



# The Cycle of Sleep and Effects of Sleep Deprivation



## Key Points

- To understand sleep deprivation, you need to understand normal sleep patterns
- Sleep deprivation will interfere with numerous body functions needed for health
- Determine the need and level of intervention when dealing with a sleep problem

Understanding the effects of sleep deprivation might keep you up at night. “Sleep is important for every function that you have and if you are lacking in sleep, virtually everything you can think of that you do...[will be] affected by the lack of sleep.” Dr. Franklin Douglis (M.D.) doesn’t soften his words when it comes to sleep and the effects of sleep deficiency.

Dr. Douglis is a specialist in Otolaryngology Head and Neck Surgery (Ear, Nose, and Throat). He is also a member of the American Academy of Sleep Medicine (AASM) and uses the combination of disciplines to help sleep problems from insomnia to obstructive sleep apnea.

## Causes for Sleep Interruption

Sleep deprivation has many causes, including physical—such as sleep apnea, allergies, menopause, or pain—and psychological—such as anxiety, depression, or stress. Even stress related sleeplessness can be caused from negative (distress) or positive (eustress) events. Prescription medications and other drugs can also disrupt sleep patterns and sleep deprivation can be an intermittent or a chronic situation.

## Understanding the Circadian Rhythm

Most living organisms function around an approximate 24-hour cycle where physical, mental, and behavioral processes follow the daily pattern of light. This circadian rhythm or cycle is influenced by the body's internal "clock", but can also be influenced by the surrounding environment.

This flow of functioning monitors your sleep-wake cycles (a balance between the circadian and homeostatic mechanisms), hormone releases and body temperature. In addition, this cycle regulates many other vital bodily functions from determining the time of day when you will have your best coordination—approximately 2:30pm—to when your level of the hormone melatonin rises to help you fall asleep—approximately 9pm.

Abnormal circadian rhythms have been linked to various sleep disorders, such as insomnia and disrupted sleep-wake cycles as well as associated with depression, bipolar disorder and seasonal affective disorder (SAD).

## Normal Sleep Stages

How much sleep an individual needs depends on many factors, including age and daily activities. Based on a few age groups, the approximate amount of sleep required in a 24 hour period are:

- 16 hours for infants
- 9 hours for teenagers
- 7 to 8 hours for adults

There are five stages of sleep. We repeatedly progress and restart through Non-Rapid Eye Movement (NREM)—where the body repairs and regenerates tissues, builds bone and muscle, and strengthens the immune system—to Rapid Eye Movement (REM)—where there is elevated brain activity while the muscles are immobile. The activities of each of the five stages include:

- **Stage One or N1 (NREM)** – This is the transition stage from being awake to sleeping and where most body systems begin to relax and slow down. This is the only stage that does not repeat throughout the night.
- **Stage Two or N2 (NREM)** – This is the transition stage from falling asleep to deeper sleep and usually the longest stage in the process. The heart rate slows and core body temperature drops in preparation for deep sleep.
- **Stage Three or N3 (NREM)** – This is the first part of deep or slow-wave sleep where there is still some faster wave activity. This is also the beginning stage of "refreshing" sleep.
- **Stage Four or N3 (NREM)** – This is the second part of slow-wave sleep and deepest sleep stage where the brain is almost exclusively producing slow-waves. This is the continuing stage of "refreshing" sleep.
- **Stage Five (REM)** – This is the dream stage of sleep and occupies more sleep time throughout the continued cycling of stages.

## The Effects of Sleep Deprivation

Dr. Douglass details the effects of sleep deprivation on bodily functions in his 2009 American Academy of Anti-Aging Medicine (AAAAM) presentation, "Why Sleep is Important and How it Affects Everything Else" (<http://progressive.uvaul.com/pd1005/A4M093/16Douglass/player.HTM#>). In the presentation, Dr. Douglass points out that the more time it takes to fall asleep (sleep latency) and the lower quality of sleep (sleep efficiency) can predict a higher mortality rate.

Among other symptoms, sleep deprivation can result in irritability, nausea, dizziness, headaches, muscle aches, and memory problems. Sleep deprivation also increases the risk of disorders including obesity, diabetes, hypertension, cardiovascular disease, and depression.

Dr. Douglass shared other effects from sleep deprivation, including:

- **Brain and cognitive functions** – A recent study reported in The Journal of Sleep highlights that sleep deprivation impairs the correct judgment of human facial emotions.
- **Hormone secretion and balance** – Sleep deprivation increases the level of ghrelin (a hormone that

stimulates hunger) and decreases leptin (a hormone that inhibits appetite).

- **Immune system function** – Sleep deprivation is known to increase all pro-inflammatory cytokines—related to cardiovascular disease. Natural Killer (NK) cells patrol during slow-wave sleep and are disrupted with sleep interruptions.

The lack of sleep, or lack of sleep quality, can also produce micro-sleeps during your waking hours. Micro-sleeps are episodes of sleep that last for a few seconds and are not usually recognized by the individual. Episodes can occur while driving—including “gap driving”—or any other activity.

## Steps to Help Combat Sleep Deprivation

When facing a sleep problem—intermittent or chronic—there are methods to help combat the problem and build towards a healthy sleep-wake cycle. These methods include:

- Physical (exercise more or adjust sleep patterns)
- Natural (over-the-counter supplements, herbs, foods)
- Professional (prescribed medicine or psychological therapy)

The intensity of a sleep problem—mild, moderate, severe—will most likely dictate the interventional plan. Visiting a professional such as Dr. Douglis can help determine the intensity, cause, and develop a necessary plan of action.

When combating a sleep problem, these escalating diagnostic/treatment steps can help determine the need and level of intervention:

1. Determine if the sleep problem is intermittent or chronic (Did you lose sleep a few nights because of excitement about a vacation or are you unable to sleep 2-3 nights a week because of anxiety?)
2. Find out what the problem is that causes sleep problems (From the lack of exercise or fear from a past event or future worry – what is keeping you up at night?)
3. Set up a sleep inducing environment (Does dimming the lights, shutting off the television, or taking a hot bath/shower work?)
4. Develop sleep restrictions (Does going to bed at the same time every night, avoiding naps during the day or forgoing afternoon coffee work?)
5. Natural Remedies (Do supplements, herbs, or foods help you fall asleep?)
6. Prescribed medication or Cognitive Behavior Therapy (Have all your efforts failed? You might need to seek the services of a medical or psychological professional.)

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## References

(1) van der Helm E; Gujar N; Walker MP. Sleep deprivation impairs the accurate recognition of human emotions. SLEEP 2010;33(3):335-342.[ABSTRACT]