



The Sleepy Teen

David Ingram, MD



Common Sleep Problems Resulting in Sleepiness

- John: Can't get up in the morning
- Claire: Can't fall or stay asleep
- Andy: Snores like a freight train
- Allison: Falling asleep all the time
- Brian: Legs bother him at night



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Common Sleep Problems in Adolescents




Eat...my...shorts!

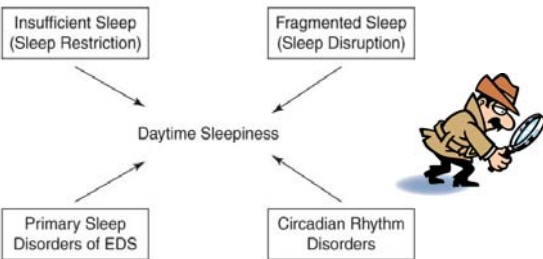
John


- 16yo male.
- CC: Can't wake up in morning.
- In bed 9pm, asleep 1am, tries to get up at 6am, but parents can't wake him. Weekend sleeps in until 1pm.
- Missing a lot of school and parents investigating homeschooling.



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Evaluation




 From: Mindell & Owens, 2015
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Evaluation

- Bedtime routine
- Sleep schedule
- Physiologic sleep disorders
- Developmental history
- Family history and culture
- Medical factors



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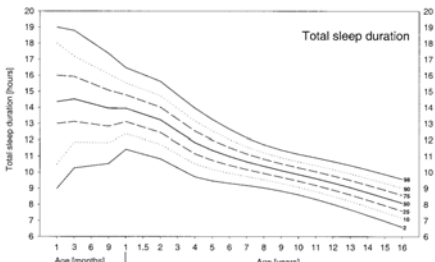
Sleep Schedule

- Entire 24 hour period
- Start at dinner
- Activities leading up to routine
- Routine
- Weekdays vs weekend
- In bed vs asleep time
- Nightwakings
- Waketime
- Naps





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Sleep Schedule




Total sleep duration

lglowstein et al, 2003


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Sleep Schedule


SLEEP DURATION RECOMMENDATIONS




SLEEPPFOUNDATION.ORG | SLEEP.ORG

Healthy Sleep Duration

The American Academy of Sleep Medicine recommends that you get the following hours of sleep on a regular basis for optimal health on each stage of life.




SleepEducation.org


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Sleep Schedule


In adolescence...

- Later bedtimes
- Changes in circadian rhythm
- Social/school demands (HW, extracurricular, jobs)
- Early school start times
- Late bedtime + Early school start time = Sleep deprived!
- Sleep need 8.5 to 9.5 hrs; avg obtained 7.5 hrs
- Social jet lag

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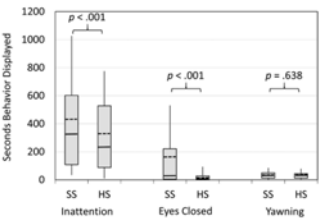
School Start Times

- AAP supports later school start times- no earlier than 8:30am (*Pediatrics* 2014;134:642:649)
- Delayed HS school start time to 8:30am or later can improve:
 - Nighttime sleep
 - Grades
 - Standardized test scores
 - Class attendance and graduation rates
 - Tardiness
 - Substances abuse
 - Symptoms of depression
 - Rates of motor vehicle collisions


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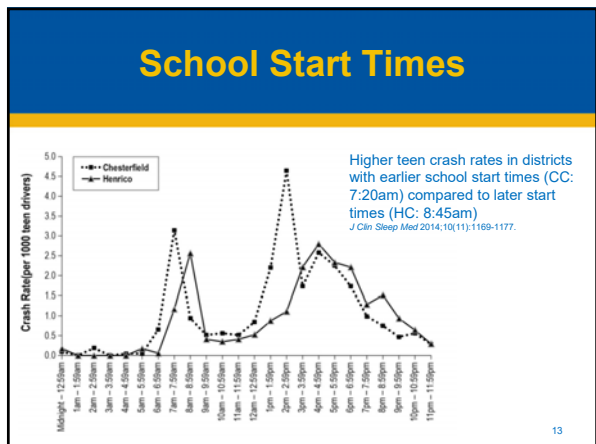
School Start Times

- Randomized
- Teenagers assigned to either Short Sleep (6.5 hours in bed) or Healthy Sleep (10 hours in bed) with constant waketime
- Simulated classroom watching video lectures
- Condition-blinded raters coded classroom behaviors



Beebe et al, In press

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School Start Times

Barriers...

- Buses are used for all schools in one district, so it is not possible for all schools to start later
- Parents do not want to put their younger child at the bus stop at an earlier time, but feel comfortable with their older child there
- After school, older children don't require child care, but younger children do
- Schools rent out sports fields in the evenings, so need their own students to be finished practicing prior to this

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KC Metro HS Start times

DIRECTORY OF SCHOOLS AND PROGRAMS						
SCHOOL	ADDRESS	ZIP	PHONE	PRINCIPAL	BELL TIMES	GRADES
HIGH SCHOOLS						
African Centered College Prep	3500 E. Meyer Blvd.	64132	418-1078	Cleora Taylor, Associate Principal	7:20 - 2:20	8 - 12
Southeast	3500 E. Meyer Blvd.	64132	418-1078	Dr. Jason Whitt	7:20 - 2:20	9 - 12
Success Academy/Anderson	1601 Forest Ave.	64108	418-5300	TBD	9:00 - 4:00	8 - 12
Central	3221 Indiana	64128	418-2000	Anthony Madry	7:20 - 2:20	9 - 12
East	1924 Van Brunt Blvd.	64127	418-3125	TBD	7:20 - 2:20	9 - 12
Lincoln College Prep	2111 Woodland Ave.	64108	418-3000	Steven Evans	7:20 - 2:20	6 - 12
Northeast	415 Van Brunt Blvd.	64124	418-3300	Doug Bolden	7:20 - 2:20	9 - 12
Paiso	4747 Flora Ave.	64110	418-2275	Dr. Dennis Walker	7:20 - 2:20	7 - 12
Manual - Career Tech	1215 E. Truman Road	64106	418-5200	Rashawn Caruthers	7:40 - 10:10 11:25 - 1:55	11 - 12

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School Start Times



ADOLESCENT SLEEP, HEALTH, AND SCHOOL START TIMES
THE NATIONAL CONFERENCE

An Interactive Conference
Bringing Together:

- Education Policy Makers
- Leading Sleep Experts
- Administrators/Teachers/Staff
- Health Care Professionals
- Community Advocates
- Transportation Experts

REGISTER NOW!

Space is Limited

WASHINGTON DC
APRIL 27-28, 2017

FOR MORE INFORMATION VISIT:
www.schoolstarttimesconference.org

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Physiologic Sleep Disorders

- Obstructive sleep apnea
 - Snoring, witnessed apneas, gasping arousals
- RLS/PLMD
 - Leg discomfort at bedtime
 - Frequent leg kicking, twitching, jerking
- Narcolepsy/Hypersomnias
 - Sleep paralysis, hallucinations, cataplexy
 - Constant or episodic
 - Sleepy or tired

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Family History

- Medical problems
- Sleep disorders
- Developmental disorders
- Parental anxiety or mood disorder



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Medical Factors

- Anemia
- Cardiac disease
- Malignancy
- Metabolic disorders
- CNS
 - Post-concussion
 - Hydrocephalus
 - Mass




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John - Delayed Sleep Phase Syndrome

- Circadian rhythm disorder
- Occurs in 16% of adolescents
- Inability to fall asleep at 'normal' time, but once asleep able to sleep without problems
- Associated with mood problems, suicidal ideation, poor school performance, isolation, job loss, substance abuse
- DSPS or psychophysilogic insomnia?



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John - Treatment

- Chronotherapy
 - Forwards
 - Backwards
 - Weekends
- Bright light therapy
- Melatonin
- Hope



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John - Treatment

- Teenagers with DSPS
- RCT x 4 weeks
 - Melatonin (3mg @7pm)
 - Light (x30 mins between 6-8am)
 - Placebo

Children's Mercy KANSAS CITY Maanen et al, In press

Claire

- 15yo female.
- CC: Can't sleep.
- In bed 9pm, asleep 1am, mind racing, up for hours in the middle of the night, up at 6am. Weekend sleeps in until 11am. Naps 4-5pm.

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Claire - Chronic Insomnia

- Sleep restriction and stimulus control
- When actually falling asleep?
- Needed waketime?
- 4 rules
- Medication?
- ASD and other NDD

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Andy

- 12yo male
- CC: Falling asleep in school.
- In bed 9pm, asleep 9:05pm, sleeps through night, up at 6am. No naps.
- Snoring, snorting arousals, restless, neck hyperextension, mouth breathing.
- Tonsils 3+



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OSA in Children


- 1-5% overall, 45% in obese adolescents
- EDS, ADHD-like, externalizing behaviors, HTN, RV/LV dysfunction, PHTN, NAFLD fibrosis
- PSG?
- T&A, CPAP, Weight loss, RME, Flonase/Singulair, Myofascial reeducation, Positional therapy

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Preoperative Sleep Study for T&A

AAP



Key Action Statement 2A:
Polysomnography
If a child or adolescent snores on a regular basis and has any of the complaints or findings shown in Table 2, clinicians should either (1) obtain a polysomnogram (Evidence Quality A, Key Action strength: Recommendation) OR (2) refer the patient to a sleep specialist or otolaryngologist for a more extensive evaluation (Evidence quality D, Key Action strength: Option). (Evidence Quality: Grade A for polysomnography; Grade D for specialist referral, Recommendation Strength: Recommendation.)

Marcus C et al, 2012

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TABLE 2: Symptoms and Signs of OSAS

History
Frequent snoring (>5 nights/week)
Labored breathing during sleep
Gasp/snorting noises/observed episodes of apnea
Stress enuresis (especially secondary enuresis)*
Sleeping in a seated position or with the neck hyperextended
Cybernetics
Headaches on awakening
Daytime sleepiness
Attention-deficit/hyperactivity disorder
Learning problems
Physical examination
Underweight or overweight
Snusilar hypertrophy
Adenoidal facies
Micromelia/macrognathia
High-arched palate
Failure to thrive
Hypertension


* Enuresis after at least 8 mo of continence.

Preoperative Sleep Study for T&A

AAO-HNS

Table 1. Summary of Action Statements for PSG

Statement	Action
1. Indications for PSG	Before performing tonsillectomy, the clinician should refer children with SDB for PSG if they exhibit any of the following: obesity, Down syndrome, craniofacial abnormalities, neuromuscular disorders, sickle cell disease, or mucopolysaccharidoses.
2. Advocating for PSG	The clinician should advocate for PSG prior to tonsillectomy for SDB in children without any of the comorbidities listed in statement 1 for whom the need for surgery is uncertain or when there is discordance between tonsillar size on physical examination and the reported severity of SDB.




Roland P et al, 2011

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Primary Snoring vs OSA

- Is this a clinically important distinction?
 - Where to draw the line?
 - Difference in associated morbidity?
 - Differential response to therapy?



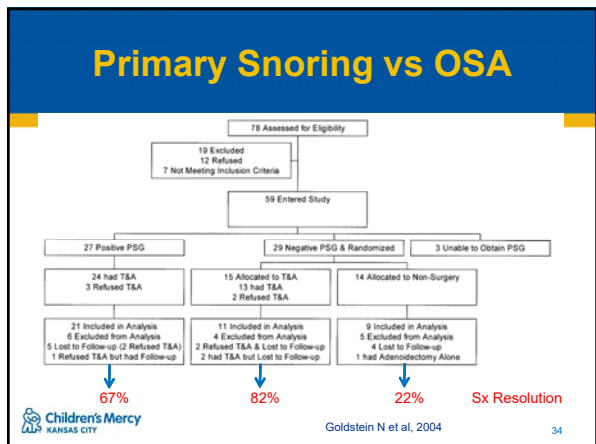
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Primary Snoring vs OSA

Study	Hypopnea definition	N	OAHl Mean (SD)	OAHl ULN
Traeger, 2005	Thermister. 50% reduction with 3% desat/arousal	66	0.23 (0.31)	0.8
Wong, 2004	Thermister. 50% reduction with 3% desat/arousal	16	0.0 (0.1)	0.2
Verhulst, 2007	Thermister. 50% reduction with 3% desat/arousal	60	0.08 (0.17)	0.4
Marcus, 2003	Thermister. 50% reduction (arousal/desat not required)	41	0.2 (0.6)	1.4
Montgomery-Downs, 2006	Thermister. 50% reduction with 4% desat/arousal	153 388	0.08 (0.16) 0.14 (0.22)	0.4 0.5

Ingram & Freidman, In Press

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Primary Snoring

- RCT of T&A for mild sleep-disordered breathing (Clinical SDB with OAH1<2)

PATS
Pediatric Adenotonsillectomy
Trial for Snoring

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Work of Breathing

Esophageal Pressures, Polysomnography, and Neurobehavioral Outcomes of Adenotonsillectomy in Children

Ronald D. Chervin, MD; Deborah L. Ruzicka, PhD, RN; Timothy F. Hoban, MD; Judith L. Fetterolf, RPSGT, REEGT; Susan L. Garrett, MD; Kenneth E. Gaire, MS; James E. Dillon, MD; Barbara T. Felt, MD; Elise K. Hodges, PhD; and Bruno J. Giordani, PhD

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Alternative Measures

- Esophageal manometry
- Pulse transit time
- Urine/blood/breath biomarkers
- Home sleep studies
- Sonomat

Normal Breathing Snoring

PSG
Nasal Flow
Thorax
Resonant Breath Sound
Breathing Movement
Spectrogram (Pz)

Gain x 10 Gain x 1

30 seconds 30 seconds

Norman et al, 2014

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Alternative Measures - Sonomat

- Mattress overlay with four sensors that measure body movements and breath sounds

Normal Breathing Snoring Stertor

Spectrogram (Pz)

2000
10

30 seconds 30 seconds 30 seconds

CA

MA

OA

HYP0

Norman et al, In Press

Alternative Measures - Sonomat

Sensitivity

100 - Specificity

- AHI ≥ 1 AUC = 0.895
- AHI ≥ 2 AUC = 0.868
- ▲— AHI ≥ 5 AUC = 0.953
- AHI ≥ 10 AUC = 0.958

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Snoring and Stertor (min)

MOAHI_{PSG} (events/hr)

- Snoring
- Stertor

Norman et al, In Press

Allison

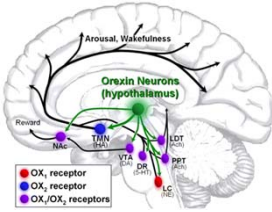
- 12yo female.
- CC: Sleepy.
- Last 2 years sleepy all the time. Falling asleep in class. Gets buckling of the knees when laughing. Tongue thrusting. Sleeps 9pm to 6am. Naps throughout the day, refreshing





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Narcolepsy


- 1 in 2000
- Intrusion of REM sleep: EDS, cataplexy, paralysis, hallucinations
- PSG/MSLT, actigraphy?, csf hypocretin
- Medications, daytime nap, school accommodations
- This is a life-long neurological condition, so be certain and right
- Other hypersomnias: IH, KLS




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Narcolepsy

<p><i>EDS</i></p> <ul style="list-style-type: none"> • 1-2 planned naps • Exercise • Stimulants <ul style="list-style-type: none"> – Methylphenidate derivatives – Modafinil – Armodafinil 	<p><i>Cataplexy</i></p> <ul style="list-style-type: none"> ▪ TCAs <ul style="list-style-type: none"> ▪ Protriptyline ▪ Imipramine ▪ Clomipramine ▪ SSRI/SNRIs <ul style="list-style-type: none"> ▪ Fluoxetine ▪ Venlafaxine
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SODIUM OXYBATE

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Brian

- 13yo male.
- CC: Legs can't stop.
- Gets into bed around 9pm but can't fall asleep because of leg symptoms.
- His legs feel uncomfortable and he has to move them. Gets up walking around. Restless.



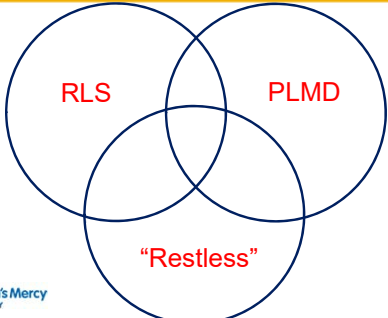
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Restless legs syndrome

<p><i>RLS Criteria</i></p> <ul style="list-style-type: none">• Urge to move the legs• Worse during rest• Improved with movement• Occur more often at night	<p><i>RLS Mimics</i></p> <ul style="list-style-type: none">▪ Positional discomfort▪ Numbness▪ Leg cramps▪ Growing pains
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The Restless Sleeper

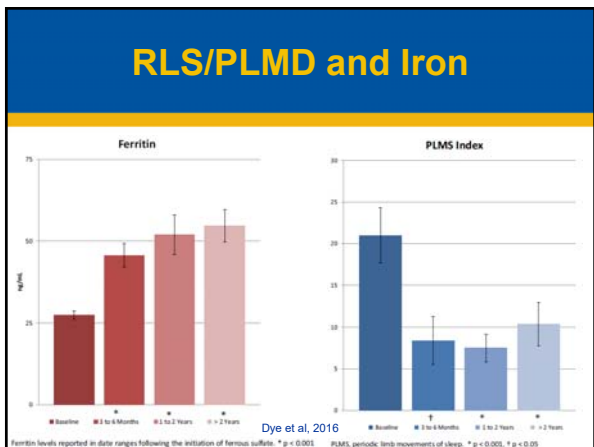


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Restless legs syndrome


- Prevalence 2-4% of children
- Etiology
 - ?Genes
 - ?Iron depletion
 - ?Dopamine synthesis
- Co-occurrence with ADHD ~25%


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RLS/PLMD and Iron

- Ferritin increases and PLMI decreases with supplemental iron
- No change in serum iron levels
- 60-80% experienced symptom improvement


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RLS/PLMD and Iron

- Check ferritin
- Iron deficiency <12
- Average ferritin in children in the US 20s
- Goal ferritin 50 to 100 for RLS/PLMD

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RLS

- 1st line: Optimize body iron stores with supplemental iron - goal ferritin 50 to 100; lifestyle (adequate sleep, physical activity, limit caffeine and exacerbating meds)
- 2nd line: gabapentin
- 3rd line: clonidine, clonazepam, mirapex/requip

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Other RLS Treatments?

- Vitamin D
 - Deficiency associated with RLS (Oran et al 2014; Balaban 2012)
 - Supplementation improves RLS symptoms (Wali et al 2015)
 - Low vit D → dopaminergic dysfunction → RLS
 - All adult data; ?children
- Vibratory devices
 - Under development
 - Data immature



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