

# Evaluating & Managing Sleep Problems: The Sleep/ADHD Conundrum

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The brain starts to work the moment you are born.

It never stops until you stand up to speak in public.

# Objectives

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- Recognize implications for sleep from having ADHD
- Recognize implications for ADHD of getting good sleep
- Recognize related conditions that may influence sleep and ADHD symptoms
- Learn to better manage ADHD through improved Sleep

# Sleep and the Brain

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- Extensive neuroscience research shows that sleep changes brain functioning.
- Both learning and memory are improved (consolidated) when followed by good sleep -
  - Information processing
  - Long term memory

# Effects of Too Little Sleep

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- Too little sleep undermines mental functioning in both adults and children
- Children restricted to 5 hours of sleep have shown
  - Daytime sleepiness
  - Diminished verbal processing
  - Reduced creativity
  - Impaired abstract reasoning  
(Randazzo, et al., 1998)

# Effects of Fragmented Sleep

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- Fragmented sleep, sleep deprivation, and poor sleep quality lead to
  - Inattention and poor executive functioning (Sadeh et al., 2002)
  - Irritability; Behavior problems
  - Emotional Instability
  - Low frustration tolerance (Dahl, 1996)

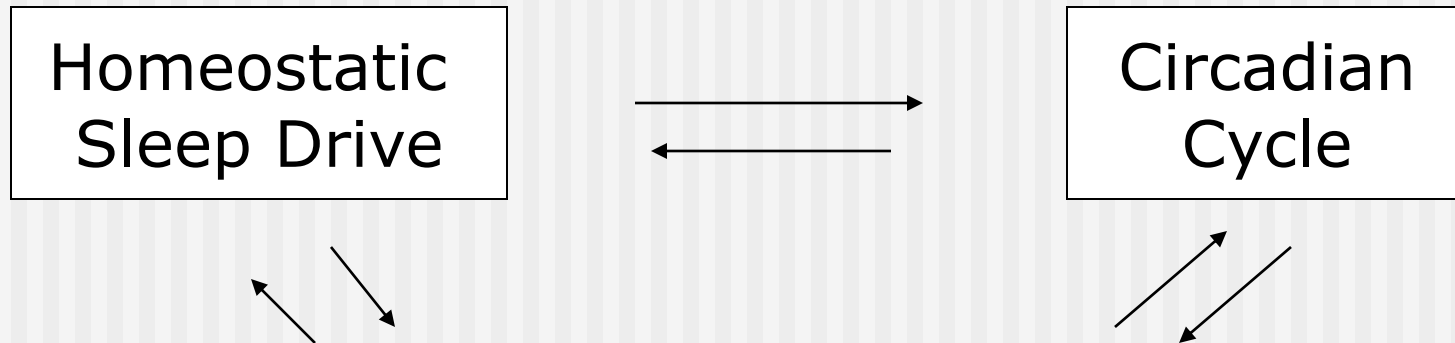
# Health Effects: Too Little Sleep

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- Obesity
- Diabetes
- Hypertension
- Metabolic Syndrome
- Cardiovascular Problems
- Accidental injuries in children
- Increased risk of motor vehicle accidents

# How Sleep Is Regulated

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## Sleep Influences

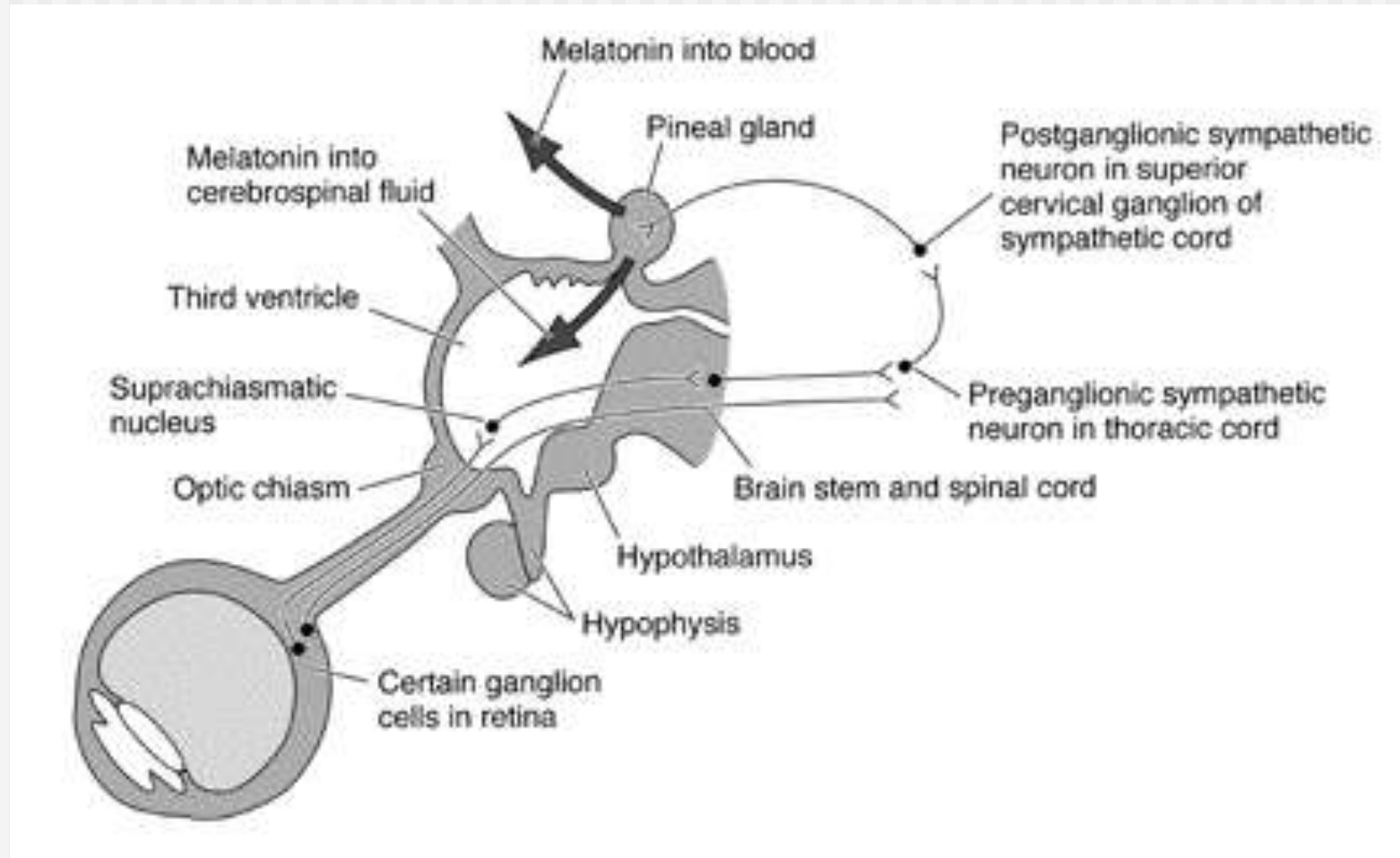
Physiologic (hunger, exercise, disease, medication, etc.)

Behavioral (sleep/wake [schedule](#), etc.)

Environmental (temperature, noise, light, etc.)



# Circadian Cycle in the Brain



# New Research Link: ADHD/Sleep

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- Children with ADHD have elevated polymorphisms of CLOCK genes
  - T3111C was higher when parents reported sleep disturbances
- Circadian rhythm is known to be influenced by CLOCK genes that affect sleep-wake cycle through release of melatonin and cortisol

# Sleep and ADHD

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- Both sleep problems and ADHD represent brain arousal disorders
- Brain systems for Attention-Arousal and Sleep Regulation are essentially the same
  - Structural Description - lower brain reticular activation, thalamus, projection paths to pre-frontal areas of the cortex – executive functioning
  - Neurochemical Description- primary noradrenergic and dopaminergic neurotransmission

# What's the Conundrum?

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- Sleep problems worsen ADHD symptoms
- ADHD worsens sleep problems, with or without medication
- Medication for ADHD may further interfere with sleep
- Medication for ADHD may mask serious sleep problems that then go untreated
  - For example, obstructive sleep apnea

# ADHD / Sleepiness Present Alike

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- Subjectively tired, drowsy, fatigued (poor self-awareness)
- Yawning, rubbing eyes, resting head
- Impulsivity, hyperactivity, aggression
- Mood lability
- Neurocognitive deficits
  - Decreased cognitive flexibility
  - Decreased verbal creativity
  - Diminished abstract reasoning
  - Memory impairments
  - Poor motor skills
  - Decreased attention and vigilance

# ADHD adds to sleep instability

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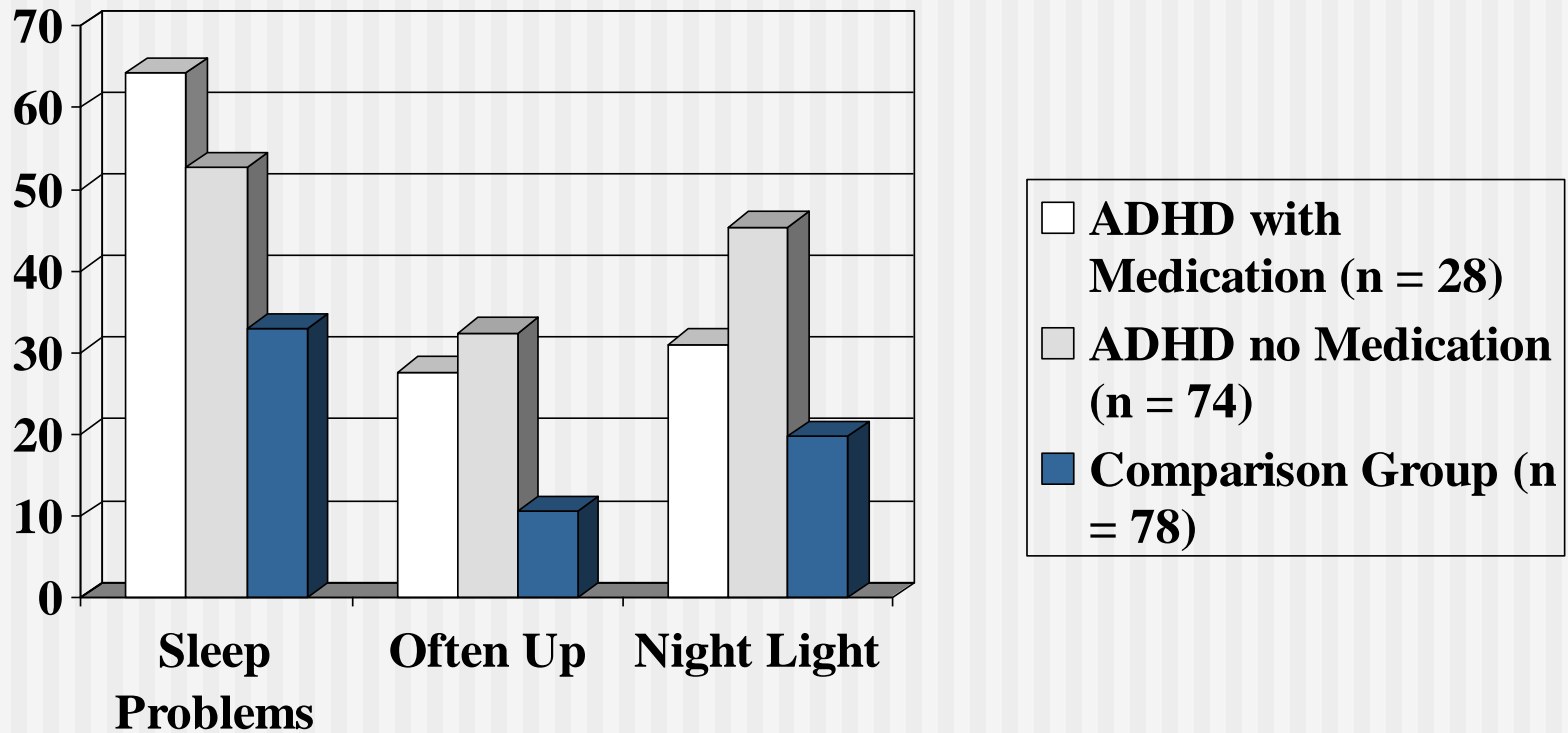
- ADHD is a form of arousal dysregulation
- ADHD is partly characterized by unstable sleep
- ADHD children are consistently sleepier than children without ADHD, as measured by mean sleep latency tests

# Sleep and Development

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- Sleep = 40% of childhood
- Prevalence of disturbed sleep and daytime sleepiness (Barkley, 2015):
  - 23% in neurotypical children
  - 56% among those with ADHD
    - 53-64% unaffected by medication (Ball, et al., 1997)
    - 52% vs. 21% evident from infancy (Trommer et al., 1988)
- Sleep Disorders are very prevalent among neurodevelopmental disorders generally – 86%?

# Sleep problems more common with ADHD than with other referral reasons



Ball, Tiernan, Janusz & Furr (1997)



# Parent Report: ADHD Sleep Problems?

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- More daytime sleepiness
- Reduced total sleep time
- More difficulty falling asleep
- More frequent awakenings
- More bedwetting
- More habitual snoring
- More sleepwalking
- More restlessness
- More nightmares and anxiety
- More sleep resistance
- More teeth grinding (bruxism)
- More difficulty with AM awakening

# Polysomnogram and ADHD

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- Polysomnogram studies have often not shown differences in sleep architecture of children with ADHD, but
  - Children with ADHD are more likely than controls to suffer from periodic limb movements (PLMS)
  - They are more active during sleep
  - They have more daytime sleepiness and show sleepiness on mean sleep latency tests
  - Age appears to be a significant moderator in that young children with ADHD may have greater problems with total sleep time and stage 1 sleep

[Adaeh, Pergamin & bar-Haim (2006) ---- meta-analysis  
12 studies; 11 journals; 331 ADHD vs. 231 controls]

# Parent Report vs. Polysomnogram?

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- Some bedtime problems may be part of ADHD presentation
- Sleep difficulties may stem from comorbid other conditions (e.g., ODD, OCD, anxiety, depression, ASD)

# ADHD May Influence Circadian Rhythm

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- Persons with ADHD show higher daytime activity especially in the afternoon, which can affect circadian rhythm
- Children with ADHD show higher heart rate, especially during afternoon and at night, which can affect circadian rhythm
- Thus, ADHD (and/or stimulants for it) can alter circadian rhythm, contributing to sleep problems

# Sleep Disorders May Present Like ADHD

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- Obstructive Sleep Apnea/Hypopnea Syndrome (OSAS)
- Primary Snoring
- Restless Legs Syndrome
- Periodic Limb Movement Disorder
- Narcolepsy

# Obstructive Sleep Apnea Syndrome (OSAS)

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- Peak age 2 - 7 years
- 2nd peak in adolescence (obesity is then a major risk factor)
- Prepubertal: female = male

# Sleep Apnea: Nocturnal symptoms

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- Loud snoring  
Respiratory pauses, snorts, gasps  
Increased respiratory effort / paradoxical breathing

Restless sleep

Sweating

Unusual sleeping positions

Parental anxiety level



# Sleep Apnea: Day Symptoms

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- Difficulty with AM waking  
Early AM headaches  
Complaints of daytime sleepiness  
Hyperactivity, poor impulse control  
Aggressiveness  
Attention span problems  
Shyness / social withdrawal  
Learning problems  
School failure

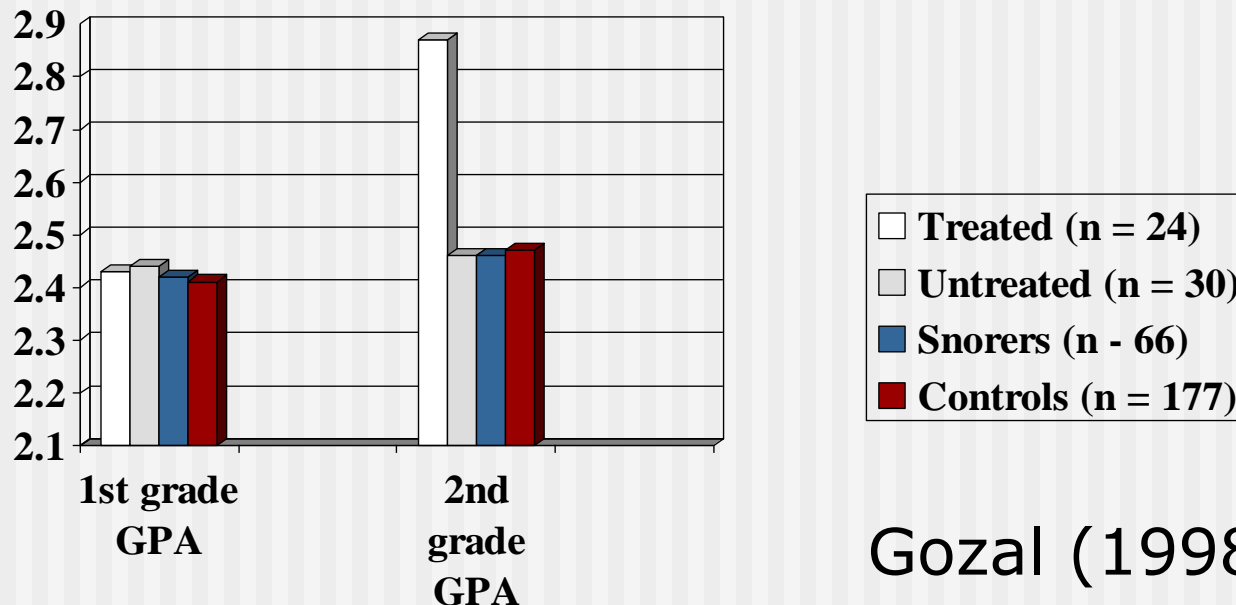


# Underachieving Children With Sleep Disordered Breathing (SBD)

N = 297 children < 10<sup>th</sup> percentile in class rank

Grouped by (1) SBD using pulse oximeter and partial pressure CO<sub>2</sub>, (2) primary snoring, or (3) controls

Treating SBD kids significantly improved their GPA



Gozal (1998) *Pediatrics*

# Adolescents /ADHD / Sleep: The Perfect Storm

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- Stay up later but don't get up later
- Due to circadian rhythm differences, older adolescents are biologically suited for later AM awakening
- High school teens average 1 hour less sleep than middle school teens
- But sleep need is not reduced
- EVMS sleep lab research found that local teens in schools with earlier start times had more car crashes (Vorona et al., 2011)
- This research has been replicated elsewhere

# Evaluation Implications

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- Assess for sleep duration and quality with every ADHD evaluation
- Assess for ADHD when doing sleep evaluations
- Determine whether there may be
  - Only ADHD
  - Only a Sleep Problem
  - Both ADHD and a Sleep Problem

# Patient/Parent Role: Evaluation

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- Notice and report
  - Sleep Duration and Quality Problems
  - Sleep Related Breathing Problems
  - Daytime Sleepiness

# Treatment Implications: Rx

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- Evaluate sleep effects of ADHD Rx
- Melatonin before bed?
  - 1/2 hour improvement in sleep onset in children compared to placebo
  - No improvement in bedtime behavior, cognition, or quality of life
- Clonidine and L-thenaine also helped
- Zopidem ineffective; neg side effects

# Treatment Implications

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- Education about ADHD and sleep
- Education about sleep hygiene
- Structure children's sleep toward better sleep hygiene
  - Later school start times for adolescents
  - Shift sleep phase gradually over time
- Employ behavioral interventions to assist sleep

# Fact Check

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- Children who do not get enough sleep are more likely to be underweight than overweight.
- False
- 23% of parents answered correctly in research by Judy Owens (2011)

# Fact Check

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- Being overweight can increase a child's risk of sleep problems.
- True
- 59% of parents answered correctly



# Fact Check

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- Snoring indicates a child is sleeping well.
  - False; 49% correct

# Fact Check

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- Being under- or overactive can be warning signs that a child is not getting enough sleep.
  - True; 53% correct

# Fact Check

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- Watching TV in the bedroom makes it more difficult for children to fall asleep.
  - True; 64%

# Fact Check

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- Children should have the same bedtime and wake time on weekdays and weekends.
  - True; 55%

# Fact Check

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- Well-rested children do not need an alarm clock to wake up in the morning.
  - True; 46%

# Fact Check

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- The average preschooler needs 10 hours of sleep per 24 hours.
- False; 7%

# Fact Check

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- The average school-aged child needs 8 hours of sleep per 24 hours.
  - False; 11% correct

# Parent Research:

## Problem Practices Are Common (age 1 – 7)

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- 70%: Adult present in room at sleep onset at least a few nights/week
- 79%: At least one electronic device in the bedroom (TV, DVD, computer)
- 76%: Parents underestimated sleep needs of their own child
- 60%: Watching TV is part of bedtime routine
- 43%: Bedtime after 9 PM
- 42%: No regular bedtime for all 7 nights/wk



“Never miss a good chance  
to shut up.”

Will Rogers

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