Pediatric Sleep Disorders: Impact of lack of diagnosis

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Founder, Director, The School of Sleep Medicine, Inc.

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There are no conflicts of interest to disclose.

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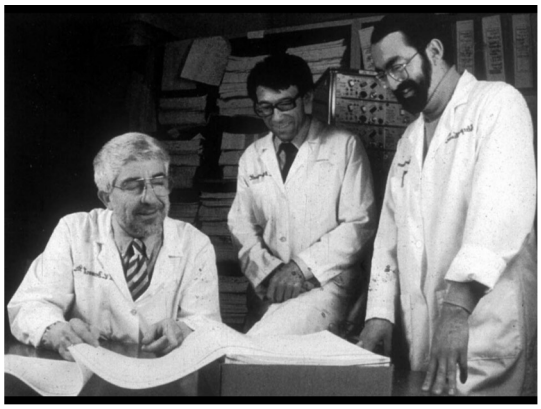

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Outline of Lecture

Overview of sleep disorders in children

Sleep disorders /Obesity/ ADHD Comorbidity

Cost of lack of study / diagnosis

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Questions

- How common are sleep problems in infants, children and adolescents ?
- What are typical characteristics ?
- Who is affected ?
- When do they occur ?
- What are the consequences of lack of treatment ?
- What can be done to decrease unnecessary suffering ?

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Current conclusions

- Sleep is a necessary process to ensure normal physiologic, mental and emotional functions during waking hours.
- In the development of central nervous system, sleep provides a foundation for the development of normal alertness, attention, and productive wakefulness.
- Perturbations in development of sleep mechanisms in early childhood pose higher risk for problems with attention, alertness, and emotional well being later in life.

Golbin 2004

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Current conclusions (cont.)

- Sleep is a necessary healing and recovery state.
- If sleep is abnormal, the consequences can be psychological or physical illness, or even death.
- Treatment of sleep disorders improves physical well being and can be instrumental in the treatment of medical and psychiatric disease.

Golbin 2004

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- **Owens** J. Classification and epidemiology of childhood sleep disorders. Prim Care. 2008 Sep;35(3):533-46, vii. doi: 10.1016/j.pop.2008.06.003. PMID: 18710669.
-
-
- Approximately **25% of all children** experience some type of sleep problem at some point during childhood. A number of studies have examined the prevalence of parent- and child-reported sleep complaints in large samples of healthy, typically developing children and adolescents; many of these have also further delineated the association between disrupted sleep and behavioral concerns. Sleep problems are **even more prevalent in children and adolescents with chronic medical, neurodevelopmental, and psychiatric conditions.** It is important to note that definitions of normal sleep patterns, sleep requirements, and sleep disorders in childhood must necessarily incorporate the **wide range of normal developmental and physical maturational changes across childhood and adolescence, and cultural, environmental, and social influences.**
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Factors Impacting Children's Sleep

- Developmental
- Circadian
- Sleep deprivation/ fragmentation
- Neurologic
- Cardiopulmonary
- Gastrointestinal
- Endocrine
- Upper respiratory
- Allergy
- Drugs
- Psychiatric/ psychological
- Infection
- Pain
- Dermatologic
- *Environment*

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Sleep Disorders in Children

- Sleep-Onset Association Disorder
- Limit-Setting Sleep Disorder
- Sleep Related Breathing Disorders
- Parasomnias
- Restless Legs and Periodic Limb Movements
- Sleep Related Seizure Disorder, Restless Sleep
- Insomnia
- Circadian Rhythm Disorders
- Narcolepsy
- Sleep disorders related to other medical conditions
- Environmental issues

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Results of National Sleep Foundation 2004 *Sleep in America* Poll

- Random sample 1473 telephone surveys
- Adults with child 10 yrs or younger
- Infants (n = 210)
- Toddlers (n=239)
- Preschoolers (n=387)
- School -aged (n=637)

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Daytime Sleepiness

- One-quarter of infants, toddlers & preschoolers appear sleepy or overtired during the day
- 3 out of 10 school-aged children have difficulty waking in the morning

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2006 NSF Sleep in America Poll

- Random sample: 1602 telephone surveys of adult caregivers of 11-17 year old adolescents
- 6th grade (n = 228)
- 7th grade (n = 238)
- 8th grade (n = 244)
- 9th grade (n = 233)
- 10th grade (n = 239)
- 11th grade (n = 221)
- 12th grade (n = 199)

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Sleepiness in Adolescents

- Only 1 out of 5 adolescents between 11 and 17 years old get an optimal amount of sleep (9 hours or more).
- While only 2 out of 10 adolescents in the 6th through 8th grade get insufficient sleep (less than 8 hours), 6 out of 10 adolescents in the 9th through 12th grade get insufficient sleep.

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Sleep Disorders in Infants

- SIDS
- Failure to Thrive (rare)
- Sleep-Related Breathing Disorders

Note: Growth spurt post Tx for OSAS Children

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SIDS epidemiology

- **Incidence of SIDS is approximately 1:1000 live births**
- **SIDS yearly incidence fluctuates, but seems to be decreasing**
- **Peak incidence between 2-4 months**
- **More than 90% prior to 6 months**
- **Less than 1% before two weeks**

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Pediatric Sleep Disorders

- 25% of children between 1 and 5 years experience some type of sleep disturbance
- Childhood sleep disturbances tend to persist if left untreated
- Children with sleep-waking disorders during the 1st year of life often experience multiple sleep problems in later years
- Wake Up America: A National Sleep Alert, 1993 Report of the National Commission on Sleep Disorders Research.

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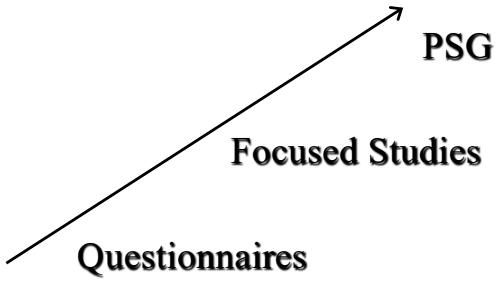
Evaluation Continuum



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Sleep Questionairres

- Stanford Sleepiness Scale, Hoddes
- Epworth
- Children
- Ron Chervin's Pediatric Sleep Questionairre
- Pittsburgh sleep quality
- And many others

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Indications for PSG in Children

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

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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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- **PSG** : The Sleep Study

The polysomnogram provides the simultaneous display of activity from the brain, muscles, heart and other aspects of physiology. The data from the PSG allow for the most sensitive look at all variables at the same moment in time. This is PSG's most powerful feature. And, brainwave activity (EEG) the most sensitive measure, is used to detect wake and sleep stages.

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Commercial Devices

Advantage: increased access to tracking available to the general public.

Activity (body movement) used as an surrogate measure of sleep (lack of movement = sleep , rather than EEG)

Black box .. Lack of access to raw data for further study.

Current challenge: integration into clinical practice ?

Significant potential to increase sleep health

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Pediatric Obesity and OSA

EDS, proinflammatory cytokine increase, increased leptin, decreased adiponectin

- points to inflammatory/insulin resistance state
- Suggests SDB in obese children shares similarities with SDB adults
- SDB in obese children may also be manifestation of metabolic syndrome

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Sleep Volume 32, Abstract Supplement, 2009

- 0185, 0195, 0215, 0217, 0218, 0226, 0228, 0229, 0230, 0237, 0249, 0265, 0297, 0341, 0342
- (Additional 10 abstracts re: kids but not in pediatric section)

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    - J Pediatr 2009; 154(6):A3.
- Obesity and Excessive Daytime Sleepiness in Prepubertal Children with Obstructive Sleep Apnea.
  - Gozal D, Kheirandish-Gozal L.
    - Pediatrics 2009; 123(1):13-8
- Obesity Prevalence Among Low-Income, Preschool-Aged Children – United States, 1998-2008.
  - MMWR Morb Mortal Wkly Rep 2009;58(28):769-73.
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  - Cappuccio FP, Taggart FM, Kandala NB, Currie A, Peile E, Stranges S, Miller MA.
    - Sleep 2008;31(5):619-26.

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- Does Excessive Daytime Sleepiness Contribute to Explaining the Association between Obesity and ADHD Symptoms.
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    - Med Hypotheses 2008; 70(1):12-6.
- Mr. Pickwick and his child went on a field trip and returned almost empty handed…What we do not know and imperatively need to learn about obesity and breathing during sleep in children!
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    - Sleep Med Rev 2008; 12(5):335-8.
- Obesity and Obstructive Sleep Apnoea Hypopnoea Syndrome in Singapore Children.
  - Tang JP.
    - Ann Acad Med Singapore 2008;37(8):710-5.

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- Marked Obesity in Infancy and Relationship to Sudden Infant Death.
  - Byard RW.
    - J Paediatr Child Health 2007;43(9):649-50.
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  - Tauman R, Gozal D.
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- Obstructive Sleep Apnea, Morbid Obesity and Adenotonsillar Surgery: A Review of the Literature.
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    - Sleep 2004;27(5):1023-4; author reply 1025.
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  - Ng DK , Lam YY, Kwok KL, Chow PY.
    - Hong Kong Med J 2004; 10(1):44-48

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- Hypopnea in Pediatric Patients with Obesity Hypertension.
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    - Nutr Clin Care 2003;6(1):4-12.

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    - Pediatrics 1998; 102(3):E29.

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Normal Sleep

- Individual differences: normal distribution, genetics, epigenetics
- Age dependent
- Cyclical in nature : Circadian with Zeitgebers
- Ultradian rhythms : REM and others

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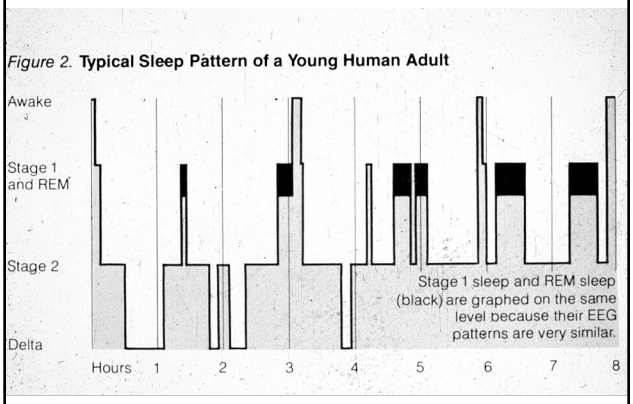

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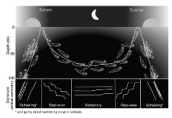
- **Diel migration** n the classic diel vertical migration pattern zooplankton such as marine worms travel to the surface to feed at night when predators such as fish are absent. A reverse nightly migration takes smaller zooplankton such as copepods to the deep, where they can avoid becoming the worms' prey.



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- Timing
- Food wakes up the liver,
- And provides the metabolic "start time "for the
- Clocks in the rest of the body. Break…fast.

- "Food is the dominant Zeitgeber
- for circadian clocks
- in most peripheral organs"
- Mistlberger and Antle, 2011

- Tahara & Shibata, Circadian Medicine (2015)

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Children's Sleep is the Gold Standard

- Short sleep latency
- 95+% sleep efficiency
- Some (few) spontaneous arousals
- Arise in the morning with smile and song
- No daytime sleepiness except for nap times

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Sleep Disorders & ADHD

Owens JA. The ADHD and sleep conundrum: a review.

J Dev Behav Pediatr. 2005; 26(4):312-22.

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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..." DSM IV

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Papers: 2003-2005

- **At least 50 studies reported**
- **Range of N = 6 to 1144**
- **Positive correlation between sleep disturbance and ADHD in all but two**
- **Study failing to show correlation (N = 30) with sleep disorders but positive for decreased sleep efficiency**
- **Study (N=48) where sleep architecture was not significantly different between ADHD controls and normals; no sleep abnormalities in the ADHD children that could be responsible for, or contributing to, the disorder. (Cooper J et al. *Clin Pediatr* 2004;43(7):609-14. No evidence of sleep apnea in children with attention deficit hyperactivity disorder.)**

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Some Additional Papers

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Some Additional Papers(2)

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Some Additional Papers(5)

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Sleep-disordered breathing & school performance in children

- Identified 1st graders performing at the bottom 10% percent of grade level
- Found over 20% had OSA
- All were offered surgery (T&A), but only half accepted
- All children who had surgery improved their grades, the others stayed the same

Gozal *Pediatrics* Vol. 102 No. 3, Sep. 1998

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Hidden Cost

- Increased use in health care services

Reuveni H et al. Health care services utilization in children with obstructive sleep apnea syndrome. *Pediatrics* 2002; 110 (1 Pt 1): 68-72.

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2008 Meeting & Papers (1)

- Giannotti F, et al. Treatment of Sleep Disorders in Childhood Autism with Melatonin or Behavioral Therapy. A Randomized Waiting-List Controlled Study. *SLEEP*, Volume 31, Abstract supplement, 2008
- Lopes M, et al. Association of Sleep Complaints with Suicidal Behavior among Children and Adolescents with Depressive Episodes. *SLEEP*, Volume 31, Abstract supplement, 2008
- Liu X, et al. Sleep, Psychopathology, and Suicidal Behavior among Adolescents of Insomnia Parents. *SLEEP*, Volume 31, Abstract supplement, 2008
- Liu X, et al. Rapid Eye Movement Sleep is associated with Overweight in Children and Adolescents. SLEEP, Volume 31, Abstract supplement, 2008

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2008 Meeting & Papers (2)

- De Leersnyder H, et al. Prolonged-Release Melatonin Restore Normal Sleep-Wake Cycle in Smith-Magenis Syndrome: A Circadian Genetic Disorder. *SLEEP*, Volume 31, Abstract supplement, 2008
- Giannottii F, et al. The Impact of Comorbid Anxiety on Sleep Pattern in Childhood Depression. *SLEEP*, Volume 31, Abstract supplement, 2008
- Armitage R, et al. Sleep and Rest Activity Cycles in Infants with and without a Maternal Family History of Depression. *SLEEP*, Volume 31, Abstract supplement, 2008

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2008 Meeting & Papers (3)

- Insana SP, et al. Indirect Effect of Tooth Grinding on Preschool Performance. *SLEEP*, Volume 31, Abstract supplement, 2008
- Umlauf MG, et al. Sleep and Activity Disturbances in 22Q11 Deletion Syndrome Using Actigraphy. *SLEEP*, Volume 31, Abstract supplement, 2008
- Landis AM, et al. Sleep, Hunger, Satiety, Food Cravings, and Caloric Intake in Adolescents. *SLEEP*, Volume 31, Abstract supplement, 2008
- Mian F, et al. Sleep Disorders in Children with Epilepsy: Clinical History and Polysomnographic Comparison with Non-Epilepsy Children Presenting at a Sleep Disorders Center. The NYU Comprehensive Epilepsy Center Experience. A Retrospective Study. *SLEEP*, Volume 31, Abstract supplement, 2008

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2008 Meeting & Papers (4)

- Hertz G, et al. Early Identification of Sleep Apnea in Infants with Prader Willi Syndrome. *SLEEP*, Volume 31, Abstract supplement, 2008
- Lopes M, et al. Sleep Complaints in Children and Adolescents with Unipolar Depressive Disorder. *SLEEP*, Volume 31, Abstract supplement, 2008
- Sridharan PR, et al. Objective and Subjective Measures of Sleep in Smith-Lemli-Optiz Syndrome (SLOS). *SLEEP*, Volume 31, Abstract supplement, 2008

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2008 Meeting & Papers (5)

- Phillips NN, et al. Sleep Architecture in Children with Down Syndrome. *SLEEP*, Volume 31, Abstract supplement, 2008
- Gruber R, et al. Performance on Attention Tests is Associated with Sleep Efficiency in Children with ADHD but not in Controls. *SLEEP*, Volume 31, Abstract supplement, 2008
- Gruber R, et al. Sleep Disturbances in Children with Attention Deficit Hyperactivity Disorder: A Home Polysomnography Study. *SLEEP*, Volume 31, Abstract supplement, 2008
- Meltzer LJ, et al. Sleep in Hospitalized Pediatric Patients and their Parents. *SLEEP*, Volume 31, Abstract supplement, 2008

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2008 Meeting & Papers (6)

- Han G, et al. Preschool/Day Care Attendance and Sleep Patterns of 2- to 5- Years-Old Children. *SLEEP*, Volume 31, Abstract supplement, 2008
- Bhatt H, et al. Parent Reported Sleep Complaints in Youth Diagnosed with Autism Spectrum Disorders. *SLEEP*, Volume 31, Abstract supplement, 2008
- Barnes M, et al. Occasional Snoring During Sleep in Children and Impairments on a Speech Discrimination Task. *SLEEP*, Volume 31, Abstract supplement, 2008
- Cairns AA, et al. Prevalence of Pediatric Sleepiness. *SLEEP*, Volume 31, Abstract supplement, 2008

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2008 Meeting & Papers (7)

- El-Hakim H, et al. Airway Findings in Down Syndrome Children with Sleep Disordered Breathing: A Case Control Study. *SLEEP*, Volume 31, Abstract supplement, 2008
- Byars KC, et al. Barriers to Adherence in Children Using Positive Airway Pressure to Treat Obstructive Sleep Apnea. *SLEEP*, Volume 31, Abstract supplement, 2008
- Souders MC. Sleep Behaviors and Sleep Quality in Children with Autistic Spectrum Disorders. *SLEEP*, Volume 31, Abstract supplement, 2008

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Do you know ?

- In 1997 about 5% of 3-17 yr olds were diagnosed with ADD or ADHD
- National estimates are 3-4 million and rising
- In 2000 an estimated 20 million Rx written for stimulants, the majority to tx ADHD
- No long term studies on effects, kids often medicated form kindergarten through HS

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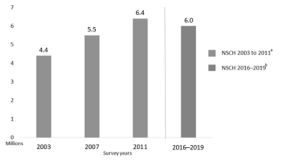

- The number of US children ever diagnosed with ADHD has changed over time
- **Estimated number of U.S. children ages 3–17 years who ever had a diagnosis of ADHD,[1] in millions**
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Biopsychosocial Model

- Sleepiness is physiological
- Decreased self esteem, depression, decreased performance travel together.
- Need for paradigm shift, society needs to push for medical awareness of possible influence of sleep deprivation and / or sleep disorders in both medical and psychiatric settings

Engle GL. The need for a new medical model: A challenge for biomedicine. *Science* 1977; 196: 129-136.

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Next Step?

- Physical evaluation, vaccinations prior to school
- Why not sleep questions?

1. How much, when, quality?
2. In what environment?

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Malcolm Gladwell. *How Little Things Make a Big Difference*, 2002

The Tipping Point

- Mavens
- Connectors
- Context
- Stickiness

- You are the mavens now, use your connections, in whatever context makes sense to you, to increase education about sleep and sleep disorders. Too many kids die by suicide.

Education is key to early diagnosis and prevention of sleep disorders.

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- You Tube Video

Finding Conner Deegan

at end of lecture …. If there is time .

5 minute video.

If not enough time in class, suggest search and view at convenience

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Questions

- How common are sleep problems in infants, children and adolescents ? Common, not rare
- What are typical characteristics ? Behavioral and emotional problems
- Who is affected ? The child, the family, society
- When do they occur ? Infancy, childhood, adolescence
- What are the consequences of lack of treatment ? Emotional and behavioral problems, increased risk of suicide
- What can be done to decrease unnecessary suffering ? Education of the public, health care providers, teachers

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Resources for further study:
Mary Carskadon PhD, Professor, Brown University
SU Sleep and Dreams History
Ph D Neuroscience Stanford (MSLT)
AASM 2023 Dement Award
New Center details: COBRA (est 2021)
Sleepforscience.org

The National Sleep Foundation sleepfoundation.org
The National Heart Lung Blood Institute: https://www.nhlbi.nih.gov/
The Sleep Research Society
The California Sleep Society
The American Academy of Sleep Medicine
The World Sleep Society
The International Pediatric Sleep Association

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