

Editorial

Sleep Deprivation – A Serious Public Health Issue

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Introduction

Sleep deprivation is a serious public health issue that harms both mental and physical health by impairing brain function, emotional regulation, and metabolic processes.

Sleep deprivation is when a person doesn't get enough sleep. This can be a short-term issue, affecting one or a few nights, or it can be a chronic concern that lasts weeks or even months. Sleep deprivation can happen for countless reasons, many of them harmless, but it's also a key symptom of certain health conditions.

Lack of sleep reduces activity in the prefrontal cortex and thalamus, leading to slow reaction times and poor concentration. It disrupts memory consolidation and makes learning new information difficult. Over activity in the amygdala paired with poor prefrontal cortex function causes high irritability and anxiety.

Chronic sleep loss is linked to high blood pressure, stroke, and heart disease. Insufficient rest raises the risk of obesity and type 2 diabetes by disrupting hunger hormones and blood sugar regulation. It increases stress hormones like cortisol and lowers the body's ability to repair itself.

The prevalence of habitual sleep loss has become a major concern today due to night shifts and other work. The consequences of lack of sleep may not have an immediate impact on health, but chronic sleep loss seems to have adverse effects on a person's well-being.^{1,2} Several studies have recorded the impact of reduced sleep time on the cardiovascular system, the metabolic system, and even depression and anxiety levels.^{3,4} The recommended amount of sleep for adults (18-65 years) should ideally be 7-9 h per day, while older adults (65+ years) should aim for 7-8 h of sleep per day. The amount of sleep required varies with age, with children and adolescents needing more sleep than adults, usually over 8 hours per day.⁵ Adults and the elderly, who often sleep less than 7 h, are at increased risk of health issues⁶; however, both sleeping too little (less than 6 h) or too much (more than 9-10 h) appears to negatively influence well-being to varying degrees.⁷

Adverse health effects are a by-product of inadequate sleep duration, with reduced sleep time reported to increase the risk of all-cause mortality among both male and female.⁸ Chronic sleep deprivation (SD) has been linked to the development of co-morbidities such as hypertension, diabetes, and obesity.⁹ The elderly population is more affected than adults, mainly due to pre-existing health conditions. Sex differences also play a role, with male being at a significantly higher risk of all-cause mortality due to short sleep. In both male and

female, the risk of all-cause mortality increases with sleeping more than recommended duration.¹⁰

Recent studies indicate relationship between sleep time and co-morbidities such as hypertension, cardiovascular diseases (including atherosclerosis, stroke, and coronary artery disease), diabetes mellitus and obesity.¹¹ Short sleep duration can lead to an increase in overall body weight and influence glucose metabolism. Insufficient sleep also affects homeostasis, leading to food cravings, reduced insulin sensitivity, and altered levels of leptin and ghrelin.¹²

Health outcomes include cancer, diabetes mellitus and cardiovascular diseases like coronary heart disease. There was an increased risk of prostate cancer if sleep was reduced below 6 h per day. Reduced melatonin secretion and circadian rhythm disruption lead to an increased cancer of risk.¹³ Short sleep presented increased mortality risk in both the sexes, but the effect of short sleep on diabetes mellitus showed a significant increase in males.¹⁴ Also, males were at a higher risk of all-cause mortality than female when short sleep was reviewed.¹⁰

Research has extensively focused on hypertension as a primary cardiovascular outcome influenced by sleep deprivation.

Sleep deprivation is very common. Experts estimate between 50 million to 70 million adults in the U.S. meet the medical criteria for sleep deprivation at any point in time. Virtually every human being experiences sleep deprivation at some point in their life. For some people, it's simply a greater or longer-lasting issue, or it happens for a more serious reason.

Stages of Sleep

There are following stages of sleep cycle:

- **Stage 1:** Light sleep. This is a short stage, usually no more than 5% of your total sleep, which begins right after you fall asleep.
- **Stage 2:** Deeper sleep. This stage is deeper and makes up about 45% of all the time you spend sleeping (this number goes up as you get older). Research indicates this stage is key in memory storage and learning.
- **Stage 3:** Deepest sleep. This stage makes up about 25% of the time you spend sleeping (this number goes down with age). There's evidence that this stage is the most important to how your body recovers and maintains itself because the brain prioritizes this stage in people with sleep deprivation. It's very hard to wake someone up from this stage, and they'll usually feel foggy or confused for up to 30 minutes after waking up.

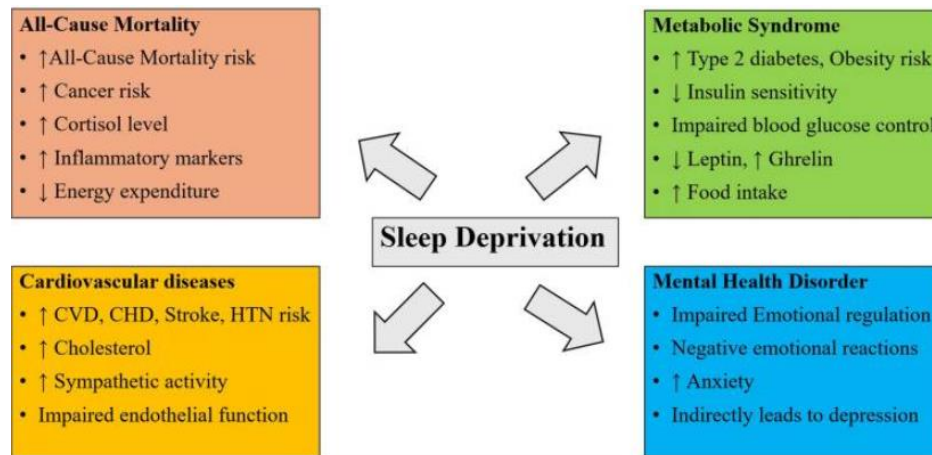


Figure: Effect on body by Sleep Deprivation

- **REM Sleep:** REM stands for “rapid eye movement.” This stage is when you dream. When a person is in REM sleep, you can see their eyes moving beneath their eyelids.

When you fall asleep, you typically enter stage 1 and then move in and out of stages 2 and 3. After that, you go into REM sleep and start dreaming. After the first REM cycle, you start a new sleep cycle and go back into stage 1 or 2. One cycle normally takes about 90 to 120 minutes before another begins. Most people go through four or five cycles per night (assuming they get a full eight hours).

Effect of Sleep Deprivation on body:

Sleep deprivation has negative effects in multiple ways throughout your body. Those can affect the following body systems, organs and processes:

- **Heart and circulatory systems:** Sleep deprivation has long-term damaging effects on your heart and circulatory health. People with chronic sleep deprivation are more likely to develop high blood pressure (hypertension) and high cholesterol (hyperlipidemia).
- **Metabolic systems:** People with chronic sleep deprivation are at a much higher risk of developing Type 2 diabetes.
- **Immune system:** Your body’s natural defenses against infections can’t work properly if you aren’t getting enough sleep.
- **Nervous system:** It’s common for people who aren’t sleeping enough to have higher pain sensitivity, which means they feel pain more easily, the pain is more intense or both.
- **Brain:** Sleep deprivation has very negative effects on how your brain works. While experts don’t fully understand sleep’s role in brain function, they do know it’s a key part of how people learn and remember. There’s also some evidence that sleep deprivation could play a role in the development of Alzheimer’s disease.

- **Mental health:** Sleep deprivation also negatively affects your mental health, making it harder for you to manage and process your emotions. People with sleep deprivation are more likely to feel symptoms of depression and anxiety.

Sleep deprivation also increases your risk of developing certain conditions or making them worse if you have them. These conditions include Type 2 diabetes, High blood pressure (hypertension), Obesity, Obstructive sleep apnea, Vascular disease, Stroke, Heart attack, Depression, Anxiety and conditions that involve psychosis.

Symptoms of Sleep Deprivation

Some of the most common symptoms include Daytime sleepiness, Fatigue, Irritability, Trouble thinking, focusing and remembering, Slowed reaction times and Headaches.

As sleep deprivation goes on for longer, the symptoms become more severe. Many of the more severe symptoms look like the effects of alcohol intoxication. The severe symptoms of sleep deprivation include “Microsleeps” (when a person briefly falls asleep for only seconds before waking back up), Uncontrollable eye movements (nystagmus), Trouble speaking clearly, Drooping eyelids (ptosis), Hand tremors, Visual and tactile (touch-based) hallucinations, Impaired judgment and Impulsive (or even reckless) behavior.

Stages of Sleep Deprivation

Sleep deprivation stages are:

- **Stage 1:** This is when you go at least 24 hours without sleeping. In this stage, the effects of sleep deprivation are similar to being under the influence of alcohol to the point where it isn’t safe for you to drive.
- **Stage 2:** Common symptoms of sleep deprivation intensify. Most people start to experience microsleeps in this stage and have trouble thinking or focusing.
- **Stage 3:** People in this stage start to show very severe symptoms like hallucinations. They may

also struggle to communicate with people around them.

- **Stage 4:** The symptoms of sleep deprivation are at their most extreme. The above symptoms worsen to severe or extreme levels. Hallucinations are common and you struggle to tell what's real and what isn't.

Causes of Sleep Deprivation

Sleep deprivation can happen for numerous reasons like Shift work (especially shifts that happen partly or fully during nighttime hours). Alcohol use (especially misuse), Using stimulants like caffeine later in the day, Bad sleep-related habits (known as sleep hygiene), High stress levels, Sleeping in a new or unfamiliar place, such as in a hotel while traveling.

However, sleep deprivation can also happen for medical reasons. Some examples include Lack of quality sleep due to sleep apnea, Degenerative brain disorders such as Alzheimer's disease or Parkinson's disease, Mental health concerns (see below for more about these), Concussions and traumatic brain injuries, Pain, Insomnia, Restless leg syndrome, Parasomnias (disruptive sleep disorders) such as night terrors, sleep paralysis, sleepwalking and more, Medications such as corticosteroids, stimulants and more, Short-term illnesses and infections, such as the common cold, the flu and more.

Mental health issues that can affect sleep include Anxiety, Bipolar disorder, Depression, Mania, Panic disorder, Post-traumatic stress disorder (PTSD) and Somniphobia (fear of sleep).

Diagnosis and Tests

Some possible tests include:

- **Sleep apnea testing.** This can happen in the form of an overnight sleep lab study called a polysomnogram or with an at-home sleep apnea testing device.
- **Electroencephalogram (EEG).** This test detects and records brain waves. Your healthcare provider, usually a neurologist, can examine your brain activity for signs of unusual brain activity that could contribute to sleep problems or other conditions.
- **Actigraphy.** This test involves wearing a device similar to a watch that tracks sleep patterns to see if you may have a different sleep cycle than is typical. This is key in diagnosing circadian rhythm disorders
- **Multiple sleep latency test (MSLT).** This test examines whether a person is prone to falling asleep during the daytime. It's often a key part of diagnosing narcolepsy.
- **Maintenance of wakefulness test (MWT).** This test looks for whether or not a person can resist falling asleep in situations where it would be easy to do so. It's a common part of safety testing for

people who drive for a living and may have conditions like sleep apnea.

Management and Treatment

Some of the more common treatments for sleep deprivation and related conditions include:

- **Behavior changes.** Many people can prevent sleep deprivation simply by adjusting their sleep-related behaviors and pre-sleep routine.
- **Medications.** Various medications can help a person fall and stay asleep or change the way they sleep. Some medications can even change the way a person dreams, making it less likely that they'll have severe nightmares or other sleep disturbances. However, many sleep-inducing medications can be habit-forming, so healthcare providers prescribe these cautiously.
- **Breathing support methods.** Conditions that affect breathing during sleep, such as sleep apnea, are treatable with various methods. These include different types of pillows and supports, mouthpieces that adjust your jaw position, surgery to widen your airway, positive airway pressure machines that keep your airway open while you sleep and more.

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