; Yorlrik, 2004; Roberts, 1995



Sleep and Mood

- Can contribute to a “negative spiral” in school and social functioning.
- Difficulties with mood, motivation, and school performance create greater stress and affective problems.
- Negative affect further interferes with sleep and arousal regulation and circadian effects lead to difficulty falling asleep, more erratic schedules, and additional deterioration.

Outline



- Sleep Basics
- Behavioral Insomnia of Childhood
- Delayed Sleep Phase Syndrome
- Off Label Use of Medication
- Screening Tools, Resources

There are no FDA approved medications for Pediatric Insomnia

Pediatricians are Prescribing Medications

- 75% of Primary Care Pediatricians recommended *non-prescription* medications for pediatric insomnia
- >50% *prescribed* a medication for sleep

TABLE 3. Physicians Reporting Medication Use (Nonprescription or Prescription) for Sleep Problems*

Clinical Circumstances	% of Respondents
Acute pain	54
Travel	45
Mental retardation/developmental delay	41
ADHD	38
Autism/pervasive developmental disorder	32
Mood/anxiety disorder	32
Acute stress (eg, death in the family)	23
Insomnia (but otherwise healthy child)	18
Chronic pain	16
Hospitalization	4
Blind	

*Data missing from 7 to 11 respondents.

Owens J, Rosen CL, Mindell JA: Medication use in the treatment of pediatric insomnia: results of a survey of community-based pediatricians. *Pediatrics* 2003;111 (5):e628-635.

TABLE 6. Physicians Reporting at Least 1 Nonprescription Medication Recommendation for Children's Sleep in the Past 6 Months*

Medication	Respondents (%)				
	Age Groups (Years)				
	0-2	3-5	6-12	≥13	Any Age
Antihistamine	48.6	58.2	46.5	54.1	67.9
Combination sleep/pain reliever	15.7	16.9	17.2	20.4	29.2
Melatonin	1.7	7.7	15.4	18.9	24.9
Herbal preparations	12.8	12.7	12.3	18.4	22.2

*Data missing from 9 to 28 respondents, depending on the age group.

TABLE 7. Physicians Reporting at Least 1 Prescription Medication Recommendation for Children's Sleep in the Past 6 Months*

Medication	Respondents (%)				
	Age Groups (Years)				
	0-2	3-5	6-12	≥13	Any Age
Alpha agonist (eg, clonidine, guanfacine)	3.0	10.6	27.8	18.9	30.6
Antihistamine (eg, diphenhydramine, hydroxyzine)	15.7	16.9	16.6	15.2	29.1
Antidepressant (eg, SSRI, tricyclic, tetracycline)	—	1.2	7.3	15.1	16.4
Benzodiazepine (eg, clonazepam, diazepam, zolazepam)	1.2	2.0	6.5	8.6	11.9
Chloral hydrate	6.7	6.0	5.8	2.3	11.6
Hypnotic (eg, zolpidem, zaleplon)	—	—	1.4	7.9	8.1
Antipsychotic (eg, risperidone)	0.45	1.4	5.0	4.9	7.9
Anticonvulsant (eg, valproic, topiramate)	0.15	0.8	0.9	0.9	1.6
Barbiturate (eg, phenobarbital)	0.6	0.5	0.15	0.45	1.2

*Data missing from 8 to 14 respondents, depending on the age group. SSRI indicates selective serotonin reuptake inhibitor.

How about Child and Adolescent Psychiatrists?

- Use for primary insomnia, depression, Bipolar Disorder, Anxiety, PTSD, DSPS, ADHD, ASD, ODD, MR.
- Alpha-agonists most commonly prescribed insomnia for ADHD
- Trazodone most commonly prescribed medication to treat insomnia in children with mood or anxiety

Owens JA, et al. Use of pharmacotherapy for insomnia in child psychiatry practice: a national survey. *Sleep Medicine* 2010; 11:692-700

Regulation of Sleep is Complex

- Multiple redundant pathways
- GABA, Histamine, Melatonin, Norepinephrine
- Benzodiazepines and BRA modulate GABA
- Antidepressants (amitriptyline, trazodone, mirtazapine) are sedating due to effect on anticholinergic and antihistaminergic mechanisms
- Alpha-agonists (clonidine and guanfacine) impact noradrenergic tone and thus can be sedating

- Behavioral interventions need to be thoroughly tried and found to be non-effective
- Underlying diagnosis contributing to insomnia should influence choice of medication
- Counsel parents regarding risk of off label medication use

Melatonin

- Sold as nutritional supplement
- More placebo-controlled trials of melatonin in treatment of pediatric insomnia than drugs licensed by the FDA
- Used in studies of typically developing children with insomnia, ADHD and comorbid insomnia, neurodevelopmental disabilities, ASD, DSPS
- Widely prescribed by pediatricians and child psychiatrists for children with ADHD and Autism Spectrum Disorders

Chronobiotic and Sleep Promoting Properties

- Chronobiotic: influences timing of sleep
- Half life is approximately **one hour**, thus more effective in treating sleep onset insomnia rather than sleep maintenance or terminal insomnia.



Treatment as a Hypnotic

- Administer 30 minutes prior to desired sleep onset
- Sedating in dosages of 1 mg and greater
- Research settings have generally been between 2.5 -10 mg for initial insomnia
- Usual practice: start with 1.5 mg, increase in 1.5 mg increments every 4-5 days as indicated to max of 6 mg.

Jan JE et al. Melatonin therapy of pediatric sleep disorders: recent advances, why it works, who are the candidates and how to treat. *Current Pediatric Reviews*, 2007;3:214-224.

Treatment as a Chronobiotic

- Smaller doses
- Timing is even more important
- Delayed Sleep Phase Syndrome: low dose melatonin (0.3 mg) is effective if given 4-5 hours before present habitual bedtime (which may not be desired final bedtime)
- Progressively dose earlier as bedtime is moved earlier
- Low dose melatonin use in blind children to entrain circadian rhythms

Adverse Effects

- Reports of enuresis, depression, excessive daytime somnolence
- Increased nightmares
- One report of increased seizures in children with profound MR, epilepsy and sleep-wake cycle disorders
- Interacts with coumadin

Sheldon SH. Proconvulsant effects of oral melatonin in neurologically disabled children. *Lancet*, 1998; 351:1254.


JCSM
Journal of Clinical
Sleep Medicine


REVIEW ARTICLES


The Use of Pharmacotherapy in the Treatment of Pediatric Insomnia in Primary Care: Rational Approaches. A Consensus Meeting Summary

Judith A. Owens M.D., M.P.H., Deborah Babcock, M.D., Jeffrey Stamey, M.D., Ronald Chervin, M.D., Robert Farkas, M.D., Mark Gooding, M.D., Daniel Grzes, M.D., Anna Ivanenko, M.D., Jodi Mindell, Ph.D., Marsha Rappley, M.D., Carol Rosen, M.D., Stephen Sheldon, D.O.

Journal of Clinical Sleep Medicine, 1:1 2005
Tables of Prescription and Herbal Medications
Behavioral Intervention Discussion
Excellent resource

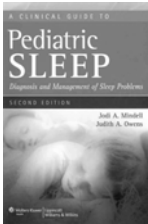
Take Charge of Your Child's Sleep,
Jodi Mindell and Judith Owens 

Sleeping Through the Night, How Infants, Toddlers and Their Parents can get a good night's sleep, Jodi Mindell 

What to do when you Dread your Bed,
Dawn Heubner 

References

- *A Clinical Guide to Pediatric Sleep,* Mindell and Owens
- *Principles and Practice of Sleep Medicine, 4th Edition.* Kryger, Roth, Dement.




OHSU Pediatric Sleep Disorders Program

Kyle Johnson, MD,
Child Psychiatry

Holger Link, MD,
Pediatric Pulmonology

Elizabeth Super, MD,
General Pediatrics
supere@ohsu.edu



Doernbecher Centralized Referral Service
888-346-0644 or 503-346-0644

