



# Autism Spectrum Disorders and Sleep



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# Disclosures

- No consultations with industry
- No involvement in speaker's bureaus
- Salary support from Autism Treatment Network in the past



# Prevalence

- Between 44% and 83% of children with autism have sleep difficulties
- Significant sleep onset and maintenance problems
- Irregular sleep-wake patterns, early waking and poor sleep routines
- Sleep problems persist in to adolescence



Richdale, 1999; Schreck, 2000; Wiggs, 2001, 2002; Malow, 2006; Giannotti 2006, 2008; Dickerson 2009; Goldman 2010



# Sleep problems independently associated with ASD

- More sleep problems in adolescents and young adults with severe ID with autism vs. severe ID without autism
- Higher IQ ( $> 55$ ) children with autism have more sleep problems than normal controls



Richdale and Prior, 1995; Bradley, 2004; Couturier, 2005

# Sleep is associated with problem behaviors in children and adolescents with Autism Spectrum Disorders

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## ABSTRACT

Multiple sleep problems have been reported in children with Autism Spectrum Disorder (ASD). The association of poor sleep with problematic daytime behaviors has been shown in small studies of younger children. We assessed the relationship between sleep and behavior in 1784 children, ages 2–18, with confirmed diagnosis of ASD participating in the Autism Treatment Network. Sleep problems were identified using the Children's Sleep Habits Questionnaire (CSHQ). The Parental Concerns Questionnaire (PCQ) was used to evaluate behavioral concerns and to define good or poor sleepers. Poor sleepers had a higher percentage of behavioral problems on all PCQ scales than good sleepers. Over three-fourths had problems with attention span and social interactions. Further delineation of this phenotype will help guide future interventions.

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## The Relationship Between Sleep Problems and Daytime Behavior in Children of Different Ages With Autism Spectrum Disorders

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### KEY WORDS

autism spectrum disorders, sleep problems, behavior problems, adaptive skills

### ABBREVIATIONS

ASD—autism spectrum disorder  
 ATN—Autism Treatment Network  
 CBCL—Child Behavior Checklist  
 CSHQ—Children's Sleep Habits Questionnaire  
 DLS—Daily Living Skills  
 HRQL—health-related quality of life  
 MANOVA—Multiple analysis of covariance  
 VABS-II—Vineland Adaptive Behavior Scales, Survey Interview Form, Second Edition

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### abstract

**BACKGROUND:** The purpose of the current study was to evaluate the relationships among sleep problems and daytime behaviors in a large, well-defined cohort of children with autism spectrum disorder (ASD).

**METHODS:** Out of a registry population of 3452 children with ASDs, a subset of 1193 children aged 4 to 10 years of age from 14 centers across the country was used to evaluate the relationship between varying levels of sleep problems and daytime behavior. Measures included Children's Sleep Habits Questionnaire, Vineland Adaptive Behavior Scales, Survey Interview Form, Second Edition, and Child Behavior Checklist. Multiple analysis of covariance was used to assess the association between sleep and behavior.

**RESULTS:** Results suggest that sleep problems, as identified by parent report by use of the Children's Sleep Habits Questionnaire, have a negative relationship with daytime behavior. More specifically, children with ASDs and sleep problems had more internalizing and externalizing behavior problems, as measured by the Child Behavior Checklist, and poorer adaptive skill development, as measured by the Vineland Adaptive Behavior Scales, than children with ASDs and no sleep problems. Children with moderate to severe sleep problems had greater behavior difficulties, but not necessarily poorer adaptive functioning, than children with mild to moderate sleep problems. Both preschool- and school-aged children demonstrated a negative relationship between behavior and sleep, whereas the relationship between sleep and adaptive functioning was much more variable.

**CONCLUSIONS:** These results suggest that, although sleep has a negative relationship with internalizing and externalizing behavior, it may have a different relationship with the acquisition of adaptive skills. *Pediatrics* 2012;130:S83–S90



Sikora DM, et al, *Pediatrics* 2012; 130: S83-S90

# Autism and Circadian Rhythms





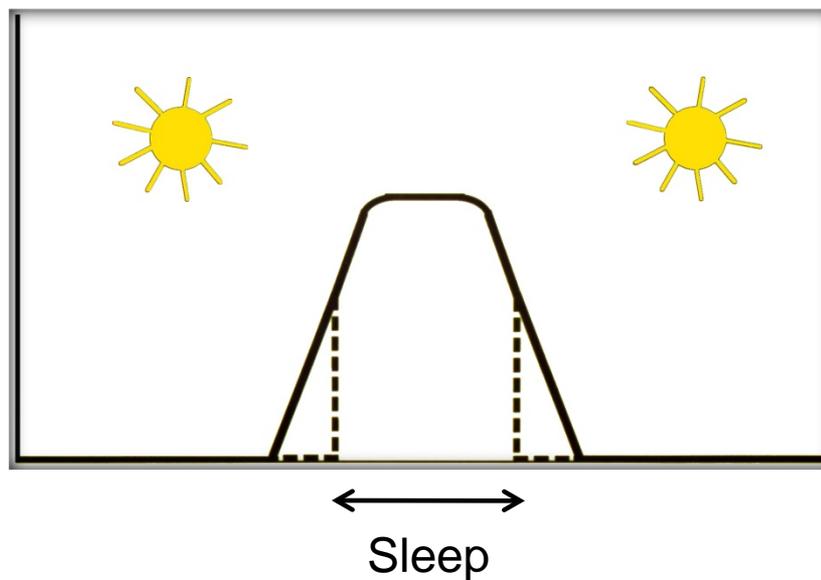
# Sleep-Wake Rhythms

- Several studies have suggested sleep/wake rhythm abnormalities based on parental surveys and sleep diaries
  - Later bedtimes and variation in wake times
  - Variation in total sleep time

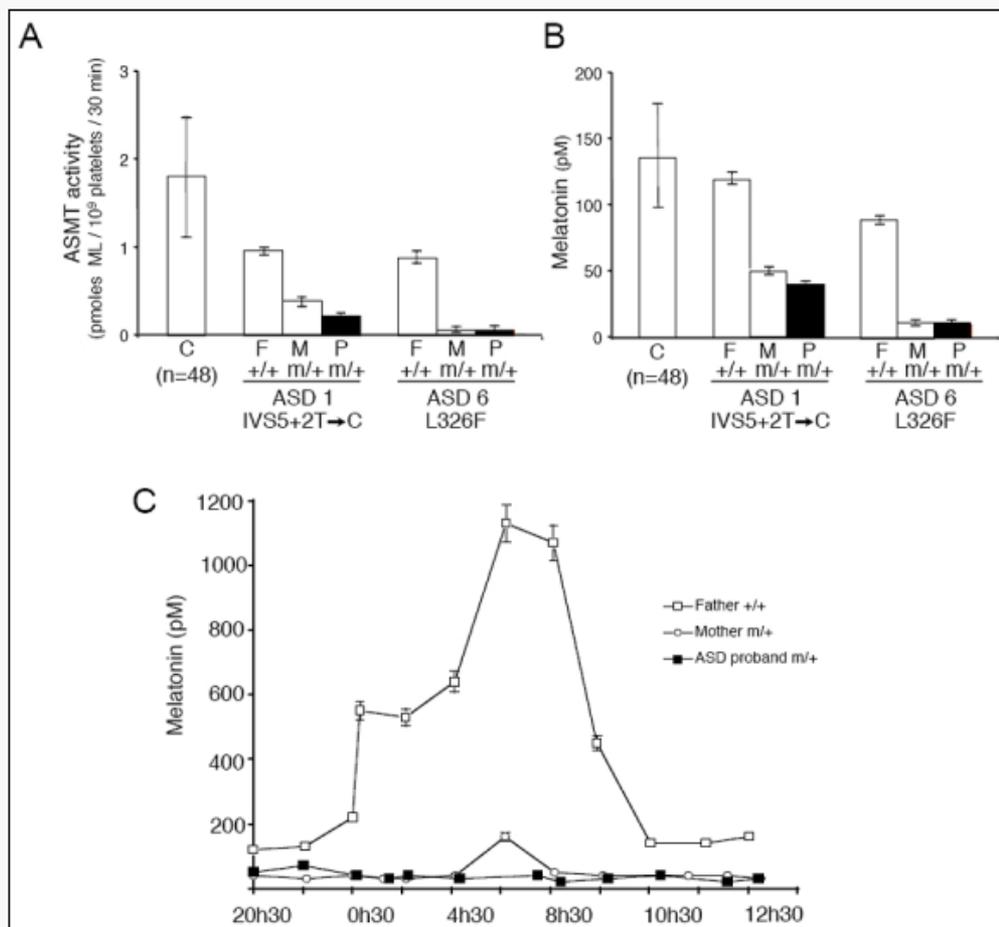


# Abnormal Melatonin Production

- Several studies have shown abnormal melatonin production
- One study showed a more marked decrease in nocturnal melatonin production in the prepubertal group



Ritvo, 1993; Nir, 1995;  
Kulman, 2000; Tordjman, 2005



ASMT = N-acetylserotonin O-methyltransferase

Melke J, et al, Mol Psychiatry 2008 Jan; 13(1):90-98



# Treatment





# Good Treatment is Based on Full Assessment

- Full sleep history including sleep environment and psychosocial stressors
- Medical, neurologic, and psychiatric history
- Sleep diaries, possibly actigraphy
- Physical examination
- PSG especially if sleep-disordered breathing, periodic limb movement disorder or nocturnal seizures are suspected



# Adenotonsillectomy and ASD

- Case report of 5 y/o girl with PDD NOS
  - Habitual snoring, witnessed apneas, gasping during sleep, elevated scores on CBCL
  - Moderate, pediatric OSA on sleep study
  - Underwent adenotonsillectomy
    - OSA resolved per follow-up sleep study
    - One month after surgery, child described as more alert, focus, and affectionate
    - Scores on CBCL normalized
    - 3 months after surgery, improved socialization and less repetitive behaviors



# RLS/PLMD and ASD

- Iron deficiency is often associated with restless legs syndrome (RLS) and periodic limb movement disorder (PLMD)
- Several studies have shown lower serum ferritin levels in children with ASD compared to controls
  - Ferritin levels of  $< 35$  ng/mL may be of clinical significance if periodic limb movements noted on sleep study and/or child meets criteria for RLS



Latif A, Autism 2002; 6(1):103-14

Youssef J, et al, Pediatr Neurol 2013; 49(4):274-8



# RLS/PLMD and ASD

- Causes of iron deficiency in ASD
  - Restricted diets
  - GI symptoms/inflammation
- Serotonin reuptake inhibitors may increase RLS/PLMD





# Treatment of Insomnia

- Depends on cause of insomnia
  - Behavioral insomnia of childhood
  - Co-morbid psychiatric condition particularly anxiety and depression
  - Circadian rhythm sleep disorder
  - Psychophysiological insomnia



# Behavioral Treatments

- Case reports of successful behavioral interventions for sleep-onset and sleep maintenance insomnia
  - extinction, graduated extinction, faded bedtime, and fading with parental presence
- Other interventions may be needed in older children
  - relaxation techniques, CBT



# Visual schedules clarify bedtime routines

Time for bed



Put on pajamas



Use the bathroom



Wash hands



Brush teeth



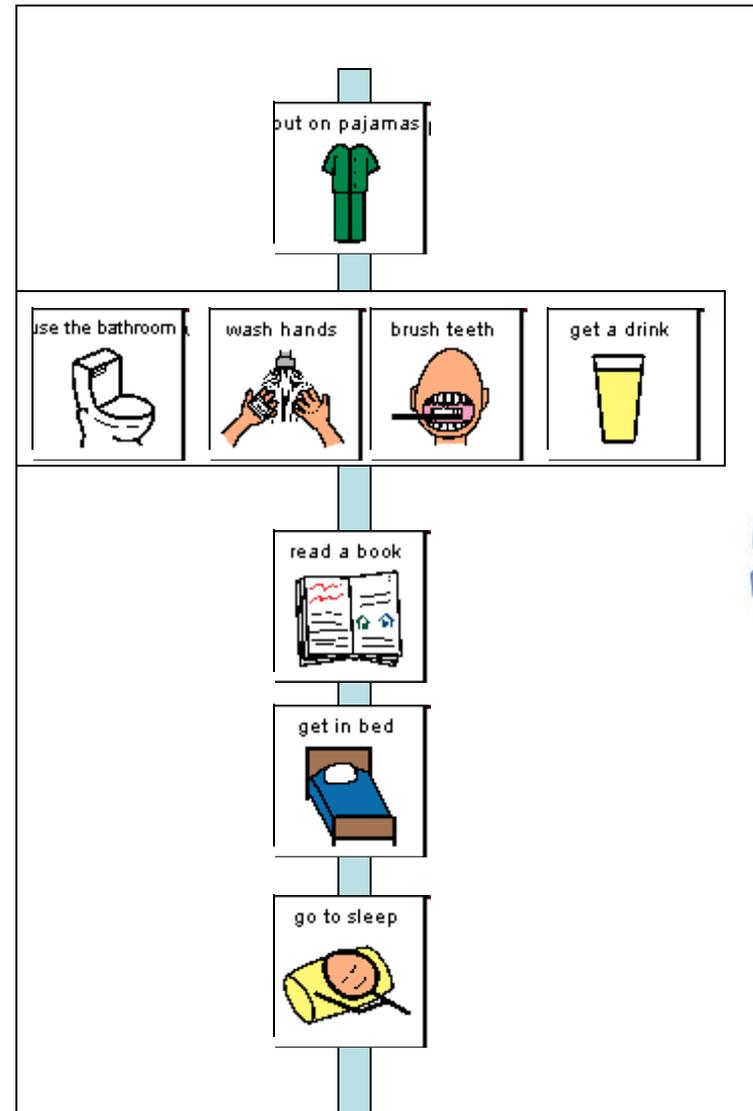
Get a drink



Read a book



Get in bed and go to sleep



# Strategies for Sleep Resistance

- Un-modified extinction
- Modified extinction (“Checking-in”)
  - Put child in bed in own room drowsy but awake and leave room
  - If child is upset, go back to room for “brief and boring” interaction – less than one minute
  - Extend the length of time between visits
- Extinction with parental presence
- Sleep restriction



# Bedtime pass





# Limit Media Use in Bedrooms

- Several studies demonstrate less sleep when children and teenagers have access to electronic media in bedrooms
- Recent study looking at bedroom media access in boys with ASD, ADHD, or Typical Development (TD)
  - Bedroom access to a TV or computer was more strongly associated with reduced sleep in ASD compared with ADHD or TD
  - Time spent playing video games was uniquely associated with less sleep in ASD group



Engelhardt, et al, Pediatrics 2013; 132(6): 1081-9

# Other Non-Pharmacologic Treatments

- Massage therapy (Escalona et al, 2001)
  - Improved sleep problems and stereotyped behaviors during the day



Qigong Sensory Training Institute

[www.qsti.org](http://www.qsti.org)

Info@qsti.org

# Qigong Massage Treatment for Sensory and Self-Regulation Problems in Young Children With Autism: A Randomized Controlled Trial

Louisa M. T. Silva, Mark Schalock, Robert Ayres, Carol Bunse, Sarojini Budden

## KEY WORDS

- autistic disorder
- child behavior disorders
- early intervention (education)
- massage
- self efficacy
- sensation disorders

Autism is commonly associated with sensory and self-regulatory disturbances. This article presents a randomized controlled study evaluating the effect of a 5-month intervention directed toward improving sensory impairment, digestion, and sleep in 46 children with autism < age 6. The intervention, Qigong Sensory Training (QST), is a qigong massage intervention based in Chinese medicine. It is two-pronged: Trainers work with children directly 20 times over 5 months, and parents give the massage daily to their children. Improvement was evaluated in two settings—preschool and home—by teachers (blind to group) and parents. Teacher evaluations showed that treated children had significant classroom improvement of social and language skills and reduction in autistic behavior compared with wait-list control participants. These findings were confirmed by parent data, indicating that the gains had generalized across contexts. A model and supporting data for understanding and treating sensory and self-regulation problems in autism is presented.

Silva, L. M. T., Schalock, M., Ayres, R., Bunse, C., & Budden, S. (2009). Qigong massage treatment for sensory and self-regulation problems in young children with autism: A randomized controlled trial. *American Journal of Occupational Therapy, 63*, 423–432.



Silva LMT, et al. Am Journal of Occupational Therapy 2009; 63: 423-432



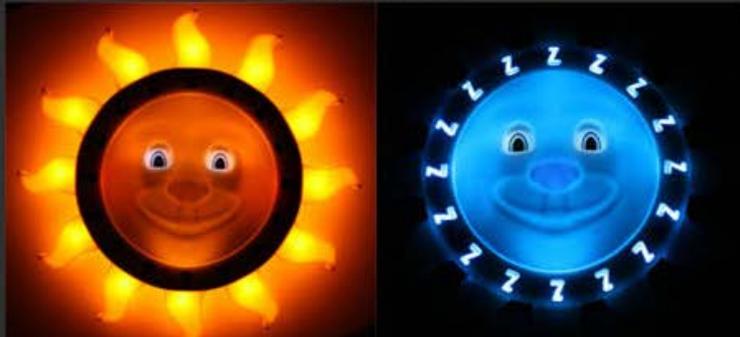
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## The Good Nite Lite

### Product Description

The objective of the "Good Nite Lite" is to educate children to stay in bed until it is morning. Children between the ages of 3 and 5 years of age are just starting to grasp the concept of day and night and how it relates to regularly scheduled rest. The Good Nite Lite can assist children with better differentiating the concept of nighttime and daytime and reinforce the benefits of appropriate sleep patterns. The Good Nite Lite device itself is an innovative combination of a traditional night light and a built in timer that changes the visual display characteristics to reinforce a regular sleep pattern.

*Measures 6" in diameter*



Having a bright light, even a regular nightlight, on in a child's room inhibits teaching them that when it is dark, it is time for sleep and when it is light, its time to get up.

**NIGHT**



At the preset time, the Good Night Light will brighten and display a cheerful "Sun" caricature letting the child know that is time to wake up and permissible to get out of bed and start the days activities.

**MORNING**



[www.goodnitelite.com](http://www.goodnitelite.com)

# Pharmacotherapy of Insomnia in Children with ASD





# Pharmacological Treatment

- Use after behavioral interventions tried and in combination
- Whenever possible, choose a medication that will treat a comorbidity such as epileptic seizures, anxiety, or a mood disorder
- Start at low doses, as children with developmental disabilities may be more susceptible to adverse effects and be less able to communicate them effectively





# Melatonin: Retrospective Study

- Retrospective study of 107 children (2-18 yrs old), with ASD treated with 0.75- 6 mg melatonin 30 minutes before bedtime in addition to sleep hygiene counseling
  - 90% were on psychotropic drugs
- Results
  - 25%: sleep no longer a concern
  - 60%: improved sleep but continued parental concerns
  - No increase in seizures or new-onset seizures
  - Only 3 children experienced side effects
    - morning sleepiness, “fogginess,” increased enuresis





# Melatonin Treatment: RCT's

- Double-blind RCT (n=7) of Melatonin 5 mg
  - Increased TST and shorter SL compared with placebo
  - Decreased awakenings compared with placebo
- Double-blind, randomized crossover trial (N=16) of CR Melatonin 5 mg
  - Part of a larger trial in children with neurodevelopmental disorders (N=50)
  - Improved sleep in 47/50 children including those with ASD and reduced family stress



Garstang and Wallis, 2006; Wasdell, 2008

J Autism Dev Disord (2011) 41:175–184  
DOI 10.1007/s10803-010-1036-5

ORIGINAL PAPER

## **Melatonin Versus Placebo in Children with Autism Spectrum Conditions and Severe Sleep Problems Not Amenable to Behaviour Management Strategies: A Randomised Controlled Crossover Trial**

Barry Wright · David Sims · Siobhan Smart · Ahmed Alwazeer ·  
Ben Alderson-Day · Victoria Allgar · Clare Whitton · Heather Tomlinson ·  
Sophie Bennett · Jenni Jardine · Nicola McCaffrey · Charlotte Leyland ·  
Christine Jakeman · Jeremy Miles

- N=22; 16 males, 4 females, mean age 9 (range 4-16)
- Melatonin 2 mg, increased every 3 nights as needed to maximum of 10 mg; 3 month trial
- Outcome: sleep diaries and questionnaires
- Results: Melatonin significantly improved sleep latency (average of 47 minutes) and total sleep (average of 52 minutes)
- No significant side effects/adverse events



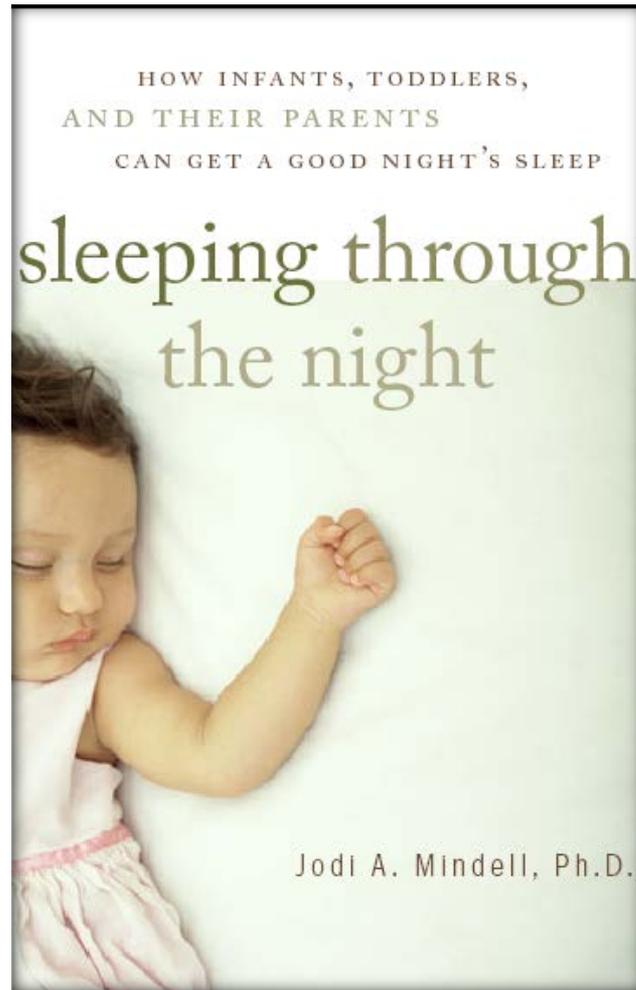
## **Melatonin for Sleep in Children with Autism: A Controlled Trial Examining Dose, Tolerability, and Outcomes**

Beth Malow · Karen W. Adkins · Susan G. McGrew ·  
Lily Wang · Suzanne E. Goldman · Diane Fawkes ·  
Courtney Burnette

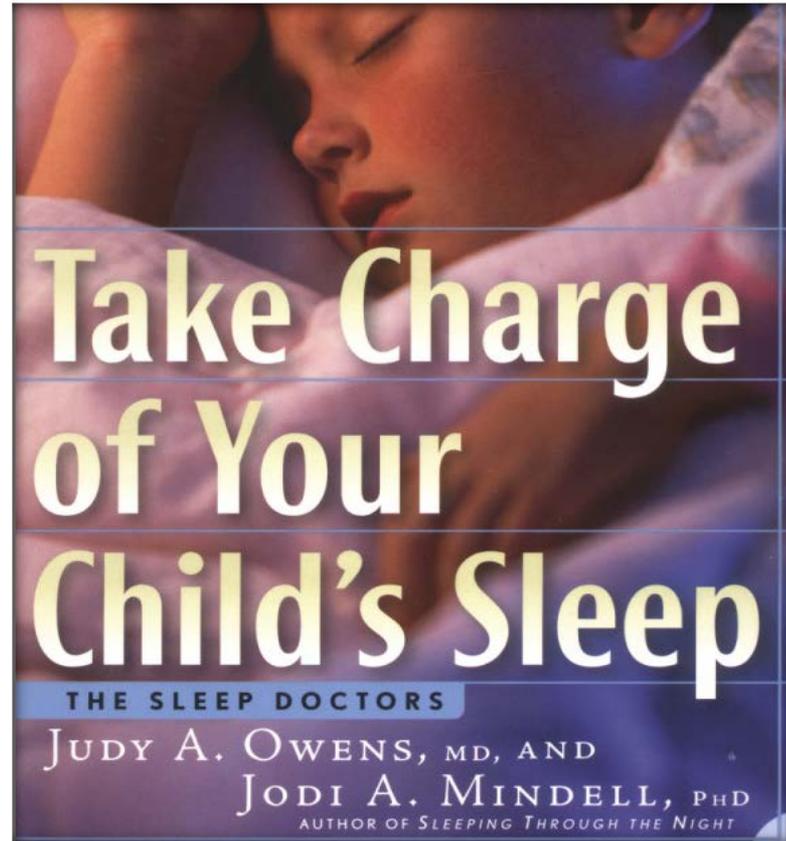
- 24 prepubertal children, free of psychotropic medicines
- Open-label dose escalation study over 14 weeks
- Melatonin (brand Natrol) improved sleep latency in most children at 1 or 3 mg doses
- Effective in week 1 of treatment, maintained effects over several months, was safe and well tolerated
- Showed improvement in sleep, behavior, and parenting stress



# Books for Parents



2005 HarperCollins  
ISBN: 0-06074256-9



2005 Marlowe & Company  
ISBN: I-56924-362-X





# Book to Pre-order



# The End!

Portland  
Aerial Tram



johnsoky@ohsu.edu