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## Sleep Problems in Children with Autism Spectrum Disorders



### Overview

- Sleep needs
- Prevalence of sleep problems in ASD
- Neurobiology
- Impact
- Types of sleep disorders
- Diagnosis
- Treatment



### Biology of Sleep

- Governed by two biological systems:
  - 1) **Sleep/wake homeostasis**: the drive to sleep that increases the longer we are awake
  - 2) **Circadian rhythms**: the internal clock in our brain that regulates when we feel sleepy and when we are alert



*Let her sleep  
 for when she wakes  
 she will move  
 Mountains*

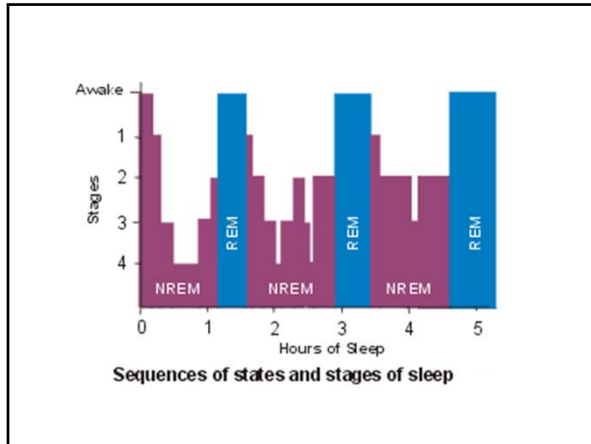
**A good laugh and a long sleep are the best cures in the doctor's book.**

gadel.info

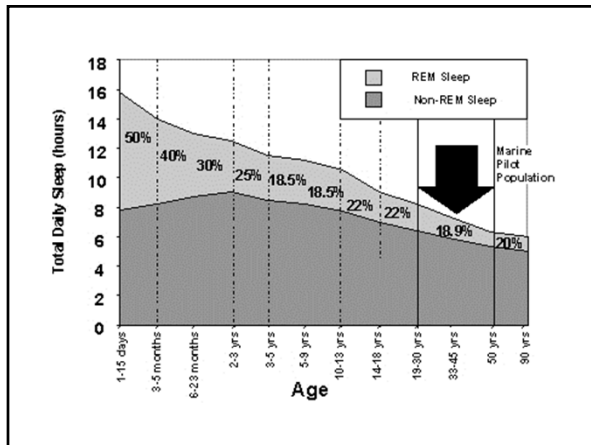
**Irish proverb**

### Sleep patterns

- REM (rapid eye movement): active sleep phase with more irregular breathing and heart rate, eye move back and forth but no body movement; dreaming occurs
- NREM (non-REM): several stages stage I and II wake easily stages III and IV very deep sleep with difficulty waking; relaxed muscles



- ### Impact of sleep deprivation
- Lower stress threshold
  - Impaired memory and trouble concentrating
  - Decreased optimism and sociability
  - Impaired creativity and innovation
  - Increased resting blood pressure
  - Increased food consumption and appetite
  - Increased risk of cardiac mortality



- ### Sleep disturbances
- Prevalence of sleep disorders in children: 20 to 30% in infants, toddlers and young children
  - Often transient and treatable
  - Types of sleep disorders: difficulty falling asleep, nighttime awakenings most common
  - Others: night terrors, sleep walking, obstructive sleep apnea

### How Much Sleep Do You Really Need?

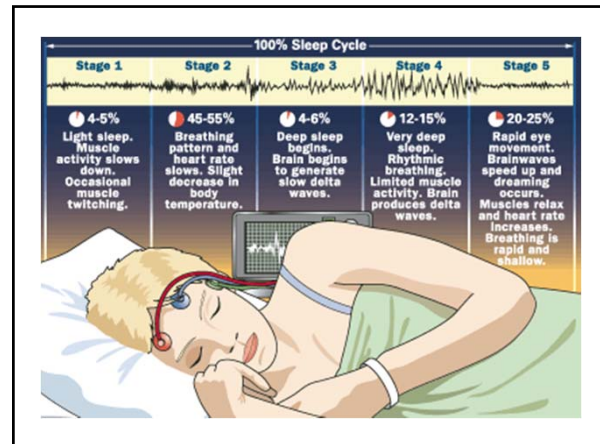
Age	Sleep Needs
Newborns (0-2 months)	12-18 hours
Infants (3 to 11 months)	14 to 15 hours
Toddlers (1-3 years)	12 to 14 hours
Preschoolers (3-5 years)	11 to 13 hours
School-age children (5-10 years)	10 to 11 hours
Teens (10-17)	8.5-9.25 hours
Adults	7-9 hours

Source: National Sleep Foundation

- ### Prevalence of Sleep Problems in ASD
- 50% to 80% of children with autism have sleep problems
  - Sleep problems similar across cognitive abilities and subtypes of autism
  - Correlation of sleep problems with aggression, anxiety and developmental regression
  - Higher than rate of sleep problems for general population of children or those with developmental delay

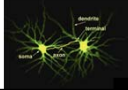
## Neurobiology

- ASD characterized by neurobiologic changes in sleep-wake cycle
- Neurotransmitters that are likely involved include: Gamma-aminobutyric acid (GABA), serotonin and melatonin
- Genes implicated in ASD (neurologins and neurexins) influence GABA synaptic function
- Serotonin is a precursor to melatonin and platelet serotonin levels have been abnormal in some studies of ASD



## Neurobiology

- Children with ASD have reduction in GABA receptors in anterior and posterior cingulate cortex and fusiform gyrus
- Difficulties with sleep onset and maintenance may be influenced by social emotional and face processing deficits regulated by the cingulate gyrus in children with ASD
- Melatonin secretion may be reduced or undergo altered time release in ASD



## Impact of sleep problems in ASD

- Sleep disturbances contribute to stress and parental sleep disruption
- Sleep problems associated with behavioral issues, inattention and hyperactivity
- In ASD, sleep problems seem to be correlated with increased repetitive behaviors and insistence on sameness
- Short sleep duration associated with higher autism severity scores, social skills deficits

## Role of sleep in learning

- Sleep plays important role in optimizing cognition, memory, behavioral regulation and learning
- Slow wave component of sleep plays critical role in memory consolidation
- Rapid eye movement (REM) sleep critical in processing memories with emotional overlay
- Sleep is essential for behavioral regulation and affective impulses

## Types of Sleep Disorders: Insomnia

- Most common of sleep problems in ASD
- Includes difficulty falling asleep, increased nighttime awakenings, decreased efficiency of sleep
- Medical conditions such as epilepsy and GERD may contribute to insomnia
- Medications (antiepileptics, psychotropics) may also play a role



## Insomnia

- Comorbid conditions such as ADHD and anxiety may also contribute
- Behavioral concerns can create problems in setting bedtime routine
- Limited communication skills may also play a role



## Types of Sleep Disorders: movement disorders

- Restless Legs Syndrome is characterized by urge to move legs; occurs at bedtime and relieved by movement
- Periodic Limb Movements in Sleep are defined by repetitive stereotypic movements of the limbs during sleep
- RLS often responds to iron supplements if iron levels low



## Types of Sleep Disorders: OSA

- Obstructive sleep apnea is caused by airway obstruction and results in disordered breathing during sleep
- Often characterized by loud snoring
- Can be the result of enlarged tonsils/adenoids, obesity; hypotonia can contribute



## Sleep history

- Bedtime, time of sleep onset
- Mood and energy level upon waking
- Daytime napping, attention, mood
- Activities in hours preceding bedtime
- Technology available in child's room
- Medications
- Anxiety or depression



## Types of Sleep Disorders: Parasomnias

- Non-rapid eye movement arousal disorders
- Include night terrors, sleep walking and confusional arousals
- Usually occur during first half of night during deep, slow wave sleep
- Some studies report increased parasomnias in ASD



## Questionnaires

- Children's Sleep Habits Questionnaire (35 items, ages 4 to 10, parents complete)
- Family Inventory of Sleep Habits
- Pediatric Daytime Sleepiness Scale
- Child Behavior Checklist



## Sleep diary

- Sleep latency
- Total sleep time
- Night waking
- Response to treatment



## Treatment

- Medical treatment of sleep disrupting conditions
- OSA, RLS
- Epilepsy
- GI problems (GERD, constipation, abdominal pain, etc.)
- Anxiety, depression
- Medication changes if disruptive of sleep

## Actigraphy

- Involves use of a portable device (usually wrist band) that records movement over extended periods of time
- Measures sleep patterns and total sleep time
- Can be helpful in characterizing circadian rhythm patterns
- May also be useful in determining response to treatment



## Treatment

- Implementation of appropriate sleep practices
- Daytime habits: attention to quantity and timing of exercise; light exposure; dietary choices; naps; bedroom use
- Evening habits: "wind-down" activities; minimizing light exposure; bedtime routine and consistency of bed time

## Polysomnography

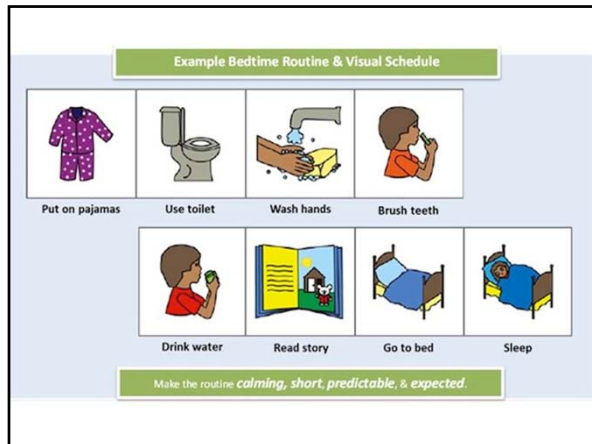
- Overnight study that records brain waves (EEG), measures oxygen level, heart rate and breathing, as well as eye and leg movements.
- Noninvasive and painless, but may be difficult for children with ASD to tolerate
- Gold standard for detecting OSA, PLMD, parasomnias, etc.



## Treatment

- Behavioral interventions
- Use of visual schedule for each step of bedtime routine
- Social stories about bedtime
- Fading
- Use of Bedtime Pass





## Resources

- Autism Speaks Toolkit: Strategies to Improve Sleep in Children with Autism Spectrum Disorders, A Parent’s Guide
- Sleep and Autism: Helping Your Child (National Autistic Society – UK)
- Establishing Positive Sleep Patterns for Children on the Autism Spectrum (Autism Society)

## Treatment

- Melatonin
- Meta-analysis of studies of children with ID found melatonin safe and effective in short term
- Retrospective study of 107 children with ASD found improvement in sleep onset and minimal side effects
- Start with 1 mg 30 minutes before bedtime; can go up fairly rapidly; usually no more than 10 mg studied

Strategies to Improve Sleep in Children with Autism Spectrum Disorders  
A Parent's Guide

AUTISM SPEAKS™  
ATN  
Autism Treatment Network

AIRP  
Autism Intervention Research  
Network on Physical Health

## Other medications

- Clonidine: retrospective study showed improved sleep onset
- Others: trazodone, mirtazepine, atypical antipsychotics




## Conclusion

- Sleep problems are very common in children with Autism Spectrum Disorders
- Insomnia is the most common sleep disorder in ASD
- Other sleep problems include sleep disordered breathing, sleep movement disorders and parasomnias
- Sleep diaries and questionnaires are helpful in diagnosis

## Conclusions

- Objective measures include actigraphy and polysomnography
- Treatment includes: 1) medical treatment of sleep disrupting conditions 2) establishing appropriate sleep practices 3) behavioral interventions and 4) melatonin/ pharmacology

## References

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