

Sleep Deprivation and Deficiency

Sleep deprivation (DEP-rih-VA-shun) is a condition that occurs if you don't get enough sleep. Sleep deficiency is a broader concept. It occurs if you have one or more of the following:

- You don't get enough sleep (sleep deprivation)
- You sleep at the wrong time of day (that is, you're out of sync with your body's natural clock)
- You don't sleep well or get all of the different types of sleep that your body needs
- You have a sleep disorder that prevents you from getting enough sleep or causes poor quality sleep

This article focuses on sleep deficiency, unless otherwise noted.

Sleeping is a basic human need, like eating, drinking, and breathing. Like these other needs, sleeping is a vital part of the foundation for good health and well-being throughout your lifetime.

Sleep deficiency can lead to physical and mental health problems, injuries, loss of productivity, and even a greater risk of death.

Overview

To understand sleep deficiency, it helps to understand how sleep works and why it's important. The two basic types of sleep are rapid eye movement (REM) and non-REM.

Non-REM sleep includes what is commonly known as deep sleep or slow wave sleep. Dreaming typically occurs during REM sleep. Generally, non-REM and REM sleep occur in a regular pattern of 3–5 cycles each night.

Your ability to function and feel well while you're awake depends on whether you're getting enough total sleep and enough of each type of sleep. It also depends on whether you're sleeping at a time when your body is prepared and ready to sleep.

You have an internal "body clock" that controls when you're awake and when your body is ready for sleep. This clock typically follows a 24-hour repeating rhythm (called the circadian rhythm). The rhythm affects every cell, tissue, and organ in your body and how they work. (For more information, go to ["What Makes You Sleep?"](#))

If you aren't getting enough sleep, are sleeping at the wrong times, or have poor quality sleep, you'll likely feel very tired during the day. You may not feel refreshed and alert when you wake up.

Sleep deficiency can interfere with work, school, driving, and social functioning. You might have trouble learning, focusing, and reacting. Also, you might find it hard to judge other people's emotions and reactions. Sleep deficiency also can make you feel frustrated, cranky, or worried in social situations.

The signs and symptoms of sleep deficiency may differ between children and adults. Children who are sleep deficient might be overly active and have problems paying attention. They also might misbehave, and their school performance can suffer.

Outlook

Sleep deficiency is a common public health problem in the United States. People in all age groups report not getting enough sleep.

As part of a health survey for the Centers for Disease Control and Prevention, about 7–19 percent of adults in the United States reported not getting enough rest or sleep every day.

Nearly 40 percent of adults report falling asleep during the day without meaning to at least once a month. Also, an estimated 50 to 70 million Americans have chronic (ongoing) sleep disorders.

Sleep deficiency is linked to many chronic health problems, including [heart disease](#), kidney disease, [high blood pressure](#), diabetes, [stroke](#), [obesity](#), and depression.

Sleep deficiency also is 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 might be linked to an increased risk of falls and broken bones.

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? - Sleep Deprivation and Deficiency

Many factors play a role in preparing your body to fall asleep and wake up. You have an internal "body clock" that controls when you're awake and when your body is ready for sleep.

The body clock typically has a 24-hour repeating rhythm (called the circadian rhythm). Two processes interact to control this rhythm. The first is a pressure to sleep that builds with every hour that you're awake. This drive for sleep reaches a peak in the evening, when most people fall asleep.

A compound called adenosine (ah-DEN-o-seen) seems to be one factor linked to this drive for sleep. While you're awake, the level of adenosine in your brain continues to rise. The increasing level of this compound signals a shift toward sleep. While you sleep, your body breaks down adenosine.

A second process involves your internal body clock. This clock is in sync with certain cues in the environment. Light, darkness, and other cues help determine when you feel awake and when you feel drowsy.

For example, light signals received through your eyes tell a special area in your brain that it is daytime. This area of your brain helps align your body clock with periods of the day and night.

Your body releases chemicals in a daily rhythm, which your body clock controls. When it gets dark, your body releases a hormone called melatonin (mel-ah-TONE-in). Melatonin signals your body that it's time to prepare for sleep, and it helps you feel drowsy.

The amount of melatonin in your bloodstream peaks as the evening wears on. Researchers believe this peak is an important part of preparing your body for sleep.

Exposure to bright artificial light in the late evening can disrupt this process, making it hard to fall asleep. Examples of bright artificial light include the light from a TV screen, computer screen, or a very bright alarm clock.

As the sun rises, your body releases cortisol (KOR-tih-sol). This hormone naturally prepares your body to

wake up.

The rhythm and timing of the body clock change with age. Teens fall asleep later at night than younger children and adults. One reason for this is because melatonin is released and peaks later in the 24-hour cycle for teens. As a result, it's natural for many teens to prefer later bedtimes at night and sleep later in the morning than adults.

People also need more sleep early in life, when they're growing and developing. For example, newborns may sleep more than 16 hours a day, and preschool-aged children need to take naps.

Young children tend to sleep more in the early evening. Teens tend to sleep more in the morning. Also, older adults tend to go to bed earlier and wake up earlier.

The patterns and types of sleep also change as people mature. For example, newborn infants spend more time in REM sleep. The amount of slow-wave sleep (a stage of non-REM sleep) peaks in early childhood and then drops sharply after puberty. It continues to decline as people age.

For more information about what makes you sleep, go to the National Heart, Lung, and Blood Institute's ["Your Guide to Healthy Sleep."](#)

Why Is Sleep Important? - Sleep Deprivation and Deficiency

Sleep plays a vital role in good health and well-being throughout your life. Getting enough quality sleep at the right times can help protect your mental health, physical health, quality of life, and safety.

The way you feel while you're awake depends in part on what happens while you're sleeping. During sleep, your body is working to support healthy brain function and maintain your physical health. In children and teens, sleep also helps support growth and development.

The damage from sleep deficiency can occur in an instant (such as a car crash), or it can harm you over time. For example, ongoing sleep deficiency can raise your risk for some chronic health problems. It also can affect how well you think, react, work, learn, and get along with others.

Healthy Brain Function and Emotional Well-Being

Sleep helps your brain work properly. While you're sleeping, your brain is preparing for the next day. It's forming new pathways to help you learn and remember information.

Studies show that a good night's sleep improves learning. Whether you're learning math, how to play the piano, how to perfect your golf swing, or how to drive a car, sleep helps enhance your learning and problem-solving skills. Sleep also helps you pay attention, make decisions, and be creative.

Studies also show that sleep deficiency alters activity in some parts of the brain. If you're sleep deficient, you may have trouble making decisions, solving problems, controlling your emotions and behavior, and coping with change. Sleep deficiency also has been linked to depression, suicide, and risk-taking behavior.

Children and teens who are sleep deficient may have problems getting along with others. They may feel angry and impulsive, have mood swings, feel sad or depressed, or lack motivation. They also may have problems paying attention, and they may get lower grades and feel stressed.

Physical Health

Sleep plays an important role in your physical health. For example, sleep is involved in healing and repair of your heart and blood vessels. Ongoing sleep deficiency is linked to an increased risk of [heart disease](#), kidney disease, [high blood pressure](#), diabetes, and [stroke](#).

Sleep deficiency also increases the risk of [obesity](#). For example, one study of teenagers showed that with each hour of sleep lost, the odds of becoming obese went up. Sleep deficiency increases the risk of obesity in other age groups as well.

Sleep helps maintain a healthy balance of the hormones that make you feel hungry (ghrelin) or full (leptin). When you don't get enough sleep, your level of ghrelin goes up and your level of leptin goes down. This makes you feel hungrier than when you're well-rested.

Sleep also affects how your body reacts to insulin, the hormone that controls your blood glucose (sugar) level. Sleep deficiency results in a higher than normal blood sugar level, which may increase your risk for diabetes.

Sleep also supports healthy growth and development. Deep sleep triggers the body to release the hormone that promotes normal growth in children and teens. This hormone also boosts muscle mass and helps repair cells and tissues in children, teens, and adults. Sleep also plays a role in puberty and fertility.

Your immune system relies on sleep to stay healthy. This system defends your body against foreign or harmful substances. Ongoing sleep deficiency can change the way in which your immune system responds. For example, if you're sleep deficient, you may have trouble fighting common infections.

Daytime Performance and Safety

Getting enough quality sleep at the right times helps you function well throughout the day. People who are sleep deficient are less productive at work and school. They take longer to finish tasks, have a slower reaction time, and make more mistakes.

After several nights of losing sleep—even a loss of just 1–2 hours per night—your ability to function suffers as if you haven't slept at all for a day or two.

Lack of sleep also may lead to microsleep. Microsleep refers to brief moments of sleep that occur when you're normally awake.

You can't control microsleep, and you might not be aware of it. For example, have you ever driven somewhere and then not remembered part of the trip? If so, you may have experienced microsleep.

Even if you're not driving, microsleep can affect how you function. If you're listening to a lecture, for example, you might miss some of the information or feel like you don't understand the point. In reality, though, you may have slept through part of the lecture and not been aware of it.

Some people aren't aware of the risks of sleep deficiency. In fact, they may not even realize that they're sleep deficient. Even with limited or poor-quality sleep, they may still think that they can function well.

For example, drowsy drivers may feel capable of driving. Yet, studies show that sleep deficiency harms your driving ability as much as, or more than, being drunk. It's estimated that driver sleepiness is a factor in about 100,000 car accidents each year, resulting in about 1,500 deaths.

Drivers aren't the only ones affected by sleep deficiency. It can affect people in all lines of work, including

health care workers, pilots, students, lawyers, mechanics, and assembly line workers.

As a result, sleep deficiency is not only harmful on a personal level, but it also can cause large-scale damage. For example, 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.

How Much Sleep Is Enough? - Sleep Deprivation and Deficiency

The amount of sleep you need each day will change over the course of your life. Although sleep needs vary from person to person, the chart below shows general recommendations for different age groups.

Age	Recommended Amount of Sleep
Newborns	16–18 hours a day
Preschool-aged children	11–12 hours a day
School-aged children	At least 10 hours a day
Teens	9–10 hours a day
Adults (including the elderly)	7–8 hours a day

If you routinely lose sleep or choose to sleep less than needed, the sleep loss adds up. The total sleep lost is called your sleep debt. For example, if you lose 2 hours of sleep each night, you'll have a sleep debt of 14 hours after a week.

Some people nap as a way to deal with sleepiness. Naps may provide a short-term boost in alertness and performance. However, napping doesn't provide all of the other benefits of night-time sleep. Thus, you can't really make up for lost sleep.

Some people sleep more on their days off than on work days. They also may go to bed later and get up later on days off.

Sleeping more on days off might be a sign that you aren't getting enough sleep. Although extra sleep on days off might help you feel better, it can upset your body's sleep–wake rhythm.

Bad sleep habits and long-term sleep loss will affect your health. If you're worried about whether you're getting enough sleep, try using a sleep diary for a couple of weeks.

Write down how much you sleep each night, how alert and rested you feel in the morning, and how sleepy you feel during the day. Show the results to your doctor and talk about how you can improve your sleep. You can find a sample sleep diary in the National Heart, Lung, and Blood Institute's ["Your Guide to Healthy Sleep."](#)

Sleeping when your body is ready to sleep also is very important. Sleep deficiency can affect people even when they sleep the total number of hours recommended for their age group.

For example, people whose sleep is out of sync with their body clocks (such as shift workers) or routinely interrupted (such as caregivers or emergency responders) might need to pay special attention to their sleep needs.

If your job or daily routine limits your ability to get enough sleep or sleep at the right times, talk with your doctor. You also should talk with your doctor if you sleep more than 8 hours a night, but don't feel well rested. You may have a sleep disorder or other health problem.

Who Is at Risk for Sleep Deprivation and Deficiency? - Sleep Deprivation and Deficiency

Sleep deficiency, which includes sleep deprivation, affects people of all ages, races, and ethnicities. Certain groups of people may be more likely to be sleep deficient. Examples include people who:

- Have limited time available for sleep, such as caregivers or people working long hours or more than one job
- Have schedules that conflict with their internal body clocks, such as shift workers, first responders, teens who have early school schedules, or people who must travel for work
- Make lifestyle choices that prevent them from getting enough sleep, such as taking medicine to stay awake, abusing alcohol or drugs, or not leaving enough time for sleep
- Have undiagnosed or untreated medical problems, such as stress, anxiety, or sleep disorders
- Have medical conditions or take medicines that interfere with sleep

Certain medical conditions have been linked to sleep disorders. These conditions include [heart failure](#), [heart disease](#), [obesity](#), diabetes, [high blood pressure](#), [stroke](#) or transient ischemic attack (mini-stroke), depression, and attention-deficit hyperactivity disorder (ADHD).

If you have or have had one of these conditions, ask your doctor whether you might benefit from a sleep study.

A sleep study allows your doctor to measure how much and how well you sleep. It also helps show whether you have sleep problems and how severe they are. For more information, go to the Health Topics [Sleep Studies](#) article.

If you have a child who is overweight, talk with the doctor about your child's sleep habits.

What Are the Signs and Symptoms of Problem Sleepiness? - Sleep Deprivation and Deficiency

Sleep deficiency can cause you to feel very tired during the day. You may not feel refreshed and alert when you wake up. Sleep deficiency also can interfere with work, school, driving, and social functioning.

How sleepy you feel during the day can help you figure out whether you're having symptoms of problem sleepiness. You might be sleep deficient if you often feel like you could doze off while:

- Sitting and reading or watching TV
- Sitting still in a public place, such as a 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

Sleep deficiency can cause problems with learning, focusing, and reacting. You may have trouble making decisions, solving problems, remembering things, controlling your emotions and behavior, and coping with

change. You may take longer to finish tasks, have a slower reaction time, and make more mistakes.

The signs and symptoms of sleep deficiency may differ between children and adults. Children who are sleep deficient might be overly active and have problems paying attention. They also might misbehave, and their school performance can suffer.

Sleep-deficient children may feel angry and impulsive, have mood swings, feel sad or depressed, or lack motivation.

You may not notice how sleep deficiency affects your daily routine. 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.

To find out whether you're sleep deficient, try keeping a sleep diary for a couple of weeks. Write down how much you sleep each night, how alert and rested you feel in the morning, and how sleepy you feel during the day.

Compare the amount of time you sleep each day with the average amount of sleep recommended for your age group, as shown in the chart in "[How Much Sleep Is Enough?](#)" If you often feel very sleepy, and efforts to increase your sleep don't help, talk with your doctor.

You can find a sample sleep diary in the National Heart, Lung, and Blood Institute's "[Your Guide to Healthy Sleep.](#)"

Strategies for Getting Enough Sleep - Sleep Deprivation and Deficiency

You can take steps to improve your sleep habits. First, make sure that you allow yourself enough time to sleep. With enough sleep each night, you may find that you're happier and more productive during the day.

Sleep often is the first thing that busy people squeeze out of their schedules. Making time to sleep will help you protect your health and well-being now and in the future.

To improve your sleep habits, it also may help to:

- Go to bed and wake up at the same time every day. For children, have a set bedtime and a bedtime routine. Don't use the child's bedroom for timeouts or punishment.
- Try to keep the same sleep schedule on weeknights and weekends. Limit the difference to no more than about an hour. Staying up late and sleeping in late on weekends can disrupt your body clock's sleep–wake rhythm.
- Use the hour before bed for quiet time. Avoid strenuous exercise and bright artificial light, such as from a TV or computer screen. The light may signal the brain that it's time to be awake.
- Avoid heavy and/or large meals within a couple hours of bedtime. (Having a light snack is okay.) Also, avoid alcoholic drinks before bed.
- Avoid nicotine (for example, cigarettes) and caffeine (including caffeinated soda, coffee, tea, and chocolate). Nicotine and caffeine are stimulants, and both substances can interfere with sleep. The effects of caffeine can last as long as 8 hours. So, a cup of coffee in the late afternoon can make it hard for you to fall asleep at night.
- Spend time outside every day (when possible) and be physically active.
- Keep your bedroom quiet, cool, and dark (a dim night light is fine, if needed).
- Take a hot bath or use relaxation techniques before bed.

Napping during the day may provide a boost in alertness and performance. However, if you have trouble falling asleep at night, limit naps or take them earlier in the afternoon. Adults should nap for no more than 20 minutes.

Napping in preschool-aged children is normal and promotes healthy growth and development.

For more information about healthy sleep habits, go to the National Heart, Lung, and Blood Institute's ["Your Guide to Healthy Sleep."](#)

Strategies for Special Groups

Some people have schedules that conflict with their internal body clocks. For example, shift workers and teens who have early school schedules may have trouble getting enough sleep. This can affect how they feel mentally, physically, and emotionally.

If you're a shift worker, you may find it helpful to:

- Take naps and increase the amount of time available for sleep
- Keep the lights bright at work
- Limit shift changes so your body clock can adjust
- Limit caffeine use to the first part of your shift
- Remove sound and light distractions in your bedroom during daytime sleep (for example, use light-blocking curtains)

If you're still not able to fall asleep during the day or have problems adapting to a shift-work schedule, talk with your doctor about other options to help you sleep.

When possible, employers and schools might find it helpful to consider options to address issues related to sleep deficiency.

How To Discuss Sleep With Your Doctor - Sleep Deprivation and Deficiency

Doctors might not detect sleep problems during routine office visits because patients are awake. Thus, you should let your doctor know if you think you might have a sleep problem.

For example, talk with your doctor if you often feel sleepy during the day, don't wake up feeling refreshed and alert, or are having trouble adapting to shift work.

To get a better sense of your sleep problem, your doctor will ask you about your sleep habits. Before you see the doctor, think about how to describe your problems, including:

- How often you have trouble sleeping and how long you've had the problem
- When you go to bed and get up on workdays and days off
- How long it takes you to fall asleep, how often you wake up at night, and how long it takes you to fall back asleep
- Whether you snore loudly and often or wake up gasping or feeling out of breath
- How refreshed you feel when you wake up, and how tired you feel during the day
- How often you doze off or have trouble staying awake during routine tasks, especially driving

Your doctor also may ask questions about your personal routine and habits. For example, he or she may

ask about your work and exercise routines. Your doctor also may ask whether you use caffeine, tobacco, alcohol, or any medicines (including over-the-counter medicines).

To help your doctor, consider keeping a sleep diary for a couple of weeks. Write down when you go to sleep, wake up, and take naps. (For example, you might note: Went to bed at 10 a.m.; woke up at 3 a.m. and couldn't fall back asleep; napped after work for 2 hours.)

Also write down how much you sleep each night, how alert and rested you feel in the morning, as well as how sleepy you feel at various times during the day. Share the information in your sleep diary with your doctor. You can find a sample sleep diary in the National Heart, Lung, and Blood Institute's "[Your Guide to Healthy Sleep.](#)"

Doctors can diagnose some sleep disorders by asking questions about sleep schedules and habits and by getting information from sleep partners or parents. To diagnose other sleep disorders, doctors also use the results from sleep studies and other medical tests.

Sleep studies allow your doctor to measure how much and how well you sleep. They also help show whether you have sleep problems and how severe they are. For more information, go to the Health Topics [Sleep Studies](#) article.

Your doctor will do a physical exam to rule out other medical problems that might interfere with sleep. You may need [blood tests](#) to check for thyroid problems or other conditions that can cause sleep problems.

Clinical Trials - Sleep Deprivation and Deficiency

The National Heart, Lung, and Blood Institute (NHLBI) is strongly committed to supporting research aimed at preventing and treating heart, lung, and blood diseases and conditions and sleep disorders.

NHLBI-supported research has led to many advances in medical knowledge and care. For example, this research has uncovered some of the causes of various sleep disorders and ways to diagnose and treat these disorders.

The NHLBI continues to support research aimed at learning more about sleep and sleep disorders. For example, the NHLBI currently supports studies that explore:

- How well light and nonlight therapies regulate sleep cycles and improve sleep quality.
- The biological factors that determine how much sleep people need.
- Ways to improve sleep habits and reduce the risk of poor sleep in children from minority or disadvantaged populations.
- How reduced amounts of sleep affect insulin in the body. (Insulin is a hormone that helps move blood sugar into cells, where it's used for energy.)

In November of 2011, the National Institutes of Health (NIH) released its "[2011 NIH Sleep Disorders Research Plan.](#)" The plan expands upon previous and current research programs and identifies new research opportunities.

The NHLBI's National Center on Sleep Disorders Research will coordinate this research across the NIH and other Federal agencies. The research will focus on sleep and the body's natural 24-hour cycle, the role of genes and the environment on sleep health, and ways to improve the prevention, diagnosis, and treatment of sleep disorders.

Much of this research depends on the willingness of volunteers to take part in [clinical trials](#). Clinical trials test new ways to prevent, diagnose, or treat various diseases, conditions, and health problems.

For example, new treatments for a disease or condition (such as medicines, medical devices, surgeries, or procedures) are tested in volunteers who have the illness. Testing shows whether a treatment is safe and effective in humans before it is made available for widespread use.

By taking part in a clinical trial, you may gain access to new treatments before they're widely available. You also will have the support of a team of health care providers, who will likely monitor your health closely. Even if you don't directly benefit from the results of a clinical trial, the information gathered can help others and add to scientific knowledge.

If you volunteer for a clinical trial, the research will be explained to you in detail. You'll learn about treatments and tests you may receive, and the benefits and risks they may pose. You'll also be given a chance to ask questions about the research. This process is called informed consent.

If you agree to take part in the trial, you'll be asked to sign an informed consent form. This form is not a contract. You have the right to withdraw from a study at any time, for any reason. Also, you have the right to learn about new risks or findings that emerge during the trial.

For more information about clinical trials related to sleep deficiency, talk with your doctor. You also can visit the following Web sites to learn more about clinical research and to search for clinical trials:

- <http://clinicalresearch.nih.gov>
- www.clinicaltrials.gov
- www.nhlbi.nih.gov/studies/index.htm
- www.researchmatch.org

For more information about clinical trials for children, visit the NHLBI's [Children and Clinical Studies](#) Web page.

Links to Other Information About Sleep Deprivation and Deficiency - Sleep Deprivation and Deficiency

NHLBI Resources

- ["2011 National Institutes of Health Sleep Disorders Research Plan"](#)
- [National Center on Sleep Disorders Research](#)
- [Sleep Studies](#) (Health Topics)
- [Updated NIH Sleep Disorders Research Plan Seeks To Promote and Protect Sleep Health](#) (National Institutes of Health News Release, November 2011)
- ["Your Guide to Healthy Sleep"](#)

Non-NHLBI Resources

- [Sleep and Sleep Disorders Fact Sheets](#) (Centers for Disease Control and Prevention)
- [Sleep Disorders](#) (MedlinePlus)

Clinical Trials

- [Children and Clinical Studies](#)

- [Clinical Trials](#) (Health Topics)
- [Current Research](#) (ClinicalTrials.gov)
- [NHLBI Clinical Trials](#)
- [NIH Clinical Research Trials and You](#) (National Institutes of Health)
- [ResearchMatch](#) (funded by the National Institutes of Health)