CHILD AND ADOLESCENT SLEEP DISORDERS UPDATE

Rafael Pelayo, MD FAASM

STANFORD
SCHOOL OF MEDICINE

1

WHAT WE SEE IN CLINIC

- Normal Sleep?
- Sleep Onset Association Disorder
- Limit Setting Disorder
- OSA/SDB
- Parasomnias
- PLM/RLS
- Delayed Sleep Phase Syndrome

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SLEEP STUDIES IN CHILDREN: WHAT CAN WE LEARN FROM THEM?

3

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SLEEP STUDIES INDICATIONS IN CHILDREN

- Diagnose SRBD (central and obstructive)
- Titration of positive airway pressure
- Evaluate SRBD treatment effectiveness
- Diagnose PLMD
- Diagnose narcolepsy/ CNS Hypersomnia
- Evaluate unresponsive insomnia
- Evaluate parasomnias and seizures

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WHAT IS THE BIGGEST CHALLENGE PEDIATRIC SLEEP MEDICINE?

Lack of normative data and established scoring criteria

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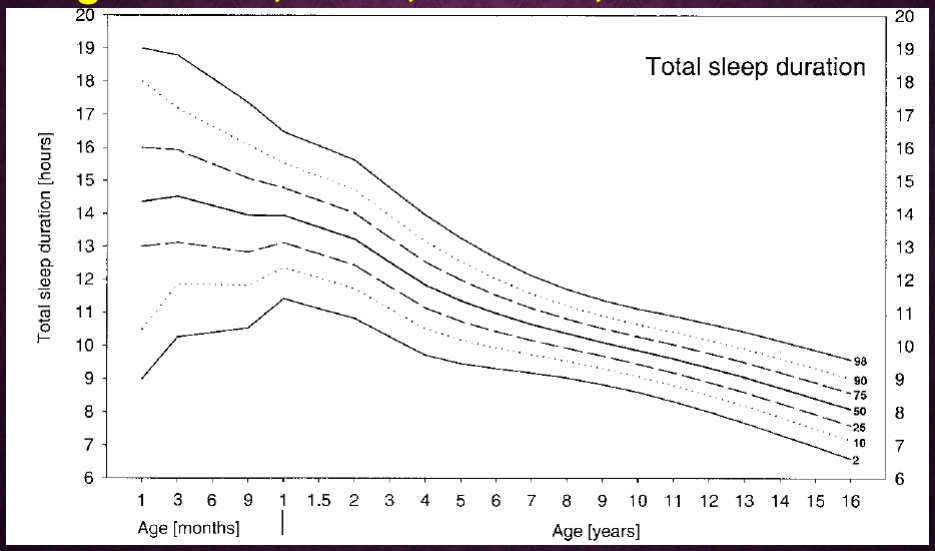
Iglowstein, Jenni, Molinari, et al *Ped'03*



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SLEEP DURATION FROM INFANCY TO ADOLESCENCE: REFERENCE VALUES AND GENERATIONAL TRENDS *PEDIATRICS '03*

- 493 subjects from the Zurich Longitudinal Studies were followed using structured sleep related questionnaires at 1, 3, 6, 9, 12, 18, and 24 months after birth and then at annual intervals until 16 years of age
- Total sleep duration decreased from an average of 14.2 hrs (SD: 1.9 hrs) at 6 months of age to an average of 8.1 hrs (SD: 0.8 hrs) at 16 years of age.
- Total sleep duration decreased across the studied cohorts (1974 –1993) because of increasingly later bedtime but unchanged wake time across decades

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"HE/SHE WON'T SLEEP"

COMPLAINT EVERY PROVIDER HEARS

WHAT GOES THROUGH YOUR MIND WHEN YOU HEAR THIS??

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SLEEP MEDICINE ≠ SLEEP STUDIES

10

Pitfalls in Polysomnograms

- False negatives can occur especially if REM sleep is low.
- False positives are unusual
- Look for Total Sleep Time (TST)
- Check if wake up time was spontaneous or forced
- Look for REM % (should be 20-25%)
- Look at Sleep Efficiency (should be min 85%; the higher the better, but don't trust 100%)
- Look for incongruence between AHI and oxygen saturation nadir

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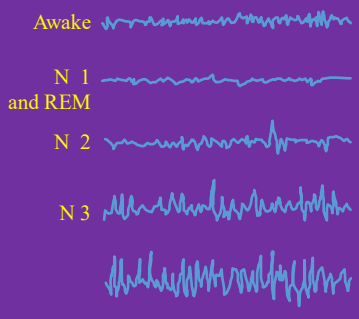
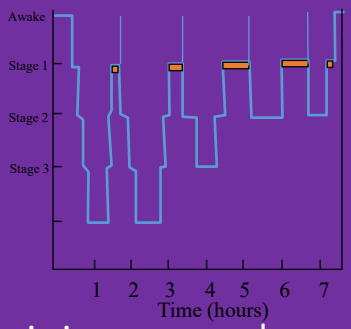
Sleeping through the night is a myth
None of us sleep through the entire night

EEG Recordings



Typical Nighttime Sleep Pattern
in Young Adult



We are not merely sleep depriving ourselves we are specifically dream deprived

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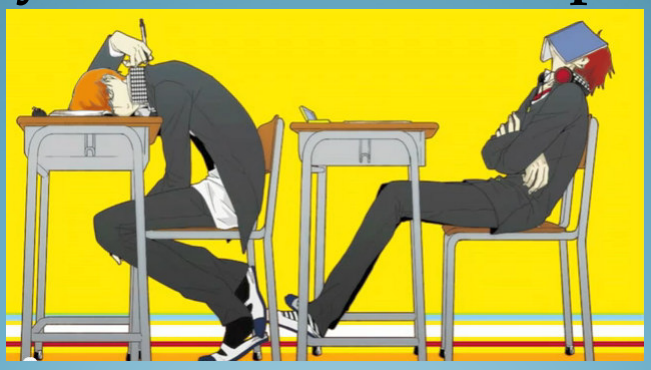
MYTH WE FALL ASLEEP BECAUSE WE ARE BORED

Monotony does not cause sleepiness



Monotony does unmask sleepiness

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CAN SLEEPY STUDENTS LEARN ANYTHING?

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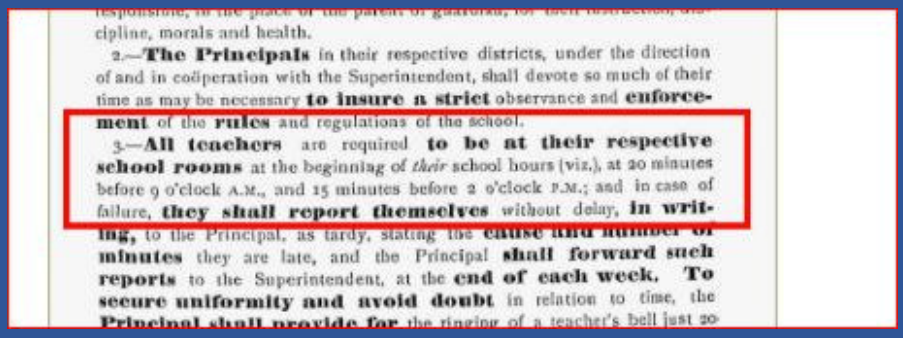
Until the mid-20th century, most schools started at about the same time, and rarely before 9 a.m.



cipline, morals and health.

2.—**The Principals** in their respective districts, under the direction of and in coöperation with the Superintendent, shall devote so much of their time as may be necessary **to insure a strict** observance and **enforcement** of the **rules** and regulations of the school.

3.—**All teachers** are required **to be at their respective school rooms** at the beginning of *their* school hours (viz.), at 20 minutes before 9 o'clock A.M., and 15 minutes before 2 o'clock P.M.; and in case of failure, **they shall report themselves** without delay, **in writing,** to the Principal, as tardy, stating the **cause and number of minutes** they are late, and the Principal **shall forward such reports** to the Superintendent, at the **end of each week. To secure uniformity and avoid doubt** in relation to time, the **Principal shall provide for** the ringing of a teacher's bell just 20

Source: New Haven Public Schools. *Annual report of the Board of Education of the New Haven City School District.* New Haven [CT]: City of New Haven, August 31, 1878, p. 117.

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Their Biology Changes

- Adolescent changes in the homeostatic drive to sleep (slower build-up of sleep pressure, more resistance to sleep pressure)
- Circadian shift at puberty seen in other mammals
- Animal studies demonstrate a delayed internal clock at puberty (including primates and rodents)
- Wake time is also shifted later – with REM sleep concentrated in the last third of the night (about 5 a.m.-8 a.m.)

Sources: Hagenauer et al. 2009; Gradisar, 2011; Carskadon, 2011; Hagenauer, 2012

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Sleep and the adolescent brain
Curr Opin Physiol 2020

Reviewed the maturation changes that occur in the adolescent brain. In both humans and mice, "adolescence is accompanied by increased risk-taking, novelty-seeking and peer-directed social interaction in both species. Biologically, a period of rapid synaptic pruning is seen, wherein the number of synaptic connections undergoes marked decline. Generally speaking, in both species this pruning commences around the time of puberty and continues to the end of the adolescence".

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Sleepy Teens Throughout the World

- Most adolescents needs somewhere between 8 and 10 hours of sleep per night for optimal growth, development, health, and learning.
- Average sleep time on school nights for teenagers aged 14-19 varies from 5:46 hours in South Korea to 7:44 hours in Belgium.
- US teens get an average of 7:08 hours of sleep on school nights, waking on average at 7:14 a.m.

Source: Sleep Cycle data, November 2014; NSF and AASM Sleep Recommendations

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The Great Sleep Recession: Changes in Sleep Duration Among US Adolescents, 1991–2012 *Ped 2015*

- Nationally cross sectional survey from 1991 to 2012 (N = 272,077). They were asked how often they get ≥7 h of sleep and how often they felt they got less sleep than they should
- Sleep generally declined over 20 years
- Girls were less likely to report getting ≥7 h
- Only about 25% of 17 y felt they were getting enough sleep

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Insufficient Sleep and Suicidality in Adolescents *Sleep 2012*

- 8,530 Korean teens, completed Beck Scale for Suicidal Ideation (SSI), Beck Depression Inventory (BDI), ESS, and sleep questionnaire
- 19% with BIISS (weekdays ≤ 7 hr; weekend oversleep ≥ 2 hr; ESS ≥ 9; no insomnia)
- BISS teens had ↑ SSI scores even after controlling for age, sex, and BDI score
- Longer weekend oversleep and shorter weekday sleep duration predicted a higher SSI score
- Korean teen suicide rate 10.7 per 100,000 (US 7.3)

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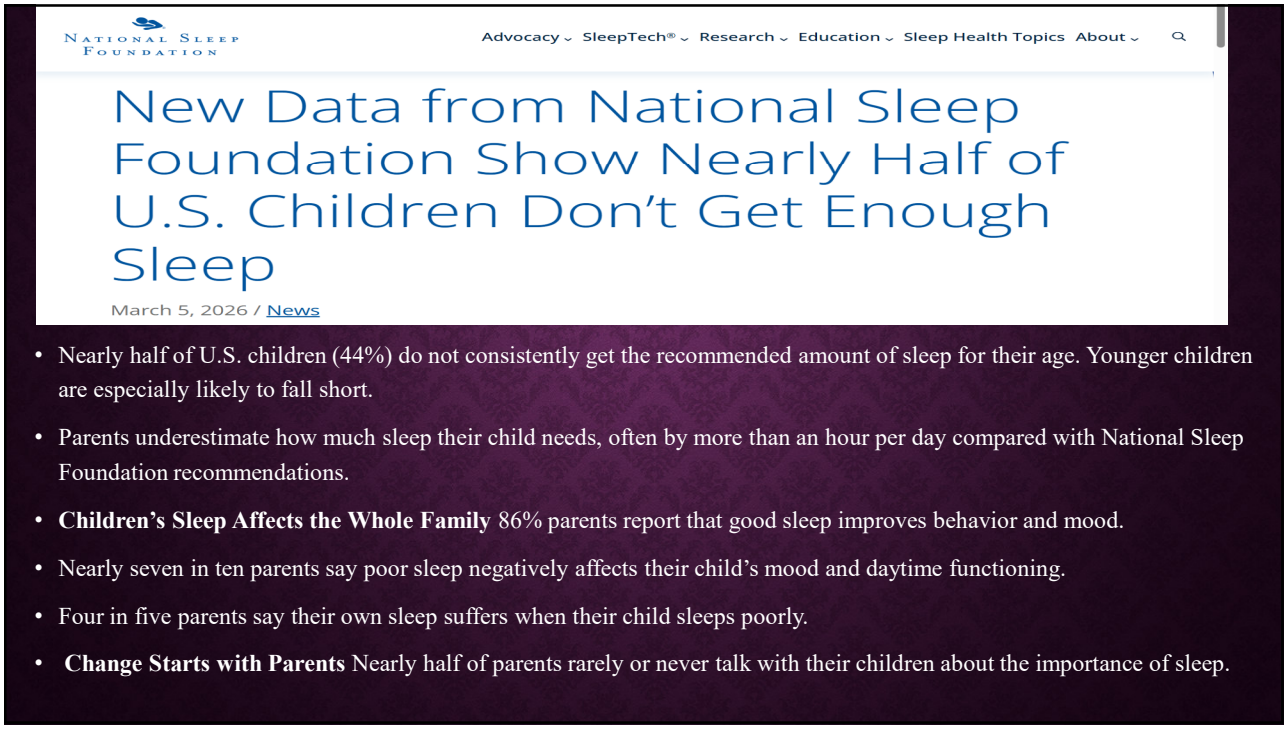

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WHAT IS YOUR MOTIVATION TO GO TO BED?

What is your motivation to get out of bed?

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WHAT WOULD THE MARKET BE FOR ENERGY DRINKS IF SOCIETY WAS SLEEPING BETTER?

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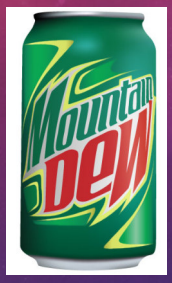
A Teenager Died After Drinking Too Much Caffeine

Drank a diet Mountain Dew, a cafe latte from McDonald's, and an energy drink within two hours, a coroner ruled

BuzzFeed May 16, 2017.



54 mg in can

77 mg per shot

160 mg per 16 oz can

25

MARKETING OF 300MG CAFFEINE TO CHILDREN

$2 a can

26

USA Today

Family blames popular energy drink for teen's death, lawsuit says

A family is suing a distributor of Alani Nu energy drinks. The lawsuit blames energy drinks for her death and says they need better...

5 days ago

People.com

Texas Teen Died Due to 'Enlarged Heart' from Caffeine from Energy Drink, Attorney Claims: Reports

The family of Texas teenager Larissa Rodriguez, who died in October 2025, filed a wrongful death lawsuit against the distributors of Alani...

6 days ago

WOAI

Teen dies after drinking 'a large amount of caffeine' from energy drinks

Cardiomyopathy attributed to stress and excessive caffeine

At least 1 can daily for months

10/20/25

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TIME

SIGN UP FOR OUR ENTERTAINMENT NEWSLETTER

HEALTH • MEDICINE

Melatonin Overdoses Are Spiking in Young Kids

3 MINUTE READ

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Sleep- Disordered Breathing

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SLEEPING SHOULD BE SILENT

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Fact: This has always been about kids

" Chronic enlargement of the tonsillar tissue is an affection of great importance, and may influence in an extraordinary way the mental and and bodily development of children... At night the child's sleep is greatly disturbed, the respirations are loud and snorting, and there is sometimes prolonged pauses, followed by deep, noisy inspiration. The child may wake up in a paroxysm of shortness of breath."

William Osler

The Principles and Practice of Medicine 1892

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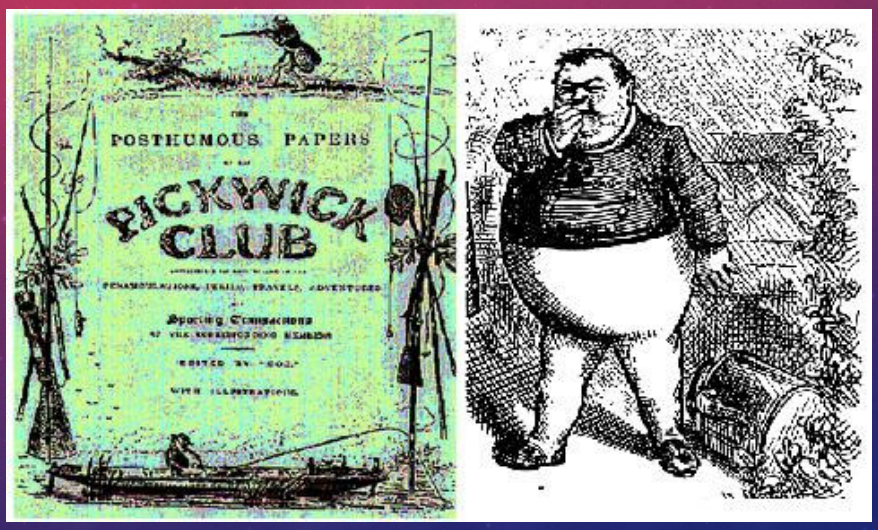
PICKWICKIAN SYNDROME



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"…and on the box sat a fat and red-faced boy, in the state of somnolency." C. Dickens

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" Chronic enlargement of the tonsillar tissue is an affection of great importance, and may influence in an extraordinary way the mental and and bodily development of children… At night the child's sleep is greatly disturbed, the respirations are loud and snorting, and there is sometimes prolonged pauses, followed by deep, noisy inspiration. The child may wake up in a paroxysm of shortness of breath."

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The Principles and Practice of Medicine 1892

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"Mouth breathing means adenoids; adenoids mean deadened intellects." In Gulick and Ayres, Medical inspection of schools, 1917 (2nd ed.), p. 4.

"Typical adenoid faces showing mouth breathing, flattened noses, and protruding eyes." In Gulick and Ayres, Medical inspection of schools, 1917 (2nd ed.), p. 170.

https://nyamcenterforhistory.org/2015/03/10/ adenoids-and-american-school-hygiene-in-the-early-20th-century/

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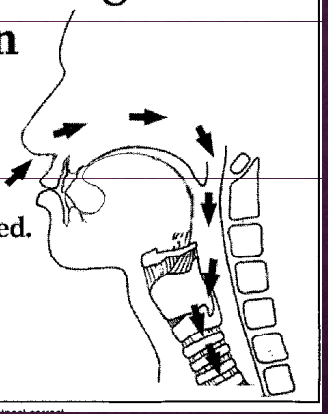
SLEEP DISORDERS IN CHILDREN

Correct Physiological Rest Position

Anterior portion of tongue on palate.
Lips closed and relaxed.
Teeth apart.
Nasal breathing.



Naso-Respiratory Function and Cranialfacial Growth James McNamara1979 as presented by James B. DuHammel DDS

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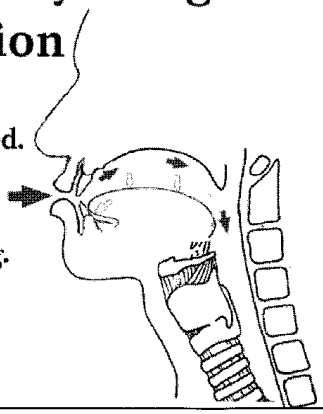
SLEEP DISORDERS IN CHILDREN

Incorrect Physiological Rest Position

Tongue depressed.
Lips apart.
Teeth apart.
Mouth breathing.
Head forward.



Naso-Respiratory Function and Cranialfacial Growth James McNamara1979 as presented by James B. DuHammel DDS

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ATTENTION-DEFICIT/HYPERACTIVITY DISORDER

" The essential feature of ADD/HD is a persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequent and severe than is typically observed in individuals at a comparable level of development."

"There are no specific physical features...although minor physical anomalies (...**high arched palate...)** may occur at a higher rate..."

Diagnostic and Statistical Manual of Mental Disorders DSM IV 1994

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AI Overview

Calling someone a "mouth-breather" is a derogatory insult implying they are stupid, slow-witted, dull, or unrefined. It stems from the observation that breathing through the mouth, often with a slack jaw, gives a dopey or "zoned out" appearance, historically used to label someone as a moron or imbecile. Wikipedia +4

Key Aspects of the Insult:

- **Low Intelligence:** It directly attacks a person's intelligence, suggesting they are incompetent or foolish.
- **Dopey Appearance:** It implies a vacant expression or a lack of mental sharpness.
- **Unrefined or Lazy:** It is often used to describe someone deemed uncouth or lacking mental effort.
- **Origin:** The term has been used since at least the early 20th century to describe someone as stupid, sometimes rooted in the physical,,, medical condition of needing to breathe through the mouth Wikipedia. Wikipedia +5

While technically referring to a medical condition where nasal obstruction forces mouth breathing, as an insult, it is meant to label someone as intellectually inferior. TL Dental +1

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SNORING PREDICTS HYPERACTIVITY FOUR YEARS LATER CHERVIN 2005

- Parents of 229 children aged 2 to 13 yrs, recruited at 2 general clinics, completed initial and 4-yr f/u surveys.
- Surveys included a Pediatric Sleep Questionnaire about snoring, sleepiness, and overall risk of SDB, and the hyperactivity index within the Conners' Parent Rating Scale.
- 13% were rated as hyperactive (hyperactivity index > 60) at f/u. Hyperactivity at f/u was predicted by baseline habitual snoring (odds ratio = 4.4) or loud snoring (4.5) and, sleepiness (3.0), or SDB (4.0).
- This 4-year prospective study shows that snoring and other symptoms of SDB are strong risk factors for future emergence or exacerbation of hyperactive behavior. These findings support the hypothesis that untreated childhood sleep-disordered breathing contributes to development of hyperactivity

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PEDIATRIC SDB FEATURES

- Unrefreshing sleep
- Behavioral awake problems
- Difficulty gaining weight
- Bed wetting/ secondary nocturnal enuresis
- Night sweats
- Snoring/ Mouth breathing

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INCREASED BEHAVIORAL MORBIDITY IN SCHOOL-AGED CHILDREN WITH SLEEP-DISORDERED BREATHING ROSEN ET AL *PEDIATRICS* '04

- Cross-sectional study of 829 children were recruited from a cohort study
- Children had unattended in-home PSG
- 5% with OSA (median AHI: 7.1), 15% had primary snoring
- 45% of parents unaware of snoring in the OSA group
- Children with SDB had significantly higher behavioral problems

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TREATMENT OF PEDIATRIC OSA

- Adenotonsillectomy. Take it all out!
- The tonsillar tissues reach maximum size from 3-6 years of age.
- For OSA, the absolute size of the tissue is less important than their relative size to the pharyngeal space.

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Adenotonsillectomy for Snoring and Mild Sleep Apnea in Children: A Randomized Clinical Trial *JAMA 2023*

12-month, multicenter, randomized, parallel-arm trial of 459 children aged 3 to 13 years with mild obstructive SDB. Although eAT did not result in significant differences in executive function or attention compared with watchful waiting, improvements in behavior, symptoms, quality of life, and blood pressure were observed

- Progression of the AHI to greater than 3 events/h (1.3% of children in the adenotonsillectomy group compared with 13.2%in the watchful waiting group;

Mild OSA defined habitual snoring occurring most of the sleep period on ≥3 or more nights per week for 3 or more months and (2) diagnostic polysomnography indicating an obstructive apnea index less than 1 event per hour of sleep, obstructive apnea-hypopnea index less than 3 events per hour, and the absence of oxygen desaturation below 90% associated with obstructive events.

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Adenotonsillectomy and Health Care Utilization in Children With Snoring and Mild Sleep Apnea: A Randomized Clinical Trial *JAMA Ped March 2025*

- Randomized clinical trial, Pediatric Adenotonsillectomy Trial for Snoring (PATS), was a 12-month, parallel-arm trial of 459 children (3 to 13 years; diagnosed with mild SDB;
- Difference in encounters was primarily driven by fewer office visits and outpatient procedures rather than hospitalizations
- Adenotonsillectomy was associated with 32% reduced all-cause HCU and 48 % reduction in prescription over 1 year in children with mild SDB

If they ask you does their child NEED surgery the answer is NO, but if they ask may their child benefit from surgery the answer is YES!

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Secondary Analyses of the Childhood Adenotonsillectomy Trial: A Narrative Review. JAMA Otolaryngol Head Neck Surg. 2022

- Adenotonsillectomy, performed for approximately 500 000 children annually in the US alone. The Childhood Adenotonsillectomy Trial (CHAT), the first randomized clinical trial to test the efficacy of adenotonsillectomy, compared the management of pediatric nonsevere OSA by early adenotonsillectomy (eAT) vs watchful waiting with supportive care.
- The results of most secondary analyses suggest that children who underwent eAT experienced the greatest improvements in symptom burden, sleepiness, parent-reported behavior, and quality of life. Changes in other domains, such as cognition, cardiovascular physiology, and metabolic indicators, were modest and selective. The associations between most treatment outcomes and polysomnographic parameters were weak. Symptoms were poor predictors of OSA severity.
- Directions for future research include whether the findings from this landmark study are generalizable to younger children and children with primary snoring and severe OSA. Similar studies may help address practice variability associated with pediatric OSA and help identify children who are most likely to benefit from undergoing eAT.

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Adenotonsillectomy for Snoring and Mild Sleep Apnea in Children: A Randomized Clinical Trial *JAMA 2023*

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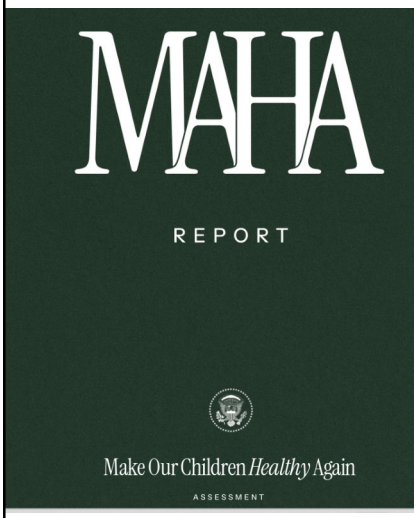

May 2025

"Adenotonsillectomy for children with sleep apnea, an historically common procedure, conferred no benefit in trials,428 suggesting the many, and often severe, harms of this surgery are unnecessary."

Waters KA, Chawla J, Harris MA, et al. Cognition after early tonsillectomy for mild OSA. Pediatrics. 2020

Ignored the same authors subsequent publications showing "T/A for mild obstructive sleep apnea led to large improvements in sleep and behavior in preschool-aged children…" Sleep and Behavior 24 Months After Early Tonsillectomy for Mild OSA: An RCT. Pediatrics. 2021

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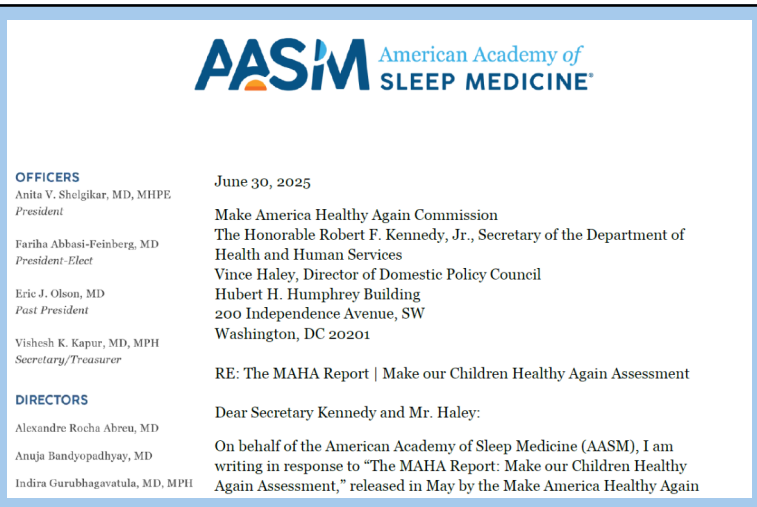

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June 30, 2025

Make America Healthy Again Commission
The Honorable Robert F. Kennedy, Jr., Secretary of the Department of Health and Human Services
Vince Haley, Director of Domestic Policy Council
Hubert H. Humphrey Building
200 Independence Avenue, SW
Washington, DC 20201

RE: The MAHA Report | Make our Children Healthy Again Assessment

Dear Secretary Kennedy and Mr. Haley:

On behalf of the American Academy of Sleep Medicine (AASM), I am writing in response to "The MAHA Report: Make our Children Healthy Again Assessment," released in May by the Make America Healthy Again

"…it is necessary to correct the report's misstatement that, "Adenotonsillectomy for children with sleep apnea…conferred no benefit in trials, suggesting the many, and often severe, harms of this surgery are unnecessary." This statement was based on only one cited study of children with mild sleep apnea, and the study did find improvements in sleep and behavior after surgery"

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ALTERNATIVES TO SURGERY FOR SDB

- CPAP
- Bi-Level Postive Airway Pressure (BiPAP™)
- "Smart" CPAP
- Orthodontics?
- Positional Therapy

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NCPAP IN INFANTS

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The effects of rapid maxillary expansion on persistent pediatric snoring post-tonsillectomy. Sleep Breath. 2022

- To investigate the short-term effects of rapid maxillary expansion (RME) on the quality of life of children who had persistent snoring post-adenotonsillectomy (AT).
- **Methods:** The study included children with maxillary constriction aged 5 to 12 years, two or more years after AT whose parents/guardians reported that they still snored ≥ 5 nights per week. We enrolled children with sleep-disordered breathing, including children with primary snoring and children with obstructive sleep apnea (OSA). All patients underwent laryngeal nasofibroscopy and complete polysomnography. Quality of Life (QOL) Questionnaire (OSA-18), the Pediatric Sleep Questionnaire (PSQ), Conners Abbreviated Scale (CAS), and the Epworth Sleepiness Scale (ESS) were administered before and after RME.
- **Results:** Of 24 children enrolled, 13 had primary snoring and 11 had OSA. Overall OSA-18 scores were reduced in both groups (intragroup difference, $p < 0.001$). The PSQ total score, CAS, and ESS were significantly reduced in both groups ($p < 0.001$) In the evaluation of snoring, there was a reduction due to the treatment effect in both groups ($p < 0.001$). Daytime sleepiness and attention deficit hyperactivity disorders were also positively affected in both groups.
- **Conclusions:** Our study demonstrated the potential benefit of RME in treating children with persistent snoring and transverse maxillary deficiency (TMD). RME can improve snoring and the QOL of children with refractory SDB after AT.

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OXFORD Sleep Research Society®

SLEEP, 2023, XX, 1–11
https://doi.org/10.1093/sleep/zsad095
Advance access publication 4 April 2023
Perspective

Perspective

A roadmap of craniofacial growth modification for children with sleep-disordered breathing: a multidisciplinary proposal

Audrey Yoon[1,2,*], David Gozal[3], Clete Kushida[1], Rafael Pelayo[1], Stanley Liu[4], Jasmine Faldu[5] and Christine Hong[6]

Craniofacial modification by orthodontic techniques is increasingly incorporated into the multidisciplinary management of sleep-disordered breathing in children and adolescents…Orthodontists can guide craniofacial growth depending on age.

From infancy to adulthood the dentition and craniofacial complex change with growth patterns that can be intercepted and targeted at critical time points

The appropriate application of these orthodontic techniques will not only provide an important therapeutic option for children and adolescents with symptomatic sleep-disordered breathing but may help also mitigate or prevent its onset.

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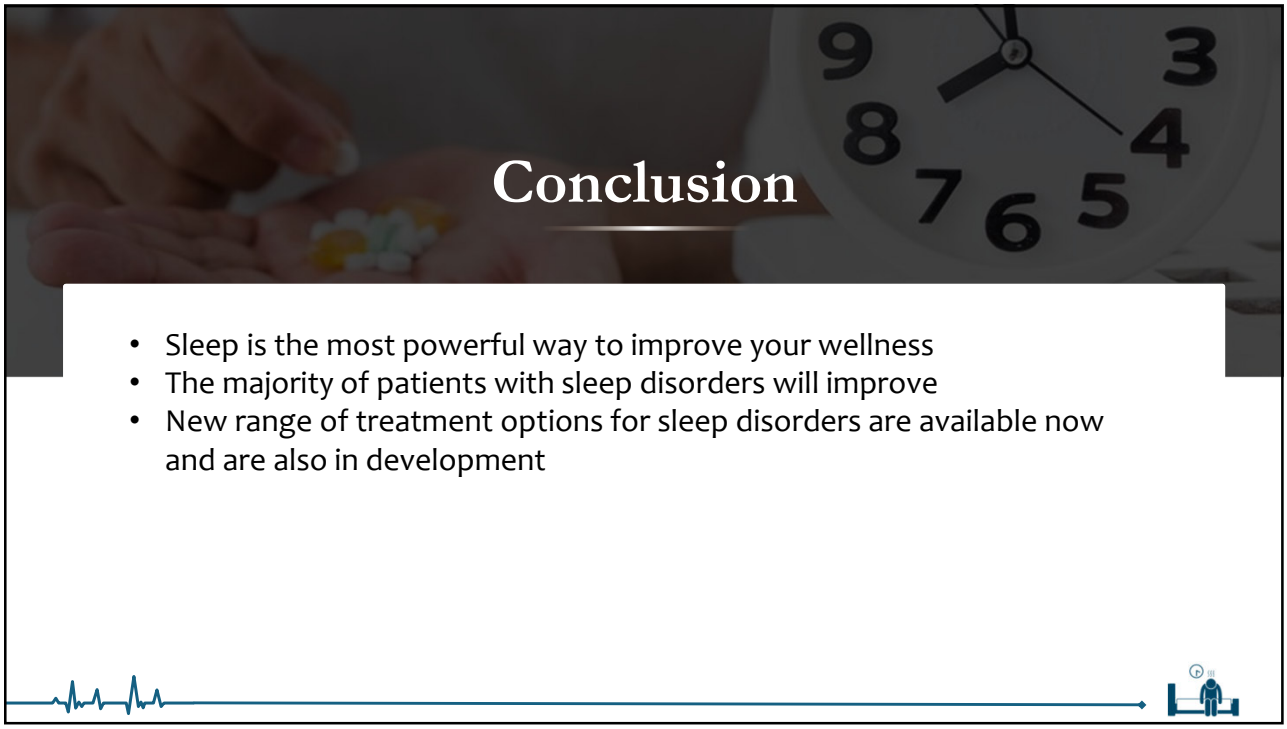

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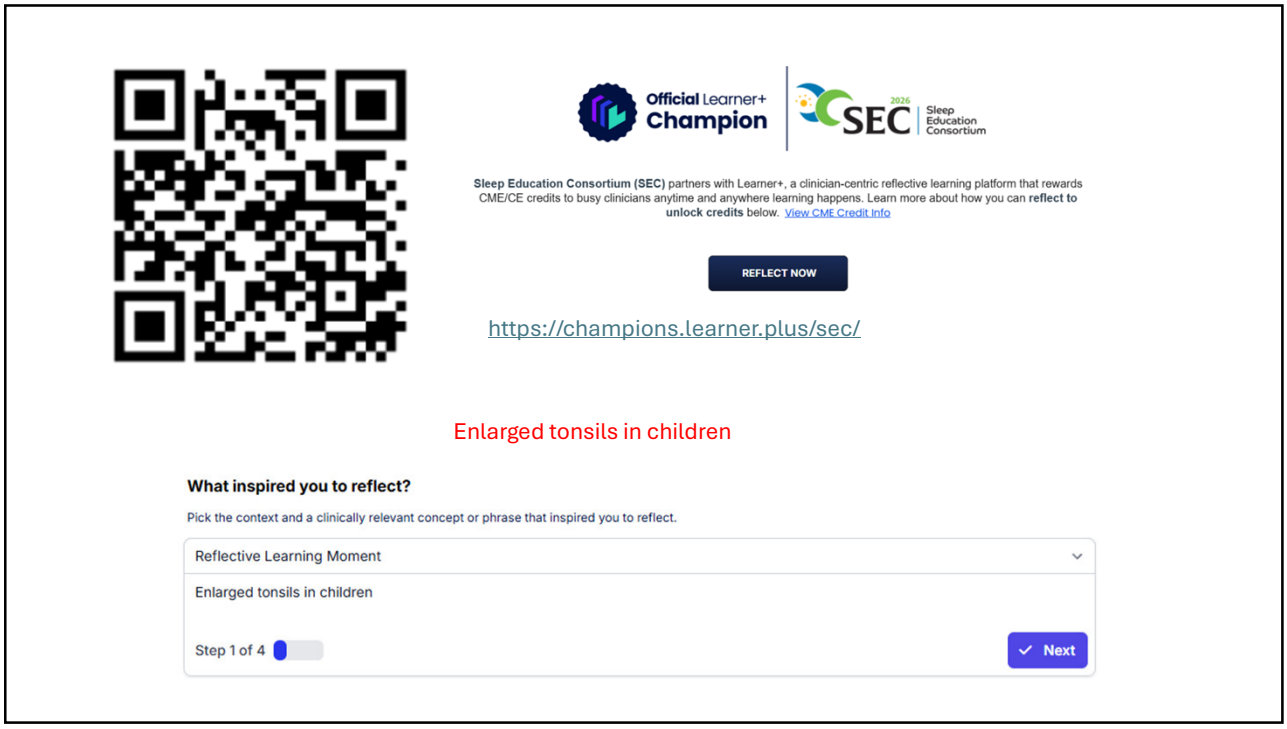

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