Adverse Health Effects of Sleep Deprivation

Presented By Dr. Ramesh
Definition of Sleep (medical dictionary)

• A period of rest for the body and mind during which volition and consciousness are in partial of complete abeyance and the bodily functions partially suspended.

• Sleep had also been described as a behavioral state marked by characteristic immobile posture and diminished but readily reversible sensitivity to external stimuli.
How much sleep is needed for good health:

**AGE DEPENDENT:**
The American Academy of Sleep Medicine & the Sleep Research Society Recommend:

<table>
<thead>
<tr>
<th>AGE GROUP</th>
<th>Recommended Hours/Sleep per day</th>
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<tbody>
<tr>
<td>Infant 4-12 mos.</td>
<td>12-16 hours per 24 hours including naps</td>
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<tr>
<td>Toddler 1-2 yrs</td>
<td>11-14 hours per 24 hours including naps</td>
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<tr>
<td>Pre-School 3-5 yrs</td>
<td>10-13 hours per 24 hours including naps</td>
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<tr>
<td>School Age 6-12 yrs</td>
<td>9-12 hours per 24 hours</td>
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<tr>
<td>Teen 13-18 yrs</td>
<td>8-10 hours per 24 hours</td>
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<tr>
<td>Adult 18-60 yrs</td>
<td>7-9 hours per night</td>
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How much sleep is needed for good health:

The amount of sleep you need changes as you age.

Children need more sleep than adults.
Other Factors Can Affect Sleep Requirements

**PREGNANCY:** changes in the body during early pregnancy can increase the need for sleep.

**AGING:** older adults need about the same amount of sleep as younger adults. However, sleeping patterns may change. Older adults tend to sleep more lightly and for shorter time spans than do younger adults.

**PREVIOUS SLEEP DEPRIVATION:** If you’re sleep deprived, the amount of sleep you need increases.
Other Factors Can Affect Sleep Requirements

**SLEEP QUALITY:** If your sleep is frequently interrupted you’re not getting quality sleep. The quality of sleep is just as important as the quantity.

**MEDICAL CAUSES:** Illnesses, injuries may all require more than normal sleep to recuperate.
SLEEP STATES: REM & NON-REM SLEEP

• Each is regulated by a different part of the brain
• Difference between those states is as profound as the difference between sleep and wakefulness.
• REM sleep is regulated from the brain stem.
• Non-REM sleep is regulated from higher brain centers.
• Both types of sleep are necessary for optimal health; yet have different effects on the body. Generally, REM sleep rejuvenates the brain and NON-REM rejuvenates the body.
CYCLES OF SLEEP

- Body alternates between the two main sleep cycles; REM and NON REM
- Usually when one first falls asleep he will go into NON REM sleep which can actually be broken down into 4 stages lasting about 90 minutes
- REM sleep occurs next and can last anywhere between 10 minutes to an hour
- During the night, the body will cycle between NON REM sleep and REM but spend most of the time in NON REM sleep
NON RAPID EYE MOVEMENT SLEEP

Also known as quiet sleep
Formerly divided into 4 stages
American Academy of Sleep Medicine (AASM) 2007 update reduced to 3 stages

NON REM STAGE 1:
Beginning of the sleep cycle relatively light stage of sleep
Brain produces high amplitude “theta waves” which are very slow brain waves
This period lasts only 5-10 minutes
NON RAPID EYE MOVEMENT SLEEP

NON REM STAGE 2:
Less aware of surroundings
Body temperature drops
Breathing and heart rate become more regular
This period lasts 20 minutes
Brain produces bursts of rapid rhythmic brain wave activity known as sleep spindles
50% of total sleep in this stage
NON RAPID EYE MOVEMENT SLEEP

NON REM STAGE 3:
Muscles relax
BP & breathing rate drop
Deepest sleep occurs
Brain produces deep slow brain waves known as “delta waves” 15-20% of total adult sleep time
RAPID EYE MOVEMENT (REM) SLEEP

Brain becomes more active
Body becomes relaxed and immobilized
Dreams occur
Eyes move rapidly
Increased respiration rate
20% of total adult sleep time
Also called paradoxical sleep
The Sequence of Sleep Stages

- Sleep begins in Stage 1 and progresses into Stages 2 and 3.
- After Stage 3 sleep, Stage 2 Sleep is repeated before entering REM sleep.
- Once REM sleep is over, the body returns to Stage 2 sleep.
- Sleep cycles through these stages approximately four or five times throughout the night.
- We enter REM stage approximately 90 minutes after falling asleep.
- The 1st cycle of REM sleep might only last a short time, but each cycle becomes longer lasting up to one hour.
- Sleep is thus not a passive process.
- Research has shown that the brain is actually quite active during the different stages of sleep.
The Sequence of Sleep Stages

- **Stage 1**: In stage 1 we experience a light transitional sleep. This is where drowsiness and sleep begin.

- **REM**: REM sleep revitalizes the memory. In this stage brain activity is very high and intense dreaming is likely to occur.

- **Stage 2**: In stage 2 more stable sleep occurs. Chemicals produced in the brain block the senses making it difficult to be woken.

- **Stage 3**: Stage 3 is deep sleep. Growth hormone is released during this stage. Most stage 3 sleep occurs in the first third of the night.
Benefits of a Good Night’s Sleep

• Keeps your heart healthy
• May help prevent cancer
• Reduce stress
• Reduces inflammation
• Makes you more alert
• Improves your memory
• May help you lose weight
• Napping makes you “smarter”
• Reduces risk of depression
Benefits of a Good Night’s Sleep

• Helps body repair itself
• Less pain
• Lower risk of injury
• Better mood
• Better sex life
• Prevents headache
• And many more...!
What are Sleep Deprivation and Deficiency

**Sleep Deprivation:** Condition that occurs if you don’t get enough sleep

**Sleep Deficiency:** Broader concept

It occurs if you have one or more of the following:

- You don’t get enough sleep
- You sleep at the wrong time of day
- You don’t sleep well or get all the stages of sleep
- You have a sleep disorder that prevents you from getting enough sleep or causes poor quality sleep
1. Sleep deficiency is a common public health problem in the U.S. affecting all age groups.

2. According to CDC about 7-19% of adults in the US reported not getting enough rest or sleep every day.

3. Nearly 40% of adults reported falling asleep during the day without meaning to at least once a month.

4. An estimated 50-70 million Americans have chronic (ongoing) sleep disorders.

5. Sleep deficiency is linked to many chronic health problems including heart disease, kidney disease, high blood pressure, diabetes, stroke, obesity and depression.
6. Sleep deficiency is also associated with an increased risk of injury in adults, teens and children. For example, driver sleepiness (not related to alcohol) is responsible for serious car crash injuries and death. In the elderly, sleep deficiency may be linked to an increased risk of falls and broken bones.

7. In addition, sleep deficiency has played a role in human errors linked to tragic accidents, such as nuclear reactor meltdowns, grounding of large ships and aviation accidents.

A common myth is that people can learn to get by on little sleep with no negative effects. However, research shows that getting enough quality sleep at the right times is vital for mental health, physical health, quality of life and safety.
WHAT MAKES YOU SLEEP

1. Internal “body clock” controls when you’re awake and when your body is ready for sleep.

2. Adenosine: level in brain continues to rise when awake. Increasing levels of Adenosine signals a shift towards sleep.

3. Light, darkness and other cues.

4. Body releases chemicals. In the dark—melatonin is released which helps you feel drowsy.

5. As the sun rises, your body releases cortisol which prepares your body to wake up.
Who Is At Risk for Sleep Deprivation and Deficiency

• Have limited time available for sleep e.g. caregivers
• Have schedules that conflict with internal body clocks eg: shift workers, 1st responders, business travelers, etc.
• Make lifestyle choices that prevent them from getting enough sleep such as taking medicine to stay awake, ETOH or drug abuse.
• Have undiagnosed or untreated medical problems such as stress anxiety or sleep disorders.
• Have medical conditions or take medicines that interfere with sleep.
Medical Conditions Linked to Sleep Disorders

- Heart failure
- Heart disease
- Obesity
- Diabetes Mellitus
- High Blood Pressure
- Stroke or TIA
- Depression
- ADHD
Very tired during the day
Don’t feel refreshed and alert when waking up
Interference with work, school, driving, social functioning
If you often feel like you doze off while:
- sitting and reading or watching TV
- sitting still in a public place such as movie theater, meeting or classroom
- riding in a car for an hour without stopping
- sitting and talking to someone
- sitting quietly after lunch
- sitting in traffic for a few minutes
• Problems focusing & reacting
• Trouble making decisions, solving problems, remembering things, controlling emotions and behavior coping with change
• Children who are sleep deficient: overly active, problems paying attention, misbehave, school performance may suffer
How to Find out Whether You’re Sleep Deficient

Keep a Sleep Diary for 2-3 Weeks

Sample of Sleep Diary
(National Heart Lung and Blood Institute’s “Your Guide to Healthy Sleep”

https://www.nhlbi.nih.gov/health-topics/all-publications-and-resources/your-guide-healthy-sleep
Common Sleep Disorders

- Bruxism
- Delayed Sleep Phase Disorder
- Hypopnea Syndrome
- Narcolepsy
- Restless Leg Syndrome
- Obstructive Sleep Apnea
- Sleep Walking
- Etc.
FIRST: Allow yourself enough time to sleep

• Go to bed and wake up at the same time every day
• Try to keep the same sleep schedule on weeknights and weekends.
• Use the hour before bed for quiet time
• Avoid strenuous exercise and bright light such as TV, computer screen
• Avoid heavy and/or large meals within a couple of hours of bedtime
STRATEGIES TO GET ENOUGH SLEEP (continued)

• Avoid alcoholic drinks before bed
• Avoid nicotine, caffeine
• Spend time outside every day and be physically active
• Keep your bedroom quiet, cool and dark
• Take a hot bath or use relaxation techniques before bed.
OSA is a sleep related breathing disorder that involves a decrease or complete cessation in air flow despite an ongoing effort to breathe. It occurs when the muscles relax during sleep causing the soft tissue in the back of the throat to collapse and block the upper airway. This leads to partial reductions (hypopneas) and complete pauses (apneas) in breathing that last at least 10 seconds during sleep.

Most pauses last between 10 and 30 seconds but some may persist for one minute or longer. This can lead to abrupt reductions in blood O2 saturations with O2 levels falling as much as 40% or more in severe cases.

The brain responds to the lack of O2 by alerting the body causing a brief arousal from sleep that restores breathing. This pattern can occur hundreds of times in one night. The result is a fragmented quality of sleep that produces an excessive level of daytime sleepiness.
Most people with OSA snore loudly and frequently with periods of silence when airflow is reduced or blocked. They then make a choking, snorting, or gasping sounds when their airway reopens. A common measurement of OSA is AHI – Apnea –Hypopnea-Index

Prevalence:

- Increases between middle & older age
- OSA with daytime sleepiness occurs at least 4% of men and 2% of women
- About 24% of men and 9% of women have the breathing symptoms of OSA with or without daytime sleepiness
- About 80% to 90% of adults with OSA remain undiagnosed
- OSA occurs in about 2% of children and is most common at preschool ages
OBSTRUCTIVE SLEEP APNEA TYPES

- Mild OSA: AHI 5 – 15
- Moderate OSA: AHI 15-30
- Severe OSA: AHI>30
OSA RISK GROUPS

• People who are overweight (BMI of 25-29.9) and obese (BMI >30)
• Large neck sizes >17” for men >16” for women
• Middle aged and older men, post menopausal women
• Ethnic minorities
• Abnormalities of bony and soft tissue structure of head and neck
• Down Syndrome
• Children with large tonsils & adenoids
• Family members/history
• Endocrine disorders: Acromegaly & hypothyroidism
• Smokers
• Nocturnal nasal congestion, Rhinitis
OSA EFFECTS

- Fluctuating O2 levels
- Increased heart rate
- High Blood Pressure
- Increased risk of stroke
- Higher rate of death due to heart disease
- Impaired glucose tolerance & Insulin resistance
- Impaired concentration
- Mood changes
- Increased risk of being involved in a deadly MVA
- Disturbed sleep of the bed partner
OSA DIAGNOSIS & TREATMENT

DIAGNOSIS: Symptoms, Signs
Overnight Sleep Study Poly somnogram

TREATMENTS:

**CPAP** - Continuous Positive Airway Pressure
Standard for moderate to severe cases of OSA and good option for mild OSA

**Oral Appliances**

**Surgery**

**Behavioral Changes:**
weight loss
changing from back sleeping to side sleeping
“A brief nap may provide greater alertness for several hours and can improve attention, concentration, accuracy and productivity.” Dr. David Neubauer MD Associate Director John Hopkins Sleep Disorders Center

NASA found that even naps as short as 26 minutes improved mission task performance by 34% and saw a 16% increase in median reaction time.

Several companies encourage napping at work and have nap rooms and/or nap pods: Google, Uber, AOL, Capital One Labs, Pricewaterhouse, Coopers, etc.
Many cities in the US like NYC, Washington DC offer nap pods for rent.
REFERENCES

1) www.nhlbi.nlm.gov
2) www.cdc.gov
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