# WELLNESS



*Lumen*



# Wellness

Lumen

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## Detailed Licensing

# Licensing

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# CHAPTER OVERVIEW

## 1: About This Course

1.1: About This Course

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  - Assignments
  - Discussions
  - Exams
  - Sample Instructor Welcome
  - Sample Learning Outcomes/Course Objectives
  - Sample Course Schedules
  - Sample Weekly Summaries & Assignment Schedules
  - Student Self-Check Questions
  - Student Study Guides

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# CHAPTER OVERVIEW

## 2: Module 1- Introduction to Health and Wellness


2.1: Dimensions of Wellness
2.2: Healthy People 2020
2.3: Major Health Concerns
2.4: Risk Factors and Levels of Disease Prevention
2.5: Behavior Change and Goal Setting


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# 2.1: Dimensions of Wellness

## What is Wellness?

Wellness is being in good physical and mental health. Because mental health and physical health are linked, problems in one area can impact the other. At the same time, improving your physical health can also benefit your mental health, and vice versa. It is important to make healthy choices for both your physical and mental well-being.

Remember that wellness is not just the absence of illness or stress. You can still strive for wellness even if you are experiencing these challenges in your life.




## What are the Eight Dimensions of Wellness?

Learning about the Eight Dimensions of Wellness can help you choose how to make wellness a part of your everyday life. Wellness strategies are practical ways to start developing healthy habits that can have a positive impact on your physical and mental health.

The Eight Dimensions of Wellness are:

1. **Emotional**—Coping effectively with life and expressing emotions in an appropriate manner
2. **Environmental**—Occupying pleasant, healthy, and safe environments that support well-being; positively impacting the quality of our surroundings (including protecting and preserving nature)
3. **Financial**—Achieving satisfaction with current and future financial situations; handling finances wisely
4. **Intellectual**—Recognizing creative abilities and finding ways to expand knowledge and skills; being open-minded
5. **Occupational**—Personal fulfillment and enrichment from one's work and/or responsibilities
6. **Physical**—Recognizing the need for physical activity, healthy foods, and adequate sleep; avoiding unhealthy habits
7. **Social**—Developing a sense of connection, belonging, and sustained support system; having positive relationships
8. **Spiritual**—Having a sense of purpose and meaning in life; establishing peace, harmony, and balance in our lives

Learn more about the Eight Dimensions of Wellness by watching the video below:



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## Your Own Views on Health and Wellness

Reflect on the following questions:

- What does health mean to you?
- How important is health to you?
- What are some of your healthy habits?
- Which dimensions of wellness do you need to work on the most?

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# 2.2: Healthy People 2020

In December 2010, the Department of Health and Human Services launched Healthy People 2020, which has four overarching goals:

- Attain high-quality, longer lives free of preventable disease, disability, injury, and premature death;
- Achieve health equity, eliminate disparities, and improve the health of all groups;
- Create social and physical environments that promote good health for all; and
- Promote quality of life, healthy development, and healthy behaviors across all life stages.

Healthy People 2020 tracks approximately 1,200 objectives organized into 42 topic areas, each of which represents an important public health area. At the time of the December 2010 launch 911 objectives were measurable with baseline data and established targets. A few objectives that have achieved high levels of success are being tracked without a target for informational purposes. Targets will be set during the decade for these objectives if warranted. The rest of the objectives did not have baseline data and were considered developmental. Targets for the developmental objectives will be set when baseline data become available. Healthy People 2020 also includes a new Foundation section which addresses several important health topics: General Health Status, Health-Related Quality of Life and Well-Being, Determinants of Health, and Disparities.

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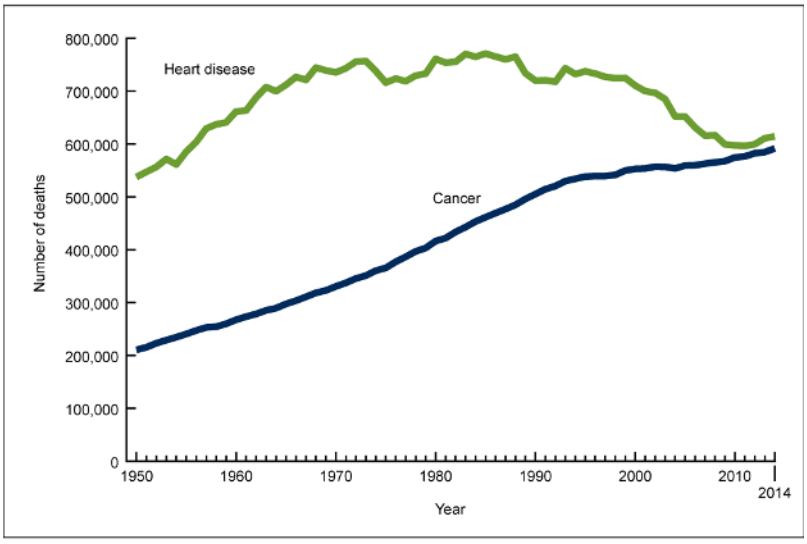
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# 2.3: Major Health Concerns

## Leading Causes of Death in the United States

Do you know what the top two leading causes of death are for Americans? Heart disease takes the number one spot, followed by cancer. As you can see by the graph below, cancer death rates have been steadily increasing throughout the years. What does this potentially mean for the future? Is cancer going to take over as the number one leading cause of death? It certainly appears to be headed in that direction.

Figure 1. Number of deaths due to heart disease and cancer: United States, 1950–2014




NOTES: Leading cause is based on number of deaths. Access data table for Figure 1 at: http://www.cdc.gov/nchs/data/databriefs/db254_table.pdf#1.
SOURCE: NCHS, National Vital Statistics System, Mortality.

**The 10 Leading Causes of Death in the United States:**

- Heart disease: 614,348
- Cancer: 591,699
- Chronic lower respiratory diseases: 147,101
- Accidents (unintentional injuries): 136,053
- Stroke (cerebrovascular diseases): 133,103
- Alzheimer's disease: 93,541
- Diabetes: 76,488
- Influenza and Pneumonia: 55,227
- Nephritis, nephrotic syndrome and nephrosis: 48,146
- Intentional self-harm (suicide): 42,773

## CDC Winnable Battles

To keep pace with emerging public health challenges and to address the leading causes of death and disability, CDC initiated an effort called Winnable Battles to achieve measurable impact quickly. Winnable Battles are public health priorities with large-scale impact on health and known effective strategies to address them. By identifying priority strategies, defining clear targets and working closely with our public health partners, we are making significant progress in reducing health disparities and the overall health burden from these diseases and conditions.

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# 2.4: Risk Factors and Levels of Disease Prevention

## What is a Risk Factor?

Part of learning how to take charge of your health requires understanding your risk factors for different diseases. Risk factors are things in your life that increase your chances of getting a certain disease. Some risk factors are beyond your control. You may be born with them or exposed to them through no fault of your own.

**Some risk factors that you have little or no control over include your:**

- Family history of a disease
- Sex/gender — male or female
- Ancestry

**Some risk factors you can control include:**

- What you eat
- How much physical activity you get
- Whether you use tobacco
- How much alcohol you drink
- Whether you misuse drugs

In fact, it has been estimated that almost 35 percent of all U.S. early deaths in 2000 could have been avoided by changing just three behaviors:

- Stopping smoking
- Eating a healthy diet (for example, eating more fruits and vegetables and less red meat)
- Getting more physical activity

You can have one risk factor for a disease or you can have many. The more risk factors you have, the more likely you are to get the disease. For example, if you eat healthy, exercise on a regular basis, and control your blood pressure, your chances of getting heart disease are less than if you are diabetic, a smoker, and inactive. To lower your risks, take small steps toward engaging in a healthy lifestyle, and you'll see big rewards.

People with a family health history of chronic disease may have the most to gain from making lifestyle changes. You can't change your genes, but you can change behaviors that affect your health, such as smoking, inactivity, and poor eating habits. In many cases, making these changes can reduce your risk of disease even if the disease runs in your family. Another change you can make is to have screening tests, such as mammograms and colorectal cancer screening. These screening tests help detect disease early. People who have a family health history of a chronic disease may benefit the most from screening tests that look for risk factors or early signs of disease. Finding disease early, before symptoms appear, can mean better health in the long run.

## Levels of Disease Prevention

Prevention includes a wide range of activities — known as "interventions" — aimed at reducing risks or threats to health. You may have heard researchers and health experts talk about three categories of prevention: primary, secondary and tertiary. What do they mean by these terms?

**Primary prevention** aims to prevent disease or injury before it ever occurs. This is done by preventing exposures to hazards that cause disease or injury, altering unhealthy or unsafe behaviours that can lead to disease or injury, and increasing resistance to disease or injury should exposure occur. Examples include:

- legislation and enforcement to ban or control the use of hazardous products (e.g. asbestos) or to mandate safe and healthy practices (e.g. use of seatbelts and bike helmets)
- education about healthy and safe habits (e.g. eating well, exercising regularly, not smoking)
- immunization against infectious diseases.

**Secondary prevention** aims to reduce the impact of a disease or injury that has already occurred. This is done by detecting and treating disease or injury as soon as possible to halt or slow its progress, encouraging personal strategies to prevent reinjury or recurrence, and implementing programs to return people to their original health and function to prevent long-term problems. Examples include:

- regular exams and screening tests to detect disease in its earliest stages (e.g. mammograms to detect breast cancer)
- daily, low-dose aspirins and/or diet and exercise programs to prevent further heart attacks or strokes
- suitably modified work so injured or ill workers can return safely to their jobs.

**Tertiary prevention** aims to soften the impact of an ongoing illness or injury that has lasting effects. This is done by helping people manage long-term, often-complex health problems and injuries (e.g. chronic diseases, permanent impairments) in order to improve as much as possible their ability to function, their quality of life and their life expectancy. Examples include:

- cardiac or stroke rehabilitation programs, chronic disease management programs (e.g. for diabetes, arthritis, depression, etc.)
- support groups that allow members to share strategies for living well
- vocational rehabilitation programs to retrain workers for new jobs when they have recovered as much as possible.

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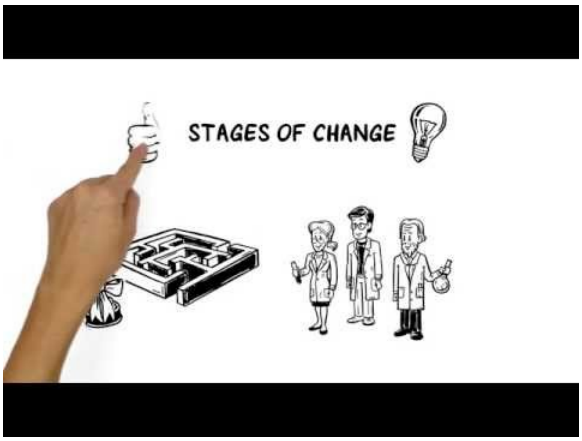
# 2.5: Behavior Change and Goal Setting

## Transtheoretical Model (Stages of Change)

The **transtheoretical model** of behavior change, developed by Prochaska and DiClemente, assesses an individual's readiness to implement a healthier behavior, and provides insight into the decision making process that leads to action. For many people, changing or modifying a behavior that is unhealthy or potentially harmful can be quite challenging. Here are the stages that lead to behavior change:

- **Precontemplation** (Not Ready) – You are not intending to take action in the foreseeable future, and can be unaware that your behavior is problematic
- **Contemplation** (Getting Ready) – You are beginning to recognize that your behavior is problematic, and start to look at the pros and cons of your continued actions
- **Preparation** (Ready) – You are intending to take action in the immediate future, and may begin taking small steps toward behavior change
- **Action** – You are making actual changes to your problem behavior by incorporating healthy choices/behaviors into your life
- **Maintenance** – You have been able to sustain action for at least six months and are working to prevent relapse into previous unhealthy behaviors

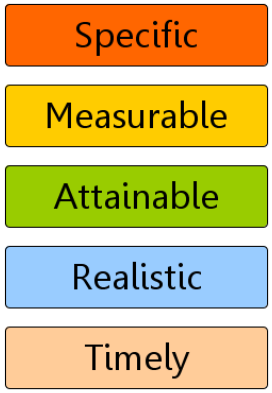
Check out this supplemental video to review the main concepts of the Transtheoretical Model:




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## SMART Goal Setting

Have you ever said to yourself that you need to "eat healthier" or "exercise more" to improve your overall health? How well did that work for you? In most cases, probably not very well. That's because these statements are too vague and do not give us any direction for what truly needs to be done to achieve such goals. To have a better chance at being successful, try using the **SMART** acronym for setting your goals (**S**= Specific, **M**= Measurable, **A**=Attainable, **R**= Realistic, **T**= Time-oriented):




**S**pecific – Create a goal that has a focused and clear path for what you actually need to do. Examples:

- I will drink 8 ounces of water 3 times per day
- I will walk briskly for 30 minutes, 5 times per week
- I will reduce my soda intake to no more than 2 cans of soda per week

Do you see how that is more helpful than just saying you will eat healthier or exercise more? It gives you direction.

**M**easurable – This enables you to track your progress, and ties in with the "specific" component. The above examples all have actual numbers associated with the behavior change that let you know whether or not it has been met.

**A**ttainable – Make sure that your goal is within your capabilities and not too far out of reach. For example, if you have not been physically active for a number of years, it would be highly unlikely that you would be able to achieve a goal of running a marathon within the next month.

**R**ealistic – Try to ensure that your goal is something you will be able to continue doing and incorporate as part of your regular routine/lifestyle. For example, if you made a goal to kayak 2 times each week, but don't have the financial resources to purchase or rent the equipment, no way to transport it, or are not close enough to a body of water in which to partake in kayaking, then this is not going to be feasible.

**T**ime-oriented – Give yourself a target date or deadline in which the goal needs to be met. This will keep you on track and motivated to reach the goal, while also evaluating your progress.

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# CHAPTER OVERVIEW

## 3: Module 2 A- Drug Use and Addiction


3.1: Understanding Drug Use and Addiction
3.2: Health Effects of Drug Abuse
3.3: Consequences of Drug Abuse
3.4: Treatment Approaches for Drug Addiction
3.5: Synthetic Drugs


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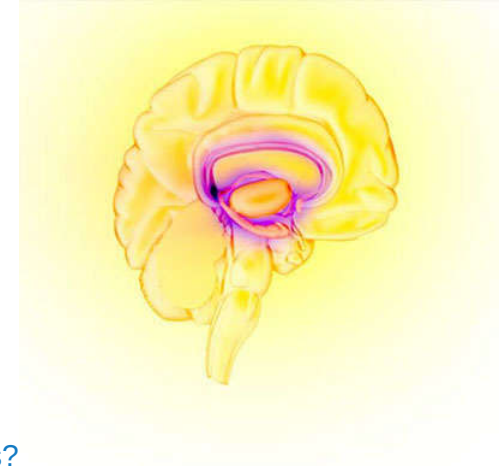
# 3.1: Understanding Drug Use and Addiction

Many people don't understand why or how other people become addicted to drugs. They may mistakenly think that those who use drugs lack moral principles or willpower and that they could stop their drug use simply by choosing to. In reality, drug addiction is a complex disease, and quitting usually takes more than good intentions or a strong will. Drugs change the brain in ways that make quitting hard, even for those who want to. Fortunately, researchers know more than ever about how drugs affect the brain and have found treatments that can help people recover from drug addiction and lead productive lives.

## What Is drug addiction?

Addiction is a chronic disease characterized by drug seeking and use that is compulsive, or difficult to control, despite harmful consequences. The initial decision to take drugs is voluntary for most people, but repeated drug use can lead to brain changes that challenge an addicted person's self-control and interfere with their ability to resist intense urges to take drugs. These brain changes can be persistent, which is why drug addiction is considered a "relapsing" disease—people in recovery from drug use disorders are at increased risk for returning to drug use even after years of not taking the drug.

It's common for a person to relapse, but relapse doesn't mean that treatment doesn't work. As with other chronic health conditions, treatment should be ongoing and should be adjusted based on how the patient responds. Treatment plans need to be reviewed often and modified to fit the patient's changing needs.



## What happens to the brain when a person takes drugs?

Most drugs affect the brain's "reward circuit" by flooding it with the chemical messenger dopamine. This reward system controls the body's ability to feel pleasure and motivates a person to repeat behaviors needed to thrive, such as eating and spending time with loved ones. This overstimulation of the reward circuit causes the intensely pleasurable "high" that can lead people to take a drug again and again.

As a person continues to use drugs, the brain adjusts to the excess dopamine by making less of it and/or reducing the ability of cells in the reward circuit to respond to it. This reduces the high that the person feels compared to the high they felt when first taking the drug—an effect known as tolerance. They might take more of the drug, trying to achieve the same dopamine high. It can also cause them to get less pleasure from other things they once enjoyed, like food or social activities.

Long-term use also causes changes in other brain chemical systems and circuits as well, affecting functions that include:

- learning
- judgment
- decision-making
- stress
- memory
- behavior

Despite being aware of these harmful outcomes, many people who use drugs continue to take them, which is the nature of addiction.

## Why do some people become addicted to drugs while others don't?

No one factor can predict if a person will become addicted to drugs. A combination of factors influences risk for addiction. The more risk factors a person has, the greater the chance that taking drugs can lead to addiction. For example:

- **Biology**. The genes that people are born with account for about half of a person's risk for addiction. Gender, ethnicity, and the presence of other mental disorders may also influence risk for drug use and addiction.
- **Environment**. A person's environment includes many different influences, from family and friends to economic status and general quality of life. Factors such as peer pressure, physical and sexual abuse, early exposure to drugs, stress, and parental guidance can greatly affect a person's likelihood of drug use and addiction.
- **Development**. Genetic and environmental factors interact with critical developmental stages in a person's life to affect addiction risk. Although taking drugs at any age can lead to addiction, the earlier that drug use begins, the more likely it will progress to addiction. This is particularly problematic for teens. Because areas in their brains that control decision-making, judgment, and self-control are still developing, teens may be especially prone to risky behaviors, including trying drugs.

## Can drug addiction be cured or prevented?

As with most other chronic diseases, such as diabetes, asthma, or heart disease, treatment for drug addiction generally isn't a cure. However, addiction is treatable and can be successfully managed. People who are recovering from an addiction will be at risk for relapse for years and possibly for their whole lives. Research shows that combining addiction treatment medicines with behavioral therapy ensures the best chance of success for most patients. Treatment approaches tailored to each patient's drug use patterns and any co-occurring medical, mental, and social problems can lead to continued recovery.

More good news is that drug use and addiction are preventable. Results from NIDA-funded research have shown that prevention programs involving families, schools, communities, and the media are effective for preventing or reducing drug use and addiction. Although personal events and cultural factors affect drug use trends, when young people view drug use as harmful, they tend to decrease their drug taking. Therefore, education and outreach are key in helping people understand the possible risks of drug use. Teachers, parents, and health care providers have crucial roles in educating young people and preventing drug use and addiction.

### Points to Remember

- Drug addiction is a chronic disease characterized by drug seeking and use that is compulsive, or difficult to control, despite harmful consequences.
- Brain changes that occur over time with drug use challenge an addicted person's self-control and interfere with their ability to resist intense urges to take drugs. This is why drug addiction is also a relapsing disease.
- Relapse is the return to drug use after an attempt to stop. Relapse indicates the need for more or different treatment.
- Most drugs affect the brain's reward circuit by flooding it with the chemical messenger dopamine. This overstimulation of the reward circuit causes the intensely pleasurable "high" that leads people to take a drug again and again.
- Over time, the brain adjusts to the excess dopamine, which reduces the high that the person feels compared to the high they felt when first taking the drug—an effect known as tolerance. They might take more of the drug, trying to achieve the same dopamine high.
- No single factor can predict whether a person will become addicted to drugs. A combination of genetic, environmental, and developmental factors influences risk for addiction. The more risk factors a person has, the greater the chance that taking drugs can lead to addiction.
- Drug addiction is treatable and can be successfully managed.
- More good news is that drug use and addiction are preventable. Teachers, parents, and health care providers have crucial roles in educating young people and preventing drug use and addiction.

Watch these videos to reinforce the previously discussed key points:

https://youtu.be/SY2luGTX7Dk
https://youtu.be/zV6zKmt7S5E

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# 3.2: Health Effects of Drug Abuse

In addition to the effects various drugs of abuse may have on specific organs of the body, many drugs produce global body changes such as dramatic changes in appetite and increases in body temperature, which may impact a variety of health conditions. Withdrawal from drug use also may lead to numerous adverse health effects, including restlessness, mood swings, fatigue, changes in appetite, muscle and bone pain, insomnia, cold flashes, diarrhea, and vomiting.

## Marijuana

Marijuana is made from the hemp plant, *Cannabis sativa*. The main psychoactive (mind-altering) chemical in marijuana is delta-9-tetrahydrocannabinol, or THC.

| Possible Health Effects | |
|---|---|
| Short-term | Enhanced sensory perception and euphoria followed by drowsiness/relaxation; slowed reaction time; problems with balance and coordination; **increased heart rate** and appetite; problems with learning and memory; hallucinations; anxiety; panic attacks; psychosis. |
| Long-term | Mental health problems, chronic cough, frequent respiratory infections. |
| Other Health-related Issues | Youth: possible loss of IQ points when repeated use begins in adolescence.<br>Pregnancy: babies born with problems involving attention, memory, and problem solving. |

**Click here for additional details regarding marijuana use.**

## Cocaine

A powerfully addictive stimulant drug made from the leaves of the coca plant native to South America.

| Possible Health Effects | |
|---|---|
| Short-term | Narrowed blood vessels; enlarged pupils; increased body temperature, heart rate, and blood pressure; headache; abdominal pain and nausea; euphoria; increased energy, alertness; insomnia, restlessness; anxiety; erratic and violent behavior, panic attacks, paranoia, psychosis; heart rhythm problems, heart attack; stroke, seizure, coma. |
| Long-term | Loss of sense of smell, nosebleeds, nasal damage and trouble swallowing from snorting; infection and death of bowel tissue from decreased blood flow; poor nutrition and weight loss from decreased appetite. |
| Other Health-related Issues | Pregnancy: premature delivery, low birth weight, smaller head circumference.<br>Risk of HIV, hepatitis, and other infectious diseases from shared needles. |

**Click here to learn more about cocaine.**

## Methamphetamine

An extremely addictive stimulant amphetamine drug.

| Possible Health Effects | |
|---|---|
| Short-term | Increased wakefulness and physical activity; decreased appetite; increased breathing, heart rate, blood pressure, temperature; irregular heartbeat. |
| Long-term | Anxiety, confusion, insomnia, mood problems, violent behavior, paranoia, hallucinations, delusions, weight loss, severe dental problems (“meth mouth”), intense itching leading to skin sores from scratching. |
| Other Health-related Issues | Pregnancy: premature delivery; separation of the placenta from the uterus; low birth weight; lethargy; heart and brain problems.<br>Risk of HIV, hepatitis, and other infectious diseases from shared needles. |

**To learn more about methamphetamine, click here.**

## CNS Depressants

CNS depressants slow down brain activity and can cause sleepiness and loss of coordination. Continued use can lead to physical dependence and withdrawal symptoms if use is stopped.

| Possible Health Effects | |
|---|---|
| Short-term | Drowsiness, slurred speech, poor concentration, confusion, dizziness, problems with movement and memory, lowered blood pressure, slowed breathing. |
| Long-term | Physical dependence, withdrawal, possibility of seizures from rebound effect. |
| Other Health-related Issues | Sleep medications are sometimes used as date rape drugs (e.g. Rohypnol).<br>Risk of HIV, hepatitis, and other infectious diseases from shared needles. |
| In Combination with Alcohol | Further slows heart rate and breathing, which can lead to death. |

**Click here to find out more about the misuse of prescription drugs.**

## Prescription Opioids

Pain relievers with an origin similar to that of heroin. Opioids can cause euphoria and are often used nonmedically, leading to overdose deaths.

| Possible Health Effects | |
|---|---|
| Short-term | Pain relief, drowsiness, nausea, constipation, euphoria, confusion, slowed breathing, death. |
| Long-term | Physical dependence, possible brain damage. |

| | |
|---|---|
| Other Health-related Issues | Pregnancy: Miscarriage, low birth weight, neonatal abstinence syndrome.<br>Older adults: higher risk of accidental misuse or abuse because many older adults have multiple prescriptions, increasing the risk of drug-drug interactions, and breakdown of drugs slows with age; also, many older adults are treated with prescription medications for pain.<br>Risk of HIV, hepatitis, and other infectious diseases from shared needles. |
| In Combination with Alcohol | Dangerous slowing of heart rate and breathing leading to coma or death. |

## Heroin

| Possible Health Effects | |
|---|---|
| Short-term | Euphoria; warm flushing of skin; dry mouth; heavy feeling in the hands and feet; clouded thinking; alternate wakeful and drowsy states; itching; nausea; vomiting; slowed breathing and heart rate. |
| Long-term | Collapsed veins; abscesses (swollen tissue with pus); infection of the lining and valves in the heart; constipation and stomach cramps; liver or kidney disease; pneumonia. |
| Other Health-related Issues | Pregnancy: miscarriage, low birth weight, neonatal abstinence syndrome.<br>Risk of HIV, hepatitis, and other infectious diseases from shared needles. |
| In Combination with Alcohol | Dangerous slowdown of heart rate and breathing, coma, death. |

**Click here to learn more about heroin and opioid abuse.**
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# 3.3: Consequences of Drug Abuse

Drug abuse is a serious public health problem that affects many communities and families in some way. Each year drug abuse causes millions of serious illnesses or injuries among Americans. Examples of abused drugs include:

- Methamphetamine
- Anabolic steroids
- Club drugs
- Cocaine
- Heroin
- Inhalants
- Marijuana
- Prescription drugs

Drug abuse also plays a role in many major social problems, such as drugged driving, violence, stress, and child abuse. Drug abuse can lead to homelessness, crime, and missed work or problems with keeping a job. It harms unborn babies and destroys families. There are different types of treatment for drug abuse. But the best is to prevent drug abuse in the first place.

## How it affects the family

When a person has a drug problem, they have a disease that can hurt the family.

Drug abuse puts a lot of stress on parents, brothers and sisters, children, grandparents—anyone who is part of the home.

When family members take drugs:

- You generally can't count on them to do what they say they will do.
- They may forget or get distracted because their focus is on getting and taking drugs.
- They might lie or steal money to buy drugs.
- They might get fired from their jobs.
- They might not come home at night.
- They may do bad things they would never do if they weren't abusing drugs.

Family members might fight a lot because of the problems the drug abuse is causing. The drug user might do and say things that upset neighbors and friends, and make the family ashamed.

Some people who are addicted don't believe that they are sick and out of control, so they don't look for treatment. They don't see the problems they are causing themselves and those around them. Other people who are addicted are aware of the problem, but may be so upset and confused that they do not know how to ask for or get help.

Drugs don't just hurt the person taking them. Everyone connected to the person can get hurt.

Drug abuse can cause many problems:

- Fighting and violence in and outside the home
- Money problems
- Trouble at school
- Trouble at work, losing a job
- Trouble in relationships
- Child abuse, neglect
- Driving accidents
- Arrests and jail

When you or a loved one abuse drugs, everyday life can feel out of control.

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# 3.4: Treatment Approaches for Drug Addiction

## Can drug addiction be treated?

Yes, but it's not simple. Because addiction is a chronic disease, people can't simply stop using drugs for a few days and be cured. Most patients need long-term or repeated care to stop using completely and recover their lives.

Addiction treatment must help the person do the following:

- stop using drugs
- stay drug-free
- be productive in the family, at work, and in society

### Principles of Effective Treatment

Based on scientific research since the mid-1970s, the following key principles should form the basis of any effective treatment program:

- Addiction is a complex but treatable disease that affects brain function and behavior.
- No single treatment is right for everyone.
- People need to have quick access to treatment.
- Effective treatment addresses all of the patient's needs, not just his or her drug use.
- Staying in treatment long enough is critical.
- Counseling and other behavioral therapies are the most commonly used forms of treatment.
- Medications are often an important part of treatment, especially when combined with behavioral therapies.
- Treatment plans must be reviewed often and modified to fit the patient's changing needs.
- Treatment should address other possible mental disorders.
- Medically assisted detoxification is only the first stage of treatment.
- Treatment doesn't need to be voluntary to be effective.
- Drug use during treatment must be monitored continuously.
- Treatment programs should test patients for HIV/AIDS, hepatitis B and C, tuberculosis, and other infectious diseases as well as teach them about steps they can take to reduce their risk of these illnesses.

## How is drug addiction treated?

Successful treatment has several steps:

- detoxification (the process by which the body rids itself of a drug)
- behavioral counseling
- medication (for opioid, tobacco, or alcohol addiction)
- evaluation and treatment for co-occurring mental health issues such as depression and anxiety
- long-term follow-up to prevent relapse

A range of care with a tailored treatment program and follow-up options can be crucial to success. Treatment should include both medical and mental health services as needed. Follow-up care may include community- or family-based recovery support systems.

## How are medications used in drug addiction treatment?

Medications can be used to manage withdrawal symptoms, prevent relapse, and treat co-occurring conditions.

**Withdrawal.** Medications help suppress withdrawal symptoms during detoxification. Detoxification is not in itself "treatment," but only the first step in the process. Patients who do not receive any further treatment after detoxification usually resume their drug use. One study of treatment facilities found that medications were used in almost 80 percent of detoxifications (SAMHSA, 2014).

**Relapse prevention.** Patients can use medications to help re-establish normal brain function and decrease cravings. Medications are available for treatment of opioid (heroin, prescription pain relievers), tobacco (nicotine), and alcohol addiction. Scientists are developing other medications to treat stimulant (cocaine, methamphetamine) and cannabis (marijuana) addiction. People who use more than one drug, which is very common, need treatment for all of the substances they use.

- ***Opioids:*** Methadone (Dolophine®, Methadose®), buprenorphine (Suboxone®, Subutex®, Probuphine®), and naltrexone (Vivitrol®) are used to treat opioid addiction. Acting on the same targets in the brain as heroin and morphine, methadone and buprenorphine suppress withdrawal symptoms and relieve cravings. Naltrexone blocks the effects of opioids at their receptor sites in the brain and should be used only in patients who have already been detoxified. All medications help patients reduce drug seeking and related criminal behavior and help them become more open to behavioral treatments.
- ***Tobacco:*** Nicotine replacement therapies have several forms, including the patch, spray, gum, and lozenges. These products are available over the counter. The U.S. Food and Drug Administration (FDA) has approved two prescription medications for nicotine addiction: bupropion (Zyban®) and varenicline (Chantix®). They work differently in the brain, but both help prevent relapse in people trying to quit. The medications are more effective when combined with behavioral treatments, such as group and individual therapy as well as telephone quitlines.
- ***Alcohol:*** Three medications have been FDA-approved for treating alcohol addiction and a fourth, topiramate, has shown promise in clinical trials (large-scale studies with people). The three approved medications are as follows:
  - **Naltrexone** blocks opioid receptors that are involved in the rewarding effects of drinking and in the craving for alcohol. It reduces relapse to heavy drinking and is highly effective in some patients. Genetic differences may affect how well the drug works in certain patients.
  - **Acamprosate (Campral®)** may reduce symptoms of long-lasting withdrawal, such as insomnia, anxiety, restlessness, and dysphoria (generally feeling unwell or unhappy). It may be more effective in patients with severe addiction.
  - **Disulfiram (Antabuse®)** interferes with the breakdown of alcohol. Acetaldehyde builds up in the body, leading to unpleasant reactions that include flushing (warmth and redness in the face), nausea, and irregular heartbeat if the patient drinks alcohol. Compliance (taking the drug as prescribed) can be a problem, but it may help patients who are highly motivated to quit drinking.
- ***Co-occuring conditions:*** Other medications are available to treat possible mental health conditions, such as depression or anxiety, that may be contributing to the person's addiction.

## How are behavioral therapies used to treat drug addiction?

Behavioral therapies help patients:

- modify their attitudes and behaviors related to drug use

- increase healthy life skills
- persist with other forms of treatment, such as medication

Patients can receive treatment in many different settings with various approaches.

**Outpatient behavioral treatment** includes a wide variety of programs for patients who visit a behavioral health counselor on a regular schedule. Most of the programs involve individual or group drug counseling, or both. These programs typically offer forms of behavioral therapy such as:

- *cognitive-behavioral therapy*, which helps patients recognize, avoid, and cope with the situations in which they are most likely to use drugs
- *multidimensional family therapy*—developed for adolescents with drug abuse problems as well as their families—which addresses a range of influences on their drug abuse patterns and is designed to improve overall family functioning
- *motivational interviewing*, which makes the most of people's readiness to change their behavior and enter treatment
- *motivational incentives* (contingency management), which uses positive reinforcement to encourage abstinence from drugs

Treatment is sometimes intensive at first, where patients attend multiple outpatient sessions each week. After completing intensive treatment, patients transition to regular outpatient treatment, which meets less often and for fewer hours per week to help sustain their recovery.

**Inpatient or residential treatment** can also be very effective, especially for those with more severe problems (including co-occurring disorders). Licensed residential treatment facilities offer 24-hour structured and intensive care, including safe housing and medical attention. Residential treatment facilities may use a variety of therapeutic approaches, and they are generally aimed at helping the patient live a drug-free, crime-free lifestyle after treatment.

## Points to Remember

- Drug addiction can be treated, but it's not simple. Addiction treatment must help the person do the following:
  - stop using drugs
  - stay drug-free
  - be productive in the family, at work, and in society
- Successful treatment has several steps:
  - detoxification
  - behavioral counseling
  - medication (for opioid, tobacco, or alcohol addiction)
  - evaluation and treatment for co-occurring mental health issues such as depression and anxiety
  - long-term follow-up to prevent relapse
- Medications can be used to manage withdrawal symptoms, prevent relapse, and treat co-occurring conditions.
- Behavioral therapies help patients:
  - modify their attitudes and behaviors related to drug use
  - increase healthy life skills
  - persist with other forms of treatment, such as medication
- People within the criminal justice system may need additional treatment services to treat drug use disorders effectively. However, many offenders don't have access to the types of services they need

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# 3.5: Synthetic Drugs

## Synthetic Drugs (a.k.a. K2, Spice, Bath Salts, etc.)

### Overview and History

- Synthetic cannabinoids, commonly known as “synthetic marijuana,” “K2,” or “Spice”, are often sold in legal retail outlets as “herbal incense” or “potpourri”, and synthetic cathinones are often sold as “bath salts” or “jewelry cleaner”. They are labeled “not for human consumption” to mask their intended purpose and avoid Food and Drug Administration (FDA) regulatory oversight of the manufacturing process.
- Synthetic cannabinoids are man-made chemicals that are applied (often sprayed) onto plant material and marketed as a “legal” high. Users claim that synthetic cannabinoids mimic Δ9-tetrahydrocannabinol (THC), the primary psychoactive active ingredient in marijuana.
- Use of synthetic cannabinoids is alarmingly high, especially among young people. According to the 2012 Monitoring the Future survey of youth drug-use trends, one in nine 12th graders in America reported using synthetic cannabinoids in the past year. This rate, unchanged from 2011, puts synthetic cannabinoids as the second most frequently used illegal drug among high school seniors after marijuana (see chart).
- Synthetic cathinones are man-made chemicals related to amphetamines. Synthetic cathinone products often consist of methylenedioxypyrovalerone (MDPV), mephedrone, and methylone.
- The Administration has been working with Federal, Congressional, state, local, and non-governmental partners to put policies and legislation in place to combat this threat, and to educate people about the tremendous health risk posed by these substances.

### A Rapidly Emerging Threat

- Synthetic cannabinoids laced on plant material were first reported in the U.S. in December 2008, when a shipment of “Spice” was seized and analyzed by U.S. Customs and Border Protection (CBP) in Dayton, Ohio.
- There is an increasingly expanding array of synthetic drugs available. 51 new synthetic cannabinoids were identified in 2012, compared to just two in 2009. Furthermore, 31 new synthetic cathinones were identified in 2012, compared to only four in 2009. In addition, 76 other synthetic compounds were identified in 2012, bringing the total number of new synthetic substances identified in 2012 to 158.

### Risk to the Public Health

- The contents and effects of synthetic cannabinoids and cathinones are unpredictable due to a constantly changing variety of chemicals used in manufacturing processes devoid of quality controls and government regulatory oversight.
- Health warnings have been issued by numerous public health authorities and poison control centers describing the adverse health effects associated with the use of synthetic drugs.
- The effects of synthetic cannabinoids include severe agitation and anxiety, nausea, vomiting, tachycardia (fast, racing heartbeat), elevated blood pressure, tremors and seizures, hallucinations, dilated pupils, and suicidal and other harmful thoughts and/or actions.
- Similar to the adverse effects of cocaine, LSD, and methamphetamine, synthetic cathinone use is associated with increased heart rate and blood pressure, chest pain, extreme paranoia, hallucinations, delusions, and violent behavior, which causes users to harm themselves or others.

### Sources and Continuing Availability

- According to CBP, many synthetic cannabinoid and cathinone products originate overseas. Law enforcement personnel have also encountered the manufacture of synthetic drugs in the U.S., including in residential neighborhoods.
- Synthetic drugs are often sold at small retail outlets and are readily available via the Internet. The chemical compositions of synthetic drugs are frequently altered in an attempt to avoid government bans.

### Government Efforts to Ban Synthetic Drug Products

- Congress has taken steps to ban many of these substances at the Federal level, and the Administration has supported such efforts.
- The Synthetic Drug Abuse Prevention Act is part of the FDA Safety and Innovation Act of 2012, signed into law by President Obama. The law permanently places 26 types of synthetic cannabinoids and cathinones into Schedule I of the Controlled

Substances Act (CSA). It also doubled the maximum period of time that the Drug Enforcement Administration (DEA) can administratively schedule substances under its emergency scheduling authority, from 18 to 36 months.

- The Controlled Substance Analogue Enforcement Act of 1986 allows many synthetic drugs to be treated as controlled substances if they are proven to be chemically and/or pharmacologically similar to a Schedule I or Schedule II controlled substance.
- In 2011, DEA exercised its emergency scheduling authority to control five types of synthetic cannabinoids, and three of the synthetic substances used to manufacture synthetic cathinones. In 2012, all but one of these substances were permanently designated as Schedule I substances under the Synthetic Drug Abuse Prevention Act, and the remaining substance was permanently placed into Schedule I by DEA regulation.
- On April 12, 2013, DEA used its emergency scheduling authority to schedule three more types of synthetic cannabinoids, temporarily designating them as Schedule I substances.
- At least 43 states have taken action to control one or more synthetic cannabinoids. Prior to 2010, synthetic cannabinoids were not controlled by any State or at the Federal level. In addition, at least 44 states have taken action to control one or more synthetic cathinones.

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# CHAPTER OVERVIEW

## 4: Module 2 B- Alcohol and Tobacco Use


4.1: Alcohol Facts
4.2: Health Effects of Alcohol Abuse
4.3: Rethinking Drinking
4.4: Tobacco Use
4.5: Quitting Smoking



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# 4.1: Alcohol Facts

## What is a “drink”?

In the United States, a standard drink contains 0.6 ounces (14.0 grams or 1.2 tablespoons) of pure alcohol. Generally, this amount of pure alcohol is found in:

- 12-ounces of beer (5% alcohol content).
- 8-ounces of malt liquor (7% alcohol content).
- 5-ounces of wine (12% alcohol content).
- 1.5-ounces of 80-proof (40% alcohol content) distilled spirits or liquor (e.g., gin, rum, vodka, whiskey).

## What is excessive drinking?

Excessive drinking includes binge drinking, heavy drinking, and any drinking by pregnant women or people younger than age 21.

- HomeBinge drinking, the most common form of excessive drinking, is defined as consuming:
  - For women, 4 or more drinks during a single occasion.
  - For men, 5 or more drinks during a single occasion.
- Heavy drinking is defined as consuming:
  - For women, 8 or more drinks per week.
  - For men, 15 or more drinks per week.

Most people who drink excessively are not alcoholics or alcohol dependent.

**Blood Alcohol Concentration (BAC)** – Differences Between Women and Men

- Women have less of a particular enzyme (gastric alcohol dehydrogenase) than men do that breaks down alcohol in the stomach. As a result, more alcohol is absorbed within a woman’s body and leads to a higher BAC than in men.
- In general, women have less body water than men resulting in a higher BAC for women.
- In general, men have a greater ratio of muscle to fat than do women. Muscle has a large amount of blood that flows through the muscle tissue. Fat has a much smaller amount of blood. The functional difference this makes is that alcohol is more diluted in a man’s body due to this larger volume of blood. Since women tend to have a higher percentage of body fat than men, this results in a higher BAC level for women compared to men.

## What is moderate drinking?

The *Dietary Guidelines for Americans* defines moderate drinking as up to 1 drink per day for women and up to 2 drinks per day for men. In addition, the *Dietary Guidelines* do not recommend that individuals who do not drink alcohol start drinking for any reason.

However, there are some people who should **not** drink any alcohol, including those who are:

- Younger than age 21.
- Pregnant or may be pregnant.
- Driving, planning to drive, or participating in other activities requiring skill, coordination, and alertness.
- Taking certain prescription or over-the-counter medications that can interact with alcohol.
- Suffering from certain medical conditions.
- Recovering from alcoholism or are unable to control the amount they drink.

By adhering to the *Dietary Guidelines*, you can reduce the risk of harm to yourself or others.

## Short-Term Health Risks

Excessive alcohol use has immediate effects that increase the risk of many harmful health conditions. These are most often the result of binge drinking and include the following:

- Injuries, such as motor vehicle crashes, falls, drownings, and burns.
- Violence, including homicide, suicide, sexual assault, and intimate partner violence.
- Alcohol poisoning, a medical emergency that results from high blood alcohol levels.

- Risky sexual behaviors, including unprotected sex or sex with multiple partners. These behaviors can result in unintended pregnancy or sexually transmitted diseases, including HIV.
- Miscarriage and stillbirth or fetal alcohol spectrum disorders (FASDs) among pregnant women.

## Long-Term Health Risks

Over time, excessive alcohol use can lead to the development of chronic diseases and other serious problems including:

- High blood pressure, heart disease, stroke, liver disease, and digestive problems.
- Cancer of the breast, mouth, throat, esophagus, liver, and colon.
- Learning and memory problems, including dementia and poor school performance.
- Mental health problems, including depression and anxiety.
- Social problems, including lost productivity, family problems, and unemployment.
- Alcohol dependence, or alcoholism.

By not drinking too much, you can reduce the risk of these short- and long-term health risks.

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# 4.2: Health Effects of Alcohol Abuse

Drinking too much – on a single occasion or over time – can take a serious toll on your health. Here's how alcohol can affect your body:

**Brain:**
Alcohol interferes with the brain's communication pathways, and can affect the way the brain looks and works. These disruptions can change mood and behavior, and make it harder to think clearly and move with coordination.

**Heart:**
Drinking a lot over a long time or too much on a single occasion can damage the heart, causing problems including:

- Cardiomyopathy – Impaired ability of the heart to deliver blood to the body, can lead to heart failure
- Arrhythmias – Irregular heart beat
- Stroke
- High blood pressure

**Liver:**
Heavy drinking takes a toll on the liver, and can lead to a variety of problems and liver inflammations including:

- Steatosis, or fatty liver
- Alcoholic hepatitis
- Fibrosis
- Cirrhosis

**Pancreas:**
Alcohol causes the pancreas to produce toxic substances that can eventually lead to pancreatitis, a dangerous inflammation and swelling of the blood vessels in the pancreas that prevents proper digestion.

**Cancer:**
Drinking too much alcohol can increase your risk of developing certain cancers, including cancers of the:

- Mouth
- Esophagus
- Throat
- Liver
- Breast

**Immune System:**
Drinking too much can weaken your immune system, making your body a much easier target for disease. Chronic drinkers are more liable to contract diseases like pneumonia and tuberculosis than people who do not drink too much. Drinking a lot on a single occasion slows your body's ability to ward off infections – even up to 24 hours after getting drunk.

Learn more about alcohol's effects on the body.

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# 4.3: Rethinking Drinking

## Why is being able to “hold your liquor” a concern?

For some people, it takes quite a few drinks to get a buzz or feel relaxed. Often they are unaware that being able to “hold your liquor” isn’t protection from alcohol problems, but instead a reason for caution. They tend to drink more, socialize with people who drink a lot, and develop a tolerance to alcohol. As a result, they have an increased risk for developing alcohol use disorder. The higher alcohol levels can also harm the liver, heart, and brain without the person drinking noticing until it’s too late. And all people who drink need to be aware that even moderate amounts of alcohol can significantly impair driving performance, even when they don’t feel a buzz from drinking.

## Why are women’s low-risk limits different from men’s?

Research shows that women start to have alcohol-related problems at lower drinking levels than men do. One reason is that, on average, women weigh less than men. In addition, alcohol disperses in body water, and pound for pound, women have less water in their bodies than men do. So after a man and woman of the same weight drink the same amount of alcohol, the woman’s blood alcohol concentration will tend to be higher, putting her at greater risk for harm. For more information, see *Alcohol: A Women’s Health Issue*.

## Isn’t drinking good for the heart?

For some people, the answer can be “yes,” depending on the amount. Regular light to moderate drinking can lower the risk for coronary heart disease, mainly among middle-aged and older adults (other factors also cut the risk, including a healthy diet and weight, exercise, and not smoking). Heavy drinking can actually increase blood pressure and damage the heart.

## Is “low-risk” drinking just another term for “moderate” drinking?

Not exactly—the weekly amounts may be the same, but the daily ones are different, and the recommendations serve different purposes for people with different drinking patterns.

- **Low-risk drinking,** for healthy men under age 65 is no more than 4 drinks on any day and 14 per week, and for healthy women (and men over 65) is no more than 3 drinks on any day and 7 per week.
- **Moderate drinking,** according to the U.S. dietary guidelines, is up to 2 drinks per day for men and up to 1 drink per day for women. (Per week, this corresponds to an upper limit of 14 drinks for men and 7 for women.)

In the United States, most people who drink don’t have a daily, low-level pattern of 1 or 2 drinks per day. Instead, they tend to have less on weekdays and more on weekends and holidays. Some people may look at the weekly limits of 14 or 7 drinks and wonder if they can have them *all* on one or two weekend days. As shown by the *daily low-risk* drinking levels, however, from a health standpoint, it’s risky to have more than 4 drinks on any day for men or 3 for women.

It’s important to note that the low-risk drinking levels are not risk free. People who drink lightly to moderately should **not** increase their intake beyond the moderate drinking guidelines, as this would increase their chances for alcohol-related problems.

## Can I do anything to protect my liver from the effects of too much alcohol?

There are no guarantees that anything will protect the liver from too much alcohol. Liver damage from heavy drinking happens in stages. Some relatively mild damage may happen after a single binge drinking episode, but this reverses itself if the heavy drinking stops. If heavy drinking continues, however, liver damage can progress through several more advanced stages, and repair becomes much more difficult, if not impossible. When the damage goes as far as cirrhosis, the only treatment is liver transplant. The best way to protect your liver’s health is by staying within the low-risk drinking limits or — if you already have liver damage or any signs of an alcohol problem — by quitting. Also, it’s best if people who drink avoid acetaminophen (found in Tylenol® and other medications). Even the standard recommended dose of acetaminophen can increase the risk of liver damage, particularly among people who drink heavily.

## I am considering cutting down or quitting drinking. How do I begin?

The first step, of course, is to decide whether cutting down or quitting is best for you. See these considerations and discuss different options with a doctor, a friend, or someone else you trust.

**Thinking about cutting back?** Here are some tips to try, small changes that can make a big difference. Choose two or three to try in the next week or two. It may help to have reminders to reinforce your decision to make a change, such as automated smartphone alerts that you send yourself.

**Thinking about quitting?** One size doesn't fit all, and it's important to find options that appeal to you. Start by visiting the choose your approach page. Here you'll find links to self-help strategies, a helpful publication about treatment options, and information about professional help and social support.

Changing habits such as smoking, overeating, or drinking too much can take a lot of effort, and you may not succeed with the first try. Setbacks are common, but you learn more each time. Each try brings you closer to your goal. Whatever course you choose, give it a fair trial.

## What treatments are available for someone with an alcohol problem?

People commonly think of 12-step programs or 28-day inpatient rehabilitation as the only options for treating alcohol problems. Other choices are available, however. It's a good idea to start by talking with a primary care doctor to put together an individualized treatment plan. A treatment plan can include:

- **Behavioral treatments**. Counseling led by a health professional aims to change drinking behavior. Types of counseling include cognitive-behavioral therapy, motivational enhancement therapy, and marital and family counseling. It's important to choose an approach that avoids heavy-handed confrontation, incorporates empathy, and increases motivation while focusing on changing drinking behavior.
- **Medications**. Three medications are currently approved by the Food and Drug Administration to treat alcohol dependence. These medications help people stop or reduce their drinking and prevent relapse. All approved medications are non-addictive, and can be used alone or in combination with other forms of treatment.
- **Mutual-support groups**. People who are quitting or cutting back on their drinking may also find peer support through organizations such as Alcoholics Anonymous and other mutual support groups.

Find a summary of treatment options in the NIAAA publication Treatment for Alcohol Problems: Finding and Getting Help. The good news is that no matter how severe the problem may seem, most people with an alcohol problem can benefit from some form of treatment.

### Thinking about a change? Click here for an interactive approach to weighing the pros and cons…

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# 4.4: Tobacco Use

Tobacco use is the leading preventable cause of disease, disability, and death in the United States. According to the Centers for Disease Control and Prevention (CDC), cigarette smoking results in more than 480,000 premature deaths in the United States each year—about 1 in every 5 U.S. deaths—and an additional 16 million people suffer with a serious illness caused by smoking. In fact, for every one person who dies from smoking, about 30 more suffer from at least one serious tobacco-related illness.

The harmful effects of smoking extend far beyond the smoker. Exposure to secondhand smoke can cause serious diseases and death. Each year, an estimated 88 million nonsmoking Americans are regularly exposed to secondhand smoke and almost 41,000 nonsmokers die from diseases caused by secondhand smoke exposure.

## How Does Tobacco Affect the Brain?

Cigarettes and other forms of tobacco—including cigars, pipe tobacco, snuff, and chewing tobacco—contain the addictive drug nicotine. Nicotine is readily absorbed into the bloodstream when a tobacco product is chewed, inhaled, or smoked. A typical smoker will take 10 puffs on a cigarette over the period of about 5 minutes that the cigarette is lit. Thus, a person who smokes about 1 pack (25 cigarettes) daily gets 250 “hits” of nicotine each day.

Upon entering the bloodstream, nicotine immediately stimulates the adrenal glands to release the hormone epinephrine (adrenaline). Epinephrine stimulates the central nervous system and increases blood pressure, respiration, and heart rate.

Similar to other addictive drugs like cocaine and heroin, nicotine increases levels of the neurotransmitter dopamine, which affects the brain pathways that control reward and pleasure. For many tobacco users, long-term brain changes induced by continued nicotine exposure result in addiction—a condition of compulsive drug seeking and use, even in the face of negative consequences. Studies suggest that additional compounds in tobacco smoke, such as acetaldehyde, may enhance nicotine’s effects on the brain.

When an addicted user tries to quit, he or she experiences withdrawal symptoms including irritability, attention difficulties, sleep disturbances, increased appetite, and powerful cravings for tobacco. Treatments can help smokers manage these symptoms and improve the likelihood of successfully quitting.

## Electronic Cigarettes

### What Are They?

E-cigarettes are battery-operated devices that typically produce a flavored nicotine vapor that looks like tobacco smoke.

### Are They Safe?

Although e-cigarette vapor does not contain the tar currently responsible for most lung cancer and other lung diseases, it has been shown to contain known carcinogens and toxic chemicals (such as formaldehyde and acetaldehyde), as well as potentially toxic metal nanoparticles from the vaporizing mechanism. There are currently no accepted measures to confirm their purity or safety, and the long-term health consequence of e-cigarette use remain unknown. NIDA is developing research programs to help answer these questions.

In addition, the U.S. Food and Drug Administration (FDA) has established a new rule for e-cigarettes and their liquid solutions in an effort to help protect the public from the dangers of tobacco use. Because e-cigarettes contain nicotine derived from tobacco, they are now subject to government regulation as tobacco products, including the requirement that both in-store and online purchasers be at least 18 years of age (see “Government Regulation of Tobacco Extended to All Tobacco Products“).

### Can They Help People Quit Smoking Traditional Cigarettes?

Because they deliver nicotine without burning tobacco, e-cigarettes are thought by many to be a safer alternative to conventional cigarettes, and some people even think they may help smokers lower nicotine cravings while they are trying to quit smoking. However, studies of the effectiveness of e-cigarettes have not shown they help with smoking cessation. It has also been suggested that they could perpetuate the nicotine addiction and actually interfere with quitting.

In fact, early evidence suggests that e-cigarette use may not only put users at risk for nicotine addiction but also serve as an introduction to nicotine that could lead to use of regular cigarettes and other tobacco products. A recent study showed that students who have used e-cigarettes by the time they start 9th grade are more likely than others to start smoking traditional cigarettes and other smokable tobacco products within the next year.

## What Other Adverse Effects Does Tobacco Have on Health?

**Cigarette smoking accounts for about one-third of all cancers, including 85-90 percent of lung cancer cases**. More people in the United States, both men and women, die from lung cancer than any other type of cancer. Smokeless tobacco (such as chewing tobacco and snuff) also increases the risk of cancer, especially oral cancers. In addition to cancer, smoking causes lung diseases such as chronic bronchitis and emphysema, and increases the risk of heart disease, including stroke, heart attack, vascular disease, and aneurysm. Smoking has also been linked to leukemia, cataracts, and pneumonia. On average, adults who smoke die 10 years earlier than nonsmokers.

Although nicotine is addictive and can be toxic if ingested in high doses, it does not cause cancer—other chemicals are responsible for most of the severe health consequences of tobacco use. Tobacco smoke is a complex mixture of chemicals such as carbon monoxide, tar, formaldehyde, cyanide, and ammonia—many of which are known carcinogens. Carbon monoxide increases the chance of cardiovascular diseases. Tar exposes the user to an increased risk of lung cancer, emphysema, and bronchial disorders.

Pregnant women who smoke cigarettes run an increased risk of miscarriage, stillborn or premature infants, or infants with low birthweight. Maternal smoking may also be associated with learning and behavioral problems in children. Smoking more than one pack of cigarettes per day during pregnancy nearly doubles the risk that the affected child will become addicted to tobacco if that child starts smoking.

While we often think of medical consequences that result from direct use of tobacco products, passive or secondary smoke also increases the risk for many diseases. Secondhand smoke, also known as environmental tobacco smoke, consists of exhaled smoke and smoke given off by the burning end of tobacco products.

**Nonsmokers exposed to secondhand smoke at home or work increase their risk of developing heart disease by 25–30 percent and lung cancer by 20–30 percent**.

In addition; secondhand smoke causes health problems in both adults and children, such as coughing, overproduction of phlegm, reduced lung function and respiratory infections, including pneumonia and bronchitis.. Each year about 150,000 – 300,000 children younger than 18 months old experience respiratory tract infections caused by secondhand smoke. Children exposed to secondhand smoke are at an increased risk of ear infections, severe asthma, respiratory infections and death. In fact, more than 100,000 babies have died in the past 50 years from sudden infant death syndrome (SIDS), and other health complications as a result of parental smoking. Children who grow up with parents who smoke are more likely to become smokers, thus placing themselves (and their future families) at risk for the same health problems as their parents when they become adults.

**There is no safe level of exposure to tobacco smoke**.

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# 4.5: Quitting Smoking

Although quitting can be difficult, the health benefits of smoking cessation are immediate and substantial—including reduced risk for cancers, heart disease, and stroke.

## What are the immediate benefits of quitting smoking?

The immediate health benefits of quitting smoking are substantial:

- Heart rate and blood pressure, which are abnormally high while smoking, begin to return to normal.
- Within a few hours, the level of carbon monoxide in the blood begins to decline. (Carbon monoxide reduces the blood's ability to carry oxygen.)
- Within a few weeks, people who quit smoking have improved circulation, produce less phlegm, and don't cough or wheeze as often.
- Within several months of quitting, people can expect substantial improvements in lung function.
- Within a few years of quitting, people will have lower risks of cancer, heart disease, and other chronic diseases than if they had continued to smoke.
- In addition, people who quit smoking will have an improved sense of smell, and food will taste better.

## What are the long-term benefits of quitting smoking?

Quitting smoking reduces the risk of cancer and many other diseases, such as heart disease and COPD, caused by smoking.

Data from the U.S. National Health Interview Survey show that people who quit smoking, regardless of their age, are less likely to die from smoking-related illness than those who continue to smoke. Smokers who quit before age 40 reduced their chance of dying prematurely from smoking-related diseases by about 90 percent, and those who quit by age 45-54 reduced their chance of dying prematurely by about two-thirds.

People who quit smoking, regardless of their age, have substantial gains in life expectancy compared with those who continue to smoke. Those who quit between the ages of 25 and 34 years lived about 10 years longer; those who quit between ages 35 and 44 lived about 9 years longer; those who quit between ages 45 and 54 lived about 6 years longer; and those who quit between ages 55 and 64 lived about 4 years longer.

## Does quitting smoking lower the risk of cancer?

Yes. Quitting smoking reduces the risk of developing and dying from cancer. Although it is never too late to get a benefit from quitting, the benefit is strongest among those who quit at a younger age.

The risk of premature death and the chance of developing cancer from smoking depend on many factors, including the number of years a person smokes, the number of cigarettes he or she smokes per day, the age at which he or she began smoking, and whether or not he or she was already ill at the time of quitting. For people who have already developed cancer, quitting smoking reduces the risk of developing a second cancer.

## Should someone already diagnosed with cancer bother to quit smoking?

Yes. Cigarette smoking has a profound adverse impact on health outcomes in cancer patients. For patients with some cancers, quitting smoking at the time of diagnosis may reduce the risk of dying by 30 percent to 40 percent. For those having surgery, chemotherapy, or other treatments, quitting smoking helps improve the body's ability to heal and respond to therapy. It also lowers the risk of pneumonia and respiratory failure. Moreover, quitting smoking may lower the risk of the cancer returning, of dying from the cancer, of a second cancer developing, and of dying from other causes.

## Are There Effective Treatments for Tobacco Addiction?

Tobacco addiction is a chronic disease that often requires multiple attempts to quit. Although some smokers are able to quit without help, many others need assistance. Both behavioral interventions (counseling) and medication can help smokers quit; but the combination of medication with counseling is more effective than either alone.

The U.S. Department of Health and Human Services' (HHS) has established a national toll-free quitline, 800-QUIT-NOW, to serve as an access point for any smoker seeking information and assistance in quitting. NIDA's scientists are looking at ways to make

smoking cessation easier by developing tools to make behavioral support available over the internet or through text-based messaging. In addition, NIDA is developing strategies designed to help vulnerable or hard-to-reach populations quit smoking.

### Behavioral Treatments

Behavioral treatments employ a variety of methods to help smokers quit, ranging from self-help materials to counseling. These interventions teach people to recognize high-risk situations and develop coping strategies to deal with them.

### Nicotine Replacement Treatments

Nicotine replacement therapies (NRTs) were the first pharmacological treatments approved by the Food and Drug Administration (FDA) for use in smoking cessation therapy. Current FDA-approved NRT products include nicotine chewing gum, the nicotine transdermal patch, nasal sprays, inhalers, and lozenges. NRTs deliver a controlled dose of nicotine to a smoker in order to relieve withdrawal symptoms during the smoking cessation process. They are most successful when used in combination with behavioral treatments.

### Other Medications

Bupropion and varenicline are two FDA-approved non-nicotine medications that have helped people quit smoking. Bupropion, a medication that goes by the trade name Zyban, was approved by the FDA in 1997, and Varenicline tartrate (trade name: Chantix) was approved in 2006. It targets nicotine receptors in the brain, easing withdrawal symptoms and blocking the effects of nicotine if people resume smoking.

### Current Treatment Research

Scientists are currently developing new smoking cessation therapies. For example, they are working on a nicotine vaccine, which would block nicotine's reinforcing effects by causing the immune system to bind to nicotine in the bloodstream preventing it from reaching the brain. In addition, some medications already in use might work better if they are used together. Scientists are looking for ways to target several relapse symptoms at the same time—like withdrawal, craving and depression.

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# CHAPTER OVERVIEW

## 5: Module 3A- Infectious Diseases


5.1: STD/STI Data
5.2: Influenza
5.3: Types of STDs/STIs
5.4: STD/STI Treatments
5.5: STD/STI Prevention


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# 5.1: STD/STI Data

## CDC FACT SHEET

**Reported STDs in the United States**

**2015 National Data for Chlamydia, Gonorrhea, and Syphilis**

Many cases of chlamydia, gonorrhea, and syphilis continue to go undiagnosed and unreported, and data on several additional STDs — such as human papillomavirus, herpes simplex virus, and trichomoniasis — are not routinely reported to CDC. As a result, the annual surveillance report captures only a fraction of the true burden of STDs in America. However, it provides important insights into the scope, distribution, and trends in STD diagnoses in the country.

STDs are a substantial health challenge facing the United States. CDC estimates that nearly **20 million new sexually transmitted infections** occur every year in this country, half among young people aged 15–24, and account for almost $16 billion in health care costs. Each of these infections is a potential threat to an individual's immediate and long-term health and well-being. In addition to increasing a person's risk for acquiring and transmitting HIV infection, STDs can lead to chronic pain and severe reproductive health complications, such as infertility and ectopic pregnancy.

### Snapshot: STDs in the United States, 2015

Despite recent declines, 2015 was the second year in a row in which increases were seen in all three nationally reported STDs. The approximately 1.5 million cases of chlamydia represent the highest number of annual cases of any condition ever reported to CDC. Substantial increases were also seen among reported cases of gonorrhea and syphilis. While young people and women are most severely affected by STDs, increasing rates among men contributed to the overall increase in 2015 across all diseases.

**Chlamydia**
- Cases reported in 2015: 1,526,658
- Rate per 100,000 people: 479; increase of 6% since 2014

**Gonorrhea**
- Cases reported in 2015: 395,216
- Rate per 100,000 people: 124; increase of 13% since 2014

**Syphilis (primary and secondary)**
- Cases reported in 2015: 23,872
- Rate per 100,000 people: 8; 19% increase since 2014

**Syphilis (congenital)**
- Cases reported in 2015: 487
- Rate per 100,000 live births: 12; 6% increase since 2014

### Gonorrhea and chlamydia primarily affect young people

Surveillance data show both the numbers and rates of reported cases of chlamydia and gonorrhea continue to be highest among young people aged 15-24.

Both young men and young women are heavily affected by STDs — but young women face the most serious long-term health consequences. It is estimated that undiagnosed STDs cause infertility in more than 20,000 women each year.

**Most Reported Chlamydia and Gonorrhea Infections Occur among 15–24-Year-Olds**




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# 5.2: Influenza

## Key Facts About Influenza (Flu)

### HomeWhat is Influenza (also called Flu)?

The flu is a contagious respiratory illness caused by influenza viruses that infect the nose, throat, and lungs. It can cause mild to severe illness, and at times can lead to death. The best way to prevent the flu is by getting a flu **vaccine** each year.

### HomeSigns and Symptoms of Flu

People who have the flu often feel some or all of these signs and symptoms:

- Fever* or feeling feverish/chills
- Cough
- Sore throat
- Runny or stuffy nose
- Muscle or body aches
- Headaches
- Fatigue (very tired)
- Some people may have vomiting and diarrhea, though this is more common in children than adults.

**It's important to note that not everyone with flu will have a fever.*

### HomeHow Flu Spreads

Most experts believe that flu viruses spread mainly by droplets made when people with flu cough, sneeze or talk. These droplets can land in the mouths or noses of people who are nearby. Less often, a person might also get flu by touching a surface or object that has flu virus on it and then touching their own mouth, eyes or possibly their nose.

### HomePeriod of Contagiousness

You may be able to pass on the flu to someone else before you know you are sick, as well as while you are sick. Most healthy adults may be able to infect others beginning 1 day **before** symptoms develop and up to 5 to 7 days **after** becoming sick. Some people, especially young children and people with weakened immune systems, might be able to infect others for an even longer time.

### HomeOnset of Symptoms

The time from when a person is exposed to flu virus to when symptoms begin is about 1 to 4 days, with an average of about 2 days.

### HomeComplications of Flu

Complications of flu can include bacterial pneumonia, ear infections, sinus infections, dehydration, and worsening of chronic medical conditions, such as congestive heart failure, asthma, or diabetes.

### HomePeople at High Risk from Flu

Anyone can get the flu (even healthy people), and serious problems related to the flu can happen at any age, but some people are at high risk of developing serious flu-related complications if they get sick. This includes people 65 years and older, people of any age with certain chronic medical conditions (such as asthma, diabetes, or heart disease), pregnant women, and young children.

### HomePreventing Flu

The first and most important step in preventing flu is to get a flu vaccination each year. CDC also recommends everyday preventive actions (like staying away from people who are sick, covering coughs and sneezes and frequent handwashing) to help slow the spread of germs that cause respiratory (nose, throat, and lungs) illnesses, like flu.

### HomeDiagnosing Flu

It is very difficult to distinguish the flu from other viral or bacterial causes of respiratory illnesses on the basis of symptoms alone. There are tests available to diagnose flu. For more information, see Diagnosing Flu.

There are influenza antiviral drugs that can be used to treat flu illness.

For more information, see "Seasonal Influenza, More Information."

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# 5.3: Types of STDs/STIs

## What are some types of sexually transmitted diseases or sexually transmitted infections (STDs/STIs)?

Approximately 20 different infections are known to be transmitted through sexual contact. Here are descriptions of some of the most common and well known:

- Chlamydia
- Gonorrhea
- Genital Herpes
- HIV/AIDS
- Human Papillomavirus (HPV)
- Syphilis
- Bacterial Vaginosis
- Trichomoniasis
- Viral Hepatitis

### Chlamydia

Chlamydia is a common STD/STI caused by the bacterium *Chlamydia trachomatis*. Chlamydia can be transmitted during vaginal, oral, or anal sexual contact with an infected partner. While many individuals will not experience symptoms, chlamydia can cause fever, abdominal pain, and unusual discharge of the penis or vagina.

In women, whether or not they are having symptoms and know about their infection, chlamydia can cause pelvic inflammatory disease (PID). In PID, the untreated STD/STI progresses and involves other parts of the woman's reproductive system, including the uterus and fallopian tubes. This progression can lead to permanent damage to the woman's reproductive organs. This damage may lead to ectopic pregnancy (in which the fetus develops in abnormal places outside of the womb, a condition that can be life-threatening) and infertility.

Additionally, if the woman is pregnant, her developing fetus is at risk, because chlamydia can be passed on during her pregnancy or delivery and could lead to eye infections or pneumonia in the infant. If chlamydia is detected early, it can be treated easily with an antibiotic taken by mouth.

### Gonorrhea

Gonorrhea is caused by the bacterium Neisseria gonorrhoeae, which can grow rapidly and multiply easily in the warm, moist areas of the reproductive tract. The most common symptoms of gonorrheal infection are a discharge from the vagina or penis and painful or difficult urination.

As with chlamydial infection, the most common and serious complications of gonorrhea occur in women and include pelvic inflammatory disease (PID), ectopic pregnancy, infertility, and the potential spread to the developing fetus if acquired during pregnancy. Gonorrhea also can infect the mouth, throat, eyes, and rectum and can spread to the blood and joints, where it can become a life-threatening illness.

In addition, people with gonorrhea can more easily contract HIV, the virus that causes AIDS. HIV-infected people with gonorrhea are also more likely to transmit the virus to someone else.

### Genital Herpes

Genital herpes is a contagious infection caused by the herpes simplex virus (HSV). There are two different strains, or types, of HSV: herpes simplex virus type 1 (HSV-1) and type 2 (HSV-2). Both can cause genital herpes, although most cases of genital herpes are caused by HSV-2. When symptomatic, HSV-1 usually appears as fever blisters or cold sores on the lips, but it can also infect the genital region through oral-genital or genital-genital contact. Symptomatic HSV-2 typically causes painful, watery skin blisters on or around the genitals or anus. However, substantial numbers of people who carry these viruses have no or only minimal signs or symptoms.

Neither HSV-1 nor HSV-2 can be cured, and even during times when an infected person has no symptoms, the virus can be found in the body's nerve cells. Periodically, some people will experience outbreaks in which new blisters form on the skin in the genital

area; at those times, the virus is more likely to be passed on to other people.

Pregnant women, especially those who acquire genital herpes for the first time during pregnancy, may pass the infection to their newborns, causing life-threatening neonatal HSV, an infection affecting the infant's skin, brain, and other organs.

## HIV/AIDS

HIV, or the human immunodeficiency virus, is the virus that causes AIDS (acquired immunodeficiency syndrome). HIV destroys the body's immune system by killing the blood cells that fight infection. Once HIV destroys a substantial proportion of these cells (CD4 cells), the body's ability to fight off and recover from infections is compromised. This advanced stage of HIV infection is known as AIDS.

The CD4 count is like a snapshot of how well your immune system is functioning. CD4 cells (also known as CD4+ T cells) are white blood cells that fight infection. The more you have, the better. These are the cells that the HIV virus kills. As HIV infection progresses, the number of these cells declines. When the CD4 count drops below 200 due to advanced HIV disease, a person is diagnosed with AIDS. A normal range for CD4 cells is about 500-1,500. Usually, when a person with low CD4 cells starts HIV medicines, the CD4 cell count increases as the HIV virus is controlled. Most, but not all, people will experience an increase in CD4 cells with effective HIV treatment.

People whose HIV has progressed to AIDS are very susceptible to opportunistic infections that do not normally make people sick and to certain forms of cancer.

AIDS can be prevented by early initiation of antiretroviral therapy in those with HIV infection. Transmission of the virus primarily occurs during unprotected sexual activity and by sharing needles used to inject intravenous drugs, although the virus also can spread from mother to infant during pregnancy, delivery, and breastfeeding.

In 2013, NIH-supported researchers reported that a 2-year-old child who was born with HIV and was treated starting in the first few days of life has had her HIV infection go into remission. This appears to be the first case of functional cure of HIV.

## Human Papillomavirus (HPV)

HPV is the most common STD/STI. More than 40 HPV types exist, and all of them can infect both men and women. The types of HPVs vary in their ability to cause genital warts; infect other regions of the body, including the mouth and throat; and cause cancers of the cervix, vulva, penis, and mouth.

Although no cure exists for HPV infection once it occurs, regular screening with a Pap smear test can prevent or detect at an early stage most cases of HPV-caused cervical cancer. (A Pap smear test involves a health care provider taking samples of cells from the cervix during a standard gynecologic exam; these cells are examined under a microscope for signs of developing cancer).

A newly available vaccine protects against most (but not all) HPV types that cause cervical cancer. The American Academy of Pediatrics recommends this vaccine for school-aged boys and girls.

## Syphilis

Syphilis infections, caused by the bacterium Treponema pallidum, are passed from person to person during vaginal, anal, or oral sex through direct contact with sores, called chancres. Between 2001 and 2009, the Centers for Disease Control and Prevention (CDC) data show that the syphilis rate increased each year. Those people at highest risk for syphilis include men having sex with both men and women and people residing in the south. The first sign of syphilis is a chancre, a painless genital sore that most often appears on the penis or in and around the vagina. Beyond being the first sign of a syphilis infection, chancres make a person two to five times more likely to contract an HIV infection. If the person is already infected with HIV, chancres also increase the likelihood that the virus will be passed on to a sexual partner. These sores typically resolve on their own, even without treatment. However, the body does not clear the infection on its own, and, over time, syphilis may involve other organs, including the skin, heart, blood vessels, liver, bones, and joints in secondary syphilis. If the illness is still not treated, tertiary syphilis can develop over a period of years and involve the nerves, eyes, and brain and can potentially cause death.

Expectant mothers harboring the bacterium are at an increased risk of miscarriage and stillbirth, and they can pass the infection on to their fetuses during pregnancy and delivery. Infants that acquire congenital syphilis during pregnancy may suffer from skeletal deformity, difficulty with speech and motor development, seizure, anemia, liver disease, and neurologic problems.

## Bacterial Vaginosis

Bacterial vaginosis is a common, possibly sexually transmitted, vaginal infection in women of reproductive age. While it is healthy and normal for a vagina to have bacteria, just like the skin, mouth, or gastrointestinal (GI) tract, sometimes changes in the balance of different types of bacteria can cause problems.

Bacterial vaginosis occurs when problematic bacteria that are normally present only in small amounts increase in number, replace normal vaginal lactobacilli bacteria, and upset the usual balance. This situation becomes more likely if a woman douches frequently or has new or multiple sexual partners. The most common sign of a bacterial vaginosis infection is a thin, milky discharge that is often described as having a “fishy” odor. However, some women will have no symptoms at all.

Regardless of symptoms, having bacterial vaginosis increases the risk of getting other STDs/STIs and is also associated with pelvic inflammatory disease (PID), an infection of the female reproductive organs, including the uterus and the fallopian tubes (which carry eggs to the uterus), and postoperative infections. Preterm labor and birth are also possibly more common in women with bacterial vaginosis.

## Trichomoniasis

Trichomoniasis infection is caused by the single-celled protozoan parasite Trichomonas vaginalis and is common in young, sexually active women. The parasite also infects men, though less frequently. The parasite can be transmitted between men and women as well as between women whenever physical contact occurs between the genital areas. Although *Trichomonas* infections do not always cause symptoms, they can cause frequent, painful, or burning urination in men and women as well as vaginal discharge, genital soreness, redness, or itching in women. Because the infection can occur without symptoms, a person may be unaware that he or she is infected and continue to re-infect a sexual partner who is having recurrent signs of infection. As with bacterial STDs/STIs, all sexual partners should be treated at the same time to avoid re-infection.

NICHD-sponsored research has shown that during pregnancy, Trichomonas infection is associated with an increased risk of premature birth and infants with low birth weight. Moreover, infants born to mothers with Trichomonas infection are more than twice as likely as infants born to uninfected women to be stillborn or to die as newborns.

## Viral Hepatitis

Viral hepatitis is a serious liver disease that can be caused by several different viruses, which can be transmitted through sexual contact.

- Hepatitis A virus (HAV) causes a short-term or self-limited liver infection that can be quite serious, although it does not result in chronic infection. While there are other ways the virus can be transmitted, HAV can be spread from person to person during sexual activity through oral-rectal contact. Vaccination can prevent HAV infection.
- Hepatitis B virus (HBV) causes a serious liver disease that can result in both immediate illness and lifelong infection leading to permanent liver scarring (cirrhosis), cancer, liver failure, and death. HBV spreads through both heterosexual and homosexual contact as well as through contact with other bodily fluids, such as blood, through shared contaminated needles used for injecting intravenous (IV) drugs, tattooing, and piercing. Pregnant women with HBV can transmit the virus to their infants during delivery. HBV infection is preventable through vaccination.
- Hepatitis C virus (HCV) can cause an immediate illness affecting the liver, but it more commonly becomes a silent, chronic infection that leads to liver scarring (cirrhosis), cancer, liver failure, and death. HCV is most commonly transmitted through sharing needles or exposure to infected blood. However, it can spread through sexual contact or from mother to fetus during pregnancy and delivery. There is no vaccine for HCV, and treatments are not always effective.

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# 5.4: STD/STI Treatments

## Treatments for Specific Types of Sexually Transmitted Diseases and Sexually Transmitted Infections (STDs/STIs)

- Gonorrhea and Chlamydia
- Genital Herpes
- Human Papillomavirus (HPV)
- Syphilis
- Bacterial Vaginosis
- Trichomoniasis
- Viral Hepatitis
- HIV/AIDS
- During Pregnancy

### Gonorrhea and Chlamydia

Gonorrhea and chlamydia are bacterial STDs/STIs that can be treated with antibiotics given either orally or by injection. Because the infections often occur together, people who have one infection are typically treated for both by their health care provider. Recent sexual partners should be treated at the same time.

### Genital Herpes

Genital herpes outbreaks can be treated with antiviral drugs. Although this medication can limit the length and severity of outbreaks, it does not cure the infection. In addition, daily suppressive therapy (daily use of antiviral medication) for herpes can reduce the likelihood of transmission to partners. A pregnant woman known to have the infection must take additional care because she can pass the infection to her infant during delivery. Women who first acquire genital HSV during pregnancy are at highest risk of transmission to their infants. If a pregnant woman has an outbreak when she goes into labor, she may need to have a cesarean section (C-section) to prevent the infant from getting the virus during birth.

### Human Papillomavirus (HPV)

A person who has an HPV infection cannot be cured. However, many HPV infections can be prevented with vaccination. Furthermore, a health care provider can treat genital warts caused by the virus as well as monitor and control a woman’s risk of cervical cancer through frequent screening with Pap smear tests.

### Syphilis

If recognized during the early stages, usually within the first year of infection, syphilis can be treated with a singular intramuscular injection of antibiotic. A person being treated for syphilis must avoid sexual contact until the chancre sores caused by the bacteria are completely healed to avoid infecting other people.

If a person does not recognize the infection early, or does not seek treatment immediately, longer treatment with antibiotics may be required. If left untreated, the infection can progress even further and potentially cause death. Although antibiotics can prevent the infection from getting worse, they cannot reverse damage that has already occurred.

### Bacterial Vaginosis

Bacterial vaginosis can be treated with antibiotics, typically metronidazole or clindamycin. Generally, male sexual partners of women with bacterial vaginosis do not need to be treated because treatment of partners has not been shown to reduce the risk of recurrence.

Treatment during pregnancy is recommended primarily for women at risk for preterm labor or having a low birthweight infant.

### Trichomoniasis

Trichomoniasis can be treated with a single dose of an antibiotic, usually either metronidazole or tinidazole, taken by mouth. Often, *Trichomonas* infection recurs, so it is important to make sure that both you and your sexual partners are treated if you are diagnosed with this infection.

## Viral Hepatitis

- Hepatitis A virus (HAV) infects the liver and may cause abdominal pain, nausea, and vomiting. Usually the infection gets better on its own without requiring treatment. In some cases, however, individuals may have lasting damage to their livers or may have such severe nausea and vomiting that they must be admitted to the hospital.
- Hepatitis B virus (HBV) can cause a lifelong infection but can be treated with antiviral medications. People with HBV infection will need to see a liver specialist with experience treating individuals with chronic liver disease. These individuals need to take special care not to pass on the virus to their sexual partners, and sexual partners should receive hepatitis B vaccine if not already immune.
- Hepatitis C virus can cause immediate illness affecting the liver or, more commonly, it can be a silent, chronic infection. As with hepatitis B, individuals with HCV may have a lifelong infection and will always be at risk of passing the virus on to their sexual partners. New treatments are available that can clear the infection in some individuals.

More information about hepatitis A, B, and C can be found on the Centers for Disease Control and Prevention website.

## HIV/AIDS

There is no cure for HIV/AIDS. However, research into new treatments has improved outcomes for people living with the disease. A combination of antiretroviral drugs can be given in highly active antiretroviral therapy to control the virus, promote a healthy immune system, help people with the virus live longer lives, and reduce the risk of transmission.

## During Pregnancy

Pregnant women who have certain types of STDs/STIs may pass them on to their infants during pregnancy or delivery. Therefore, it is important for women to be tested for such STDs/STIs as part of their early prenatal care to help ensure delivery of a healthy infant.

The specific treatment will depend on which STD/STI is involved.

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# 5.5: STD/STI Prevention

## How to Prevent STDs

Every year, there are an estimated 20 million new STD infections in the United States.

Anyone who is sexually active can get an STD. Some groups are disproportionately affected by STDs:

- Adolescents and Young Adults
- Gay, Bisexual, & other Men who have Sex with Men
- Some Racial and Ethnic Minorities

The Good News: STDs ARE preventable. There are steps you can take to keep yourself and your partner(s) healthy.

Here's How You Can Avoid (or reduce the risk of) Giving or Getting an STD:

## Practice Abstinence

The surest way to avoid STDs is to not have sex. This means not having vaginal, oral, or anal sex.



## Use Condoms

Using a condom correctly every time you have sex can help you avoid STDs. Condoms lessen the risk of infection for all STDs. **You still can get certain STDs, like herpes or HPV, from contact with your partner's skin even when using a condom**.

Most people say they used a condom the first time they ever had sex, but when asked about the last 4 weeks, less than a quarter said they used a condom every time.

Step by step male condom instructions

## Have Fewer Partners

Agree to only have sex with one person who agrees to only have sex with you. Make sure you both get tested to know for sure that neither of you has an STD. This is one of the most reliable ways to avoid STDs.



## Get Vaccinated

The most common STD can be prevented by a vaccine. The HPV vaccine is safe, effective, and can help you avoid HPV-related health problems like genital warts and some cancers.

Who should get the HPV vaccine?

- Routine vaccination for boys & girls ages 11 to 12

Catch-up vaccination for:

- Young women ages 13 to 26 and young men ages 13 to 21
- Gay, Bisexual, & other Men who have sex with Men up to age 26
- Men with compromised immune systems up to age 26

## Talk With Your Partner

Talk with your sex partner(s) about STDs and staying safe before having sex. It might be uncomfortable to start the conversation, but protecting your health is your responsibility.

## Get Tested

Many STDs don't have symptoms, but they can still cause health problems.

- Talk with your health care provider
- Search for CDC recommended tests
- Find a location to get tested for STDs

The only way to know for sure if you have an STD is to get tested.

## If You Test Positive…

If either you or your partner is infected with an STD that can be cured (remember, some STDs *cannot* be cured), both of you need to start treatment immediately to avoid getting re-infected.

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# CHAPTER OVERVIEW

## 6: Module 3B- Relationships and Sexuality


6.1: Love and Attraction Theory
6.2: Healthy Relationships
6.3: Effective Communication
6.4: Sex, Gender, and Sexuality
6.5: LGBT Health


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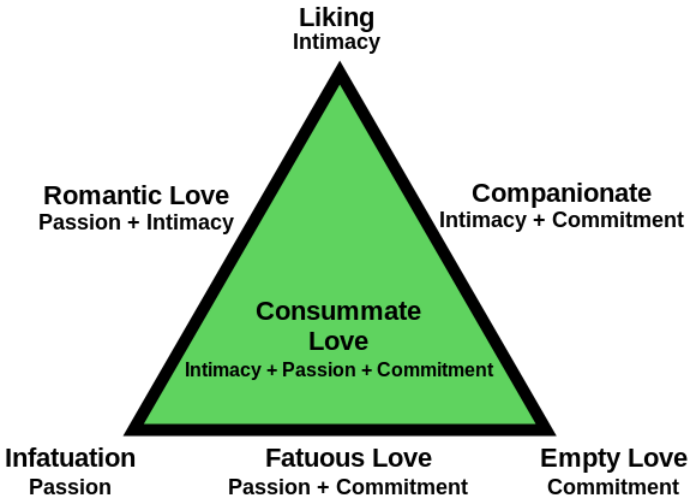

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# 6.1: Love and Attraction Theory

One of the most important factors in interpersonal attraction is *similarity*: the more similar two people are in attitudes, background, and other traits, the more probable it is that they will like each other. Contrary to popular belief, opposites do not usually attract. Although physical attraction may take precedence in the early stages of a romantic relationship, similarity and other compatibility factors become more important later on.

## Sternberg's Triangular Theory of Love

Psychologist Robert Sternberg describes love based on combinations of three components: *passion*, *intimacy*, and *commitment*. When two people share all three, they are said to be in a state of *consummate love*. This combination is considered to be an ideal type of love, but is also relatively difficult to maintain for a long period of time.




**A relationship based on a single component is less likely to survive than one based on two or three components.**

Intimate love encompasses the close bonds of loving relationships. Intimate love felt between two people means that they each feel a sense of high regard for each other. They wish to make each other happy, share with each other, be in communication with each other, help when one is in need. A couple with intimate love deeply values each other. Intimate love has been called the "warm" love because of the way it brings two people close together.

Passionate love is based on drive. Couples in passionate love feel physically attracted to each other. Sexual desire is typically a component of passionate love. Passionate love is considered the "hot" component of love because of the strong presence of arousal between two people.

Commitment, or committed love, is for couples who are committed to being together for a long period of time. Something to note about commitment, however, is that one can be committed to someone without feeling love for him or her, and one can feel love for someone without being committed to him or her.

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- Attraction and Love Theory. **Authored by**: Boundless. **Located at**: https://www.boundless.com/psychology/textbooks/boundless-psychology-textbook/social-psychology-20/social-behavior-105/attraction-loving-397-12932/. **License**: *CC BY-SA: Attribution-ShareAlike*

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# 6.2: Healthy Relationships

## Healthy vs. Unhealthy Relationships

Sometimes a relationship might not be abusive, but it might have some serious problems that make it unhealthy. If you think you might be in an unhealthy relationship, you should be able to talk to your partner about your concerns. If you feel like you can't talk to your partner, try talking to a trusted friend, family member, or counselor. Consider calling a confidential hotline to get the support you need and to explore next steps. If you're afraid to end the relationship, call a hotline for help.

Signs of an unhealthy relationship include:

- Focusing all your energy on your partner
- Dropping friends and family or activities you enjoy
- Feeling pressured or controlled a lot
- Having more bad times in the relationship than good
- Feeling sad or scared when with your partner

Signs of a healthy relationship include:

- Having more good times in the relationship than bad
- Having a life outside the relationship, with your own friends and activities
- Making decisions together, with each partner compromising at times
- Dealing with conflicts by talking honestly
- Feeling comfortable and able to be yourself
- Feeling able to take care of yourself
- Feeling like your partner supports you

Click here to further explore what Healthy Relationships are all about.

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# 6.3: Effective Communication

## Assertiveness

Assertiveness is an honest and appropriate expression of your feelings, thoughts, wants and needs. Acting in an assertive way helps you to stand up for your rights in a respectful manner. It is a way to communicate what you believe, what you want and need, and what is important to you.

**Learning to Be More Assertive**

People often associate the concept of assertiveness with standing up for your rights when you feel that someone has taken advantage of you in a negative way. However, it is also important to recognize that being more assertive can help you to communicate in a positive way in your relationships, which helps to promote mutual respect.

Assertiveness can help you:

- speak up when you have a question or concern,
- say “no” when you don’t want to do something, and
- express thoughts or feelings

**Will you always get what you want or need?** Communicating assertively does not guarantee that you will get what you want or need. However, you will have the satisfaction of expressing yourself in a positive, self-advocating way. You will probably feel better about yourself and your communication with others. And, you will increase the probability of getting what you need or want, while also respecting the wants or needs of others.

## Aggressive, Assertive and Non-Assertive Behavior

Aggressive behavior often means standing up for yourself in ways that violate the rights of others. Aggressive behavior can be demanding, hostile, and blaming.

Non-Assertive behavior is often submissive, inhibited, passive, and self-denying.

Assertive behavior involves expressing your wants, needs, thoughts and/or feelings while respecting the rights of others.

What keeps people from speaking up in an assertive way?

- Not being clear about what they want and need
- Fear of displeasing others and of not being liked
- Not believing they have the right to be assertive
- Lacking the skills to effectively express themselves

## “I” Statements vs. “You” Statements

“I” statements can help you focus on and be clear about your own thoughts and feelings, and what it is that you want or need. They may also involve an acknowledgement of the thoughts/feelings/goals of the other person.

The real focus in “I” statements is on the “I feel,” “I want,” or “I think” part of the statement. Identifying your thoughts, feelings, needs, and wants related to a situation will help you to avoid blaming someone else or getting caught up in the emotion of the moment.

“You” statements, on the other hand, tend to place blame or criticize the other person. This typically puts the other person on the defensive, and does not encourage open communication.

For example, saying “I feel worried when you are running late to meet me for dinner and don’t call to let me know” (I statement) vs. “You are always running late, and never bother to let me know” (You statement) will likely result in two very different reactions and conversations! The first statement simply expresses how the person is feeling, whereas the second statement sets a critical and accusatory tone.

**Practice**

To become more skilled in communicating assertively it is important to practice. You won’t learn how to become a more assertive person just by reading one book or attending one workshop. You can practice with your friends and family. Let them know what you are doing first! Ask for help/feedback on how you’re doing.

**Start Gradually** In the beginning, don't try changing your behavior in the most complex or difficult situations. Practice first in the least risky ones. Some examples:

- Returning a purchased item (that you are not satisfied with) to a store for a refund
- Asking your partner/roommate/kids to help empty the dishwasher or take out the garbage
- Suggesting a movie that you would like to watch for an upcoming movie night

If you start small to enhance your chances of success, you will experience how it feels to express yourself assertively and it will be easier to move on to more challenging situations.

Keep in mind:

- No one can read your mind– focus on expressing and communicating what is important to you.

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# 6.4: Sex, Gender, and Sexuality

When filling out official documents, you are often asked to provide your name, birth date, and sex or gender. But have you ever been asked to provide your sex *and* your gender? It may not have occurred to you that *sex* and *gender* are not the same. However, sociologists and most other social scientists view sex and gender as conceptually distinct. *Sex* denotes biological characteristics and exists along a spectrum from male to female. *Gender,* on the other hand, denotes social and cultural characteristics that are assigned to different sexes. Sex and gender are not always synchronous, meaning they do not always line up in an easy-to-categorize way.

## Sex

"Sex" refers to physiological differences found among male, female, and various intersex bodies. Sex includes both *primary sex characteristics* (those related to the reproductive system) and *secondary sex characteristics* (those that are not directly related to the reproductive system, such as breasts and facial hair). In humans, the biological sex of a child is determined at birth based on several factors, including chromosomes, gonads, hormones, internal reproductive anatomy, and genitalia. Biological sex has traditionally been conceptualized as a binary in Western medicine, typically divided into male and female. However, anywhere from 1.0 to 1.7% of children are born intersex, having a variation in sex characteristics (including chromosomes, gonads, or genitals) that do not allow them to be distinctly identified as male or female. Due to the existence of multiple forms of intersex conditions (which are more prevalent than researchers once thought), many view sex as existing along a spectrum, rather than simply two mutually exclusive categories.



Male, female, and the spectrum of sex

In humans, sex is typically divided into male, female, or intersex (i.e., having some combination of male and female sex characteristics). The symbols (to the left) represent female on the left and male on the right.

## Gender

A person's sex, as determined by his or her biology, does not always correspond with their gender; therefore, the terms "sex" and "gender" are not interchangeable. "Gender" is a term that refers to social or cultural distinctions associated with being male, female, or intersex. Typically, babies born with male sex characteristics (*sex)* are assigned as boys (*gender);* babies born with female sex characteristics (*sex)* are assigned as girls (*gender).* Because our society operates in a binary system when it comes to gender (in other words, seeing gender as only having two options), many children who are born intersex are forcibly assigned as either a boy or a girl and even surgically "corrected" to fit a particular gender. Scholars generally regard gender as a *social construct*—meaning that it does not exist naturally, but is instead a concept that is created by cultural and societal norms.

Gender identity is a person's sense of self as a member of a particular gender. Individuals who identify with a role that corresponds to the sex assigned to them at birth (for example, they were born with male sex characteristics, were assigned as a boy, and identify today as a boy or man) are cisgender. Those who identify with a role that is *different* from their biological sex (for example, they were born with male sex characteristics, were assigned as a boy, but identify today as a girl, woman, or some other gender altogether) are often referred to as transgender. The term "transgender" encompasses a wide range of possible identities, including agender, genderfluid, genderqueer, two-spirit (for many indigenous people), androgynous, and many others.

### The continuum of sex and gender



Those who identify with a gender that is *different* from their biological sex are referred to as transgender.

Modern scholars such as Anne Fausto-Sterling and Bonnie Spanier criticize the standard binaries of sex and gender, arguing that sex and gender are both fluid concepts that exist along a spectrum, rather than as binaries.

## Cultural Variations of Gender

Since the term “sex” refers to biological or physical distinctions, characteristics of sex will not vary significantly between different human societies. For example, persons of the female sex, in general, regardless of culture, will eventually menstruate and develop breasts that can lactate. Characteristics of gender, on the other hand, may vary greatly between different societies. For example, in American culture, it is considered feminine (or a trait of the female gender) to wear a dress or skirt. However, in many Middle Eastern, Asian, and African cultures, dresses or skirts (often referred to as sarongs, robes, or gowns) can be considered masculine. Similarly, the kilt worn by a Scottish male does not make him appear feminine in his culture.

## Sexuality

Human sexuality refers to a person’s sexual interest in and attraction to others, as well as their capacity to have erotic experiences and responses. A person’s sexual orientation is their emotional and sexual attraction to particular sexes or genders, which often shapes their sexuality. Sexuality may be experienced and expressed in a variety of ways, including thoughts, fantasies, desires, beliefs, attitudes, values, behaviors, practices, roles, and relationships. These may manifest themselves in biological, physical, emotional, social, or spiritual aspects. The *biological and physical* aspects of sexuality largely concern the human reproductive functions, including the human sexual-response cycle and the basic biological drive that exists in all species. *Emotional* aspects of sexuality include bonds between individuals that are expressed through profound feelings or physical manifestations of love, trust, and care. *Social* aspects deal with the effects of human society on one’s sexuality, while *spirituality* concerns an individual’s spiritual connection with others through sexuality.

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# 6.5: LGBT Health



## Lesbian, Gay, Bisexual, and Transgender Health

People who are lesbian, gay, bisexual, or transgender (LGBT) are members of every community. They are diverse, come from all walks of life, and include people of all races and ethnicities, all ages, all socioeconomic statuses, and from all parts of the United States and world. The perspectives and needs of LGBT people should be routinely considered in public health efforts to improve the overall health of every person and eliminate health disparities.

In addition to considering the needs of LGBT people in programs designed to improve the health of entire communities, there is also a need for culturally competent medical care and prevention services that are specific to this population. Social inequality is often associated with poorer health status, and sexual orientation has been associated with multiple health threats. Members of the LGBT community are at increased risk for a number of health threats when compared to their heterosexual peers. Differences in sexual behavior account for some of these disparities, but others are associated with social and structural inequities, such as the stigma and discrimination that LGBT populations still experience.

## The Effects of Negative Attitudes and Discrimination

Lesbian, Gay, Bisexual, and Transgender (LGBT) sexual health and well-being is affected by numerous social and cultural challenges across the life course, contributing to negative health outcomes and posing barriers to attain such protective health indicators as marriage and family formation, community support, and inclusion in faith communities.

The incidence of hate crimes and discrimination promulgated through the denial of equal rights contribute to the perpetuation of homophobia as a structural norm. As a result of cultural and societal discrimination, many LGBT people suffer an added burden of stress and experience health disparities, such as:

- Potential difficulties in getting or keeping health insurance, and possible employment instability.
- Limited access to high quality health care that is responsive to LGBT health issues.
- Mental health problems and unhealthy coping skills, such as substance abuse, risky sexual behaviors, and suicide attempts.
- Challenges or difficulties with being open about one’s sexual orientation, which can increase stress, limit social support, and negatively affect overall health.

The effects of homophobia, stigma and discrimination can be especially hard on adolescents and young adults. In addition to an increased risk of being bullied at school, they are also at risk of being rejected by their families and, as a result, are at increased risk of homelessness. A study published in 2009 compared gay, lesbian, and bisexual young adults who experienced strong rejection from their families with their peers who had more supportive families. The researchers found that those who experienced stronger rejection were about:

- 8 times more likely to have tried to commit suicide
- 6 times more likely to report high levels of depression
- 3 times more likely to use illegal drugs
- 3 times more likely to have risky sex



## Increasing Positive Perceptions and Acceptance

Whether you are gay or straight, you can help reduce homophobia, stigma, and discrimination in your community and decrease the associated negative health effects. Even small things can make a difference, such as accepting and supporting a family member, friend, or co-worker.

For additional information about Sexual Orientation, click here.

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# CHAPTER OVERVIEW

## 7: Module 4A- Nutrition


7.1: Nutrition Basics
7.2: Disease Risk and Nutrition
7.3: Dietary Guidelines for Americans
7.4: Nutrition Facts Label
7.5: Organic Foods


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# 7.1: Nutrition Basics



Food provides the energy and nutrients you need to be healthy. Nutrients include:

- protein
- carbohydrates
- fats
- vitamins
- minerals
- water

## Protein

Protein is in every cell in the body. Our bodies need protein from the foods we eat to build and maintain bones, muscles and skin. We get proteins in our diet from meat, dairy products, nuts, and certain grains and beans. Proteins from meat and other animal products are complete proteins. This means they supply all of the amino acids the body can't make on its own. Most plant proteins are incomplete. You should eat different types of plant proteins every day to get all of the amino acids your body needs.

It is important to get enough dietary protein. You need to eat protein every day, because your body doesn't store it the way it stores fats or carbohydrates. How much you need depends on your age, sex, health, and level of physical activity. Most Americans eat enough protein in their diet.

## Carbohydrates

Carbohydrates are one of the main types of nutrients. They are the most important source of energy for your body. Your digestive system changes carbohydrates into glucose (blood sugar). Your body uses this sugar for energy for your cells, tissues and organs. It stores any extra sugar in your liver and muscles for when it is needed.

Carbohydrates are called simple or complex, depending on their chemical structure. Simple carbohydrates include sugars found naturally in foods such as fruits, vegetables, milk, and milk products. They also include sugars added during food processing and refining. Complex carbohydrates include whole grain breads and cereals, starchy vegetables and legumes. Many of the complex carbohydrates are good sources of fiber.

Fiber is commonly classified as soluble, which dissolves in water, or insoluble, which doesn't dissolve.

- **Soluble fiber.** This type of fiber dissolves in water to form a gel-like material. It can help lower blood cholesterol and glucose levels. Soluble fiber is found in oats, barley, nuts, seeds, beans, lentils, peas, and some fruits and vegetables.
- **Insoluble fiber.** This type of fiber promotes the movement of material through your digestive system and adds bulk to the stool, so it can be of benefit to those who struggle with constipation or irregular stools. Insoluble fiber is found in foods such as wheat bran, vegetables, and whole grains.

For a healthy diet, limit the amount of added sugar that you eat and choose whole grains over refined grains.

## Fats

We need a certain amount of fat in our diets to stay healthy. Fats provide needed energy in the form of calories. Fats help our bodies absorb important vitamins—called fat-soluble vitamins—including vitamins A, D and E. Fats also make foods more flavorful and help us feel full. Fats are especially important for infants and toddlers, because dietary fat contributes to proper growth and development.

Problems arise, though, if we eat too much fat. Dietary fats have more than twice as many calories per gram as either proteins or carbohydrates like sugar and starch. Excess calories, of course, can pack on the pounds and raise your risk for diabetes, cancer and other conditions.

Foods can contain a mixture of different fats. **Unsaturated fats** are considered “good” fats. They’re sometimes listed as “monounsaturated” and “polyunsaturated” fat on Nutrition Facts labels. These can promote health if eaten in the right amounts. They are generally liquid at room temperature, and are known as oils. You’ll find healthful unsaturated fats in fish, nuts and most vegetable oils, including canola, corn, olive and safflower oils.

The so-called “bad” fats are **saturated fats** and **trans fats.** They tend to be solid at room temperature. Solid fats include butter, meat fats, stick margarine, shortening, and coconut and palm oils. They’re often found in chocolates, baked goods, and deep-fried and processed foods.

For additional information about fats, CLICK HERE.

## Vitamins

Vitamins are substances that your body needs to grow and develop normally. There are 13 vitamins your body needs. They are:

- Vitamin A
- B vitamins (thiamine, riboflavin, niacin, pantothenic acid, biotin, vitamin B-6, vitamin B-12 and folate)
- Vitamin C
- Vitamin D
- Vitamin E
- Vitamin K

Vitamins are classified as either fat soluble (vitamins A, D, E and K) or water soluble (vitamins B and C). This difference between the two groups is very important as it determines how each vitamin acts within the body.

You can usually get all your vitamins from the foods you eat. Your body can also make vitamins D and K. People who eat a vegetarian diet may need to take a vitamin B12 supplement.

Each vitamin has specific jobs. If you have low levels of certain vitamins, you may get health problems. For example, if you don’t get enough vitamin C, you could become anemic. Some vitamins may help prevent medical problems. Vitamin A prevents night blindness.

The best way to get enough vitamins is to eat a balanced diet with a variety of foods. In some cases, you may need to take vitamin supplements. It’s a good idea to ask your health care provider first. High doses of some vitamins can cause problems.

## Minerals

Minerals are important for your body to stay healthy. Your body uses minerals for many different jobs, including building bones, making hormones and regulating your heartbeat.

There are two kinds of minerals: macrominerals and trace minerals. Macrominerals are minerals your body needs in larger amounts. They include calcium, phosphorus, magnesium, sodium, potassium, chloride and sulfur. Your body needs just small amounts of trace minerals. These include iron, manganese, copper, iodine, zinc, cobalt, fluoride and selenium.

## Water

Water is your body’s principal chemical component and makes up about 60 percent of your body weight. Every system in your body depends on water. For example, water flushes toxins out of vital organs, carries nutrients to your cells, and provides a moist environment for ear, nose and throat tissues.

Lack of water can lead to dehydration, a condition that occurs when you don’t have enough water in your body to carry out normal functions. Even mild dehydration can drain your energy and make you tired.

Every day you lose water through your breath, perspiration, urine and bowel movements. For your body to function properly, you must replenish its water supply by consuming beverages and foods that contain water.

## What are Antioxidants?

CLICK HERE to find out! Free radicals are often discussed in conjunction with antioxidants. To learn more about the role of free radicals and your health, click here.

## Choose Nutrient-dense Foods

To eat well, it’s best to choose a mix of nutrient-dense foods every day. Nutrient-dense foods are foods that have a lot of nutrients but relatively few calories. Look for foods that contain vitamins, minerals, complex carbohydrates, lean protein, and healthy fats.

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# 7.2: Disease Risk and Nutrition

## Nutrition and Health Are Closely Related[1]

Over the past century, essential nutrient deficiencies have dramatically decreased, many infectious diseases have been conquered, and the majority of the U.S. population can now anticipate a long and productive life. However, as infectious disease rates have dropped, the rates of noncommunicable diseases—specifically, chronic diet-related diseases—have risen, due in part to changes in lifestyle behaviors.

A history of poor eating and physical activity patterns have a cumulative effect and have contributed to significant nutrition- and physical activity-related health challenges that now face the U.S. population. **About half of all American adults—117 million individuals—have one or more preventable chronic diseases, many of which are related to poor quality eating patterns and physical inactivity. These include cardiovascular disease, high blood pressure, type 2 diabetes, some cancers, and poor bone health**.

More than two-thirds of adults and nearly one-third of children and youth are overweight or obese. These high rates of overweight and obesity and chronic disease have persisted for more than two decades and come not only with increased health risks, but also at high cost. In 2008, the medical costs associated with obesity were estimated to be $147 billion. In 2012, the total estimated cost of diagnosed diabetes was $245 billion, including $176 billion in direct medical costs and $69 billion in decreased productivity.

## Type 2 Diabetes

Diabetes is a disease in which blood glucose levels are above normal. Most of the food we eat is turned into glucose, or sugar, for our bodies to use for energy. The pancreas, an organ that lies near the stomach, makes a hormone called insulin to help glucose get into the cells of our bodies. When you have diabetes, your body either doesn't make enough insulin or can't use its own insulin as well as it should. This causes sugar to build up in your blood.

Diabetes can cause serious health complications including heart disease, blindness, kidney failure, and lower-extremity amputations.




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## What is prediabetes?

Prediabetes is when the amount of glucose in your blood is above normal yet not high enough to be called diabetes. With prediabetes, your chances of getting type 2 diabetes, heart disease, and stroke are higher. With some weight loss and moderate physical activity, you can delay or prevent type 2 diabetes. You can even return to normal glucose levels, possibly without taking any medicines.




## What are the signs and symptoms of diabetes?

The signs and symptoms of diabetes are:

- being very thirsty
- urinating often
- feeling very hungry
- feeling very tired
- losing weight without trying
- sores that heal slowly
- dry, itchy skin
- feelings of pins and needles in your feet
- losing feeling in your feet
- blurry eyesight

Some people with diabetes don't have any of these signs or symptoms. The only way to know if you have diabetes is to have your doctor do a blood test.

Click here to see a Snapshot of Diabetes in the United States.

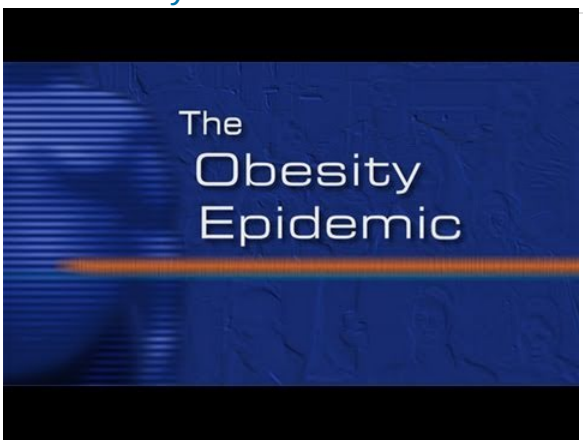
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# 7.3: Dietary Guidelines for Americans




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Every 5 years since 1980, a new edition of the *Dietary Guidelines for Americans* has been published. Its goal is to make recommendations about the components of a healthy and nutritionally adequate diet to help promote health and prevent chronic disease for current and future generations. Although many of its recommendations have remained relatively consistent over time, the *Dietary Guidelines* has evolved as scientific knowledge has grown. These advancements have provided a greater understanding of, and focus on, the importance of healthy eating patterns as a whole, and how foods and beverages act synergistically to affect health. Therefore, healthy eating patterns is a focus of the *2015-2020 Dietary Guidelines*.

## Key Recommendations: Components of Healthy Eating Patterns[1]

The *Dietary Guidelines*' Key Recommendations for healthy eating patterns should be applied in their entirety, given the interconnected relationship that each dietary component can have with others.

### Key Recommendations

**Consume a healthy eating pattern that accounts for all foods and beverages within an appropriate calorie level.**

**A healthy eating pattern includes:**

- A variety of vegetables from all of the subgroups—dark green, red and orange, legumes (beans and peas), starchy, and other
- Fruits, especially whole fruits
- Grains, at least half of which are whole grains
- Fat-free or low-fat dairy, including milk, yogurt, cheese, and/or fortified soy beverages
- A variety of protein foods, including seafood, lean meats and poultry, eggs, legumes (beans and peas), and nuts, seeds, and soy products
- Oils (such as olive and canola oil)

**A healthy eating pattern limits:**

- Saturated fats and *trans* fats, added sugars, and sodium

Key Recommendations that are quantitative are provided for several components of the diet that should be limited. These components are of particular public health concern in the United States, and the specified limits can help individuals achieve healthy eating patterns within calorie limits:

- Consume less than 10 percent of calories per day from added sugars
- Consume less than 10 percent of calories per day from saturated fats
- Consume less than 2,300 milligrams (mg) per day of sodium
- If alcohol is consumed, it should be consumed in moderation—up to one drink per day for women and up to two drinks per day for men—and only by adults of legal drinking age

# MyPlate, MyWins

## Find your healthy eating style

and maintain it for a lifetime. This means:

Everything you eat and drink over time matters.

The right mix can help you be healthier now and in the future.




## Start with small changes

to make healthier choices you can enjoy.

Visit Choose**MyPlate**.gov for more tips, tools, and information.

Click here to compare MyPlate to the Harvard Healthy Eating Plate.

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- Video: The Obesity Epidemic. **Authored by**: Centers for Disease Control and Prevention. **Located at**: https://www.youtube.com/watch?v=vCORDl4bqDE. **License**: *Public Domain: No Known Copyright*

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# 7.4: Nutrition Facts Label

## Changes to the Nutrition Facts Label

On May 20, 2016, the FDA announced the new Nutrition Facts label for packaged foods to reflect new scientific information, including the link between diet and chronic diseases such as obesity and heart disease. The new label will make it easier for consumers to make better informed food choices. FDA published the final rules in the Federal Register on May 27, 2016.

## Highlights of the Final Nutrition Facts Label

**1. Features a Refreshed Design**

- The "iconic" look of the label remains, but we are making important updates to ensure consumers have access to the information they need to make informed decisions about the foods they eat. These changes include increasing the type size for "Calories," "servings per container," and the "Serving size" declaration, and bolding the number of calories and the "Serving size" declaration to highlight this information.
- Manufacturers must declare the actual amount, in addition to percent Daily Value of vitamin D, calcium, iron and potassium. They can voluntarily declare the gram amount for other vitamins and minerals.
- The footnote is changing to better explain what percent Daily Value means. It will read: "*The % Daily Value tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice."

**2. Reflects Updated Information about Nutrition Science**




- "Added sugars," in grams and as percent Daily Value, will be included on the label. Scientific data shows that it is difficult to meet nutrient needs while staying within calorie limits if you consume more than 10 percent of your total daily calories from added sugar, and this is consistent with the 2015-2020 Dietary Guidelines for Americans.
- The list of nutrients that are required or permitted to be declared is being updated. Vitamin D and potassium will be required on the label. Calcium and iron will continue to be required. Vitamins A and C will no longer be required but can be included on a voluntary basis.
- While continuing to require "Total Fat," "Saturated Fat," and "*Trans Fat*" on the label, "Calories from Fat" is being removed because research shows the type of fat is more important than the amount.
- Daily values for nutrients like sodium, dietary fiber and vitamin D are being updated based on newer scientific evidence from the Institute of Medicine and other reports such as the 2015 Dietary Guidelines Advisory Committee Report, which was used in developing the 2015-2020 Dietary Guidelines for Americans. Daily values are reference amounts of nutrients to consume or not

to exceed and are used to calculate the percent Daily Value (% DV) that manufacturers include on the label. The %DV helps consumers understand the nutrition information in the context of a total daily diet.

**3. Updates Serving Sizes and Labeling Requirements for Certain Package Sizes**




- By law, serving sizes must be based on amounts of foods and beverages that people are actually eating, not what they should be eating. How much people eat and drink has changed since the previous serving size requirements were published in 1993. For example, the reference amount used to set a serving of ice cream was previously ½ cup but is changing to â…” cup. The reference amount used to set a serving of soda is changing from 8 ounces to 12 ounces.
- Package size affects what people eat. So for packages that are between one and two servings, such as a 20 ounce soda or a 15-ounce can of soup, the calories and other nutrients will be required to be labeled as one serving because people typically consume it in one sitting.
- For certain products that are larger than a single serving but that could be consumed in one sitting or multiple sittings, manufacturers will have to provide “dual column” labels to indicate the amount of calories and nutrients on both a “per serving” and “per package”/“per unit” basis. Examples would be a 24-ounce bottle of soda or a pint of ice cream. With dual-column labels available, people will be able to easily understand how many calories and nutrients they are getting if they eat or drink the entire package/unit at one time.

## HomeCompliance Date

Manufacturers will need to use the new label by July 26, 2018. However, manufacturers with less than $10 million in annual food sales will have an additional year to comply.

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# 7.5: Organic Foods




## Organic 101: What the USDA Organic Label Means

Amidst nutrition facts, ingredients lists, and dietary claims on food packages, “organic” might appear as one more piece of information to decipher when shopping for foods. So understanding what “organic” really means can help shoppers make informed choices during their next visit to the store or farmers’ market.

USDA certified organic foods are grown and processed according to federal guidelines addressing, among many factors, soil quality, animal raising practices, pest and weed control, and use of additives. Organic producers rely on natural substances and physical, mechanical, or biologically based farming methods to the fullest extent possible.

Produce can be called organic if it’s certified to have grown on soil that had no prohibited substances applied for three years prior to harvest. Prohibited substances include most synthetic fertilizers and pesticides. In instances when a grower has to use a synthetic substance to achieve a specific purpose, the substance must first be approved according to criteria that examine its effects on human health and the environment (see other considerations in “Organic 101: Allowed and Prohibited Substances”).

As for organic meat, regulations require that animals are raised in living conditions accommodating their natural behaviors (like the ability to graze on pasture), fed 100% organic feed and forage, and not administered antibiotics or hormones.

When it comes to processed, multi-ingredient foods, the USDA organic standards specify additional considerations. Regulations prohibit organically processed foods from containing artificial preservatives, colors, or flavors and require that their ingredients are organic, with some minor exceptions. For example, processed organic foods may contain some approved non-agricultural ingredients, like enzymes in yogurt, pectin in fruit jams, or baking soda in baked goods.

When packaged products indicate they are “made with organic [specific ingredient or food group],” this means they contain at least 70% organically produced ingredients. The remaining non-organic ingredients are produced without using prohibited practices (genetic engineering, for example) but can include substances that would not otherwise be allowed in 100% organic products. “Made with organic” products will not bear the USDA organic seal, but, as with all other organic products, must still identify the USDA-accredited certifier. You can look for the identity of the certifier on a packaged product for verification that the organic product meets USDA’s organic standards.

As with all organic foods, none of it is grown or handled using genetically modified organisms, which the organic standards expressly prohibit (see “Organic 101: What Organic Farming (and Processing) Doesn’t Allow”).

Becoming familiar with the USDA organic label and understanding its claims empower consumers to make informed decisions about the food they purchase. While there are many marketing claims that add value to foods, consumers can be assured that USDA organic products are verified organic at all steps between the farm and the store.

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# CHAPTER OVERVIEW

## 8: Module 4B- Weight Management


8.1: Prevalence of Overweight and Obesity
8.2: Balancing Calories
8.3: Body Mass Index
8.4: Health Effects of Overweight and Obesity


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# 8.1: Prevalence of Overweight and Obesity

**Overweight and Obesity in the United States**

According to data from the National Health and Nutrition Examination Survey (NHANES):

- About 1 in 3 adults were considered to be overweight.
- More than 2 in 3 adults were considered to be overweight or have obesity.
- More than 1 in 3 adults were considered to have obesity.
- About 1 in 13 adults were considered to have extreme obesity.
- About 1 in 6 children and adolescents ages 2 to 19 were considered to have obesity.

## Causes and Health Consequences of Overweight and Obesity

Factors that may contribute to weight gain among adults and youth include genes, eating habits, physical inactivity, TV, computer, phone, and other screen time, sleep habits, medical conditions or medications, and where and how people live, including their access to healthy foods and safe places to be active.

Overweight and obesity are risk factors for many health problems such as type 2 diabetes, high blood pressure, joint problems, and gallstones, among other conditions.

For more information on the causes and health consequences of overweight and obesity, please visit NIDDK's webpages on Understanding Adult Overweight and Obesity.

**Adults**

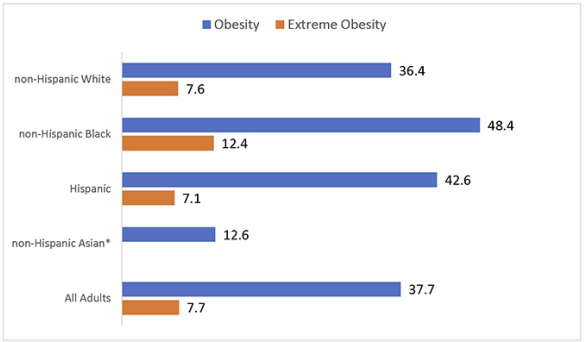
**Estimated (Age-Adjusted) Percentage of US Adults with Overweight and Obesity by Sex, 2013–2014 NHANES Data**

| | All (Men and Women) | Men | Women |
|---|---|---|---|
| Overweight or Obesity | 70.2 | 73.7 | 66.9 |
| Overweight | 32.5 | 38.7 | 26.5 |
| Obesity (including extreme obesity) | 37.7 | 35 | 40.4 |
| Extreme obesity | 7.7 | 5.5 | 9.9 |

As shown in the above table:

- More than 2 in 3 adults (70.2 percent) were considered to be overweight or have obesity
- About 1 in 3 adults (32.5 percent) were considered to be overweight
- More than 1 in 3 adults (37.7 percent) were considered to have obesity
- About 1 in 13 adults (7.7 percent) were considered to have extreme obesity
- More than 1 in 3 (38.7 percent) of men, and about 1 in 4 (26.5 percent) of women were considered to be overweight
- Obesity was higher in women (about 40 percent) than men (35 percent)
- Extreme obesity was higher in women (9.9 percent) than men (5.5 percent)
- Almost 3 in 4 men (73.7 percent) were considered to be overweight or have obesity; and about 2 in 3 women (66.9) were considered to be overweight or have obesity.

**Estimated (Age-Adjusted) Percentage of US Adults with Obesity by Race/Ethnicity, 2013–2014 NHANES Data**




*data for extreme obesity in Asians were not reported since the numbers are close to zero.

As shown in the above bar graph:

- Among non-Hispanic white adults, more than 1 in 3 (36.4 percent) were considered to have obesity, and about 1 in 13 (7.6 percent) were considered to have extreme obesity.
- Among non-Hispanic black adults, almost half (48.4 percent) were considered to have obesity, and about 1 in 8 (12.4 percent) were considered to have extreme obesity.
- Among Hispanic adults, about 1 in 2 (42.6 percent) were considered to have obesity, and about 1 in 14 (7.1 percent) were considered to have extreme obesity.
- Among non-Hispanic Asian adults, about 1 in 8 (12.6 percent) were considered to have obesity.

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# 8.2: Balancing Calories

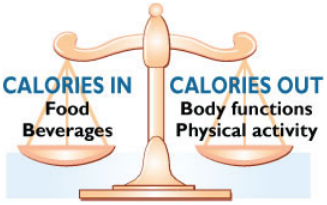
## Finding a Balance

**More than one third of U.S. adults are obese**. Weight gain occurs when you consume more calories than your body uses. Reaching and maintaining a healthy weight will help you prevent and control many diseases and conditions. The key is "Finding a Balance" in your lifestyle that includes healthy eating and regular physical activity.

## The Caloric Balance Equation

When it comes to maintaining a healthy weight for a lifetime, the bottom line is – **calories count!** Weight management is all about balance—balancing the number of calories you consume with the number of calories your body uses or "burns off."

- A *calorie* is defined as a unit of energy supplied by food. A calorie is a calorie regardless of its source. Whether you're eating carbohydrates, fats, sugars, or proteins, all of them contain calories.
- *Caloric balance* is like a scale. To remain in balance and maintain your body weight, the calories consumed (from foods) must be balanced by the calories used (in normal body functions, daily activities, and exercise).




| If you are… | Your caloric balance status is… |
|---|---|
| Maintaining your weight | "**in balance**." You are eating roughly the same number of calories that your body is using. Your weight will remain **stable**. |
| Gaining weight | "**in caloric excess**." You are eating more calories than your body is using. You will store these extra calories as fat and you'll **gain** weight. |
| Losing weight | "**in caloric deficit**." You are eating fewer calories than you are using. Your body is pulling from its fat storage cells for energy, so your weight is **decreasing**. |

## HomeAm I in Caloric Balance?

If you are maintaining your current body weight, you are in caloric balance. If you need to gain weight or to lose weight, you'll need to tip the balance scale in one direction or another to achieve your goal.

If you need to tip the balance scale in the direction of losing weight, keep in mind that **it takes approximately 3,500 calories below your calorie needs to lose a pound of body fat**. To lose about 1 to 2 pounds per week, you'll need to reduce your caloric intake by 500—1000 calories per day.

To learn how many calories you are currently eating, begin writing down the foods you eat and the beverages you drink each day. By writing down what you eat and drink, you become more aware of everything you are putting in your mouth. Also, begin writing down the physical activity you do each day and the length of time you do it. Here are simple paper and pencil tools to assist you:

- Food Diary [PDF-3KB]
- Physical Activity Diary [PDF-42KB]

Want to try an interactive approach evaluate your food intake and physical activity? Go to the SuperTracker. The site will give you a detailed assessment and analysis of your current eating and physical activity habits.

Physical activities (both daily activities and exercise) help tip the balance scale by increasing the calories you expend each day. For examples, go to How Many Calories Does Physical Activity Burn?

Find out how many calories your body needs to maintain, lose, or gain weight by clicking here.

The bottom line is… each person's body is unique and may have different caloric needs. A healthy lifestyle requires balance, in the foods you eat, in the beverages you consume, in the way you carry out your daily activities, and in the amount of physical activity or exercise you include in your daily routine. While counting calories is not necessary, it may help you in the beginning to gain an awareness of your eating habits as you strive to achieve energy balance. The ultimate test of balance is whether or not you are gaining, maintaining, or losing weight.



Research suggests that safe weight loss involves combining a reduced-calorie diet with physical activity to lose 1/2 to 2 pounds a week (after the first few weeks of weight loss). Make healthy food choices. Eat small portions. Build exercise into your daily life. Combined, these habits may be a healthy way to lose weight and keep it off. These habits may also lower your chances of developing heart disease, high blood pressure, and type 2 diabetes.

To review these key concepts, watch the video below:




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# 8.3: Body Mass Index

## What is BMI?

BMI is a person's weight in kilograms divided by the square of height in meters. BMI does not measure body fat directly, but research has shown that BMI is moderately correlated with more direct measures of body fat obtained from skinfold thickness measurements, bioelectrical impedance, densitometry (underwater weighing), dual energy x-ray absorptiometry (DXA) and other methods. Furthermore, BMI appears to be as strongly correlated with various metabolic and disease outcome as are these more direct measures of body fatness. In general, BMI is an inexpensive and easy-to-perform method of screening for weight category, for example underweight, normal or healthy weight, overweight, and obesity.

## How is BMI used?

Adult BMI Calculator

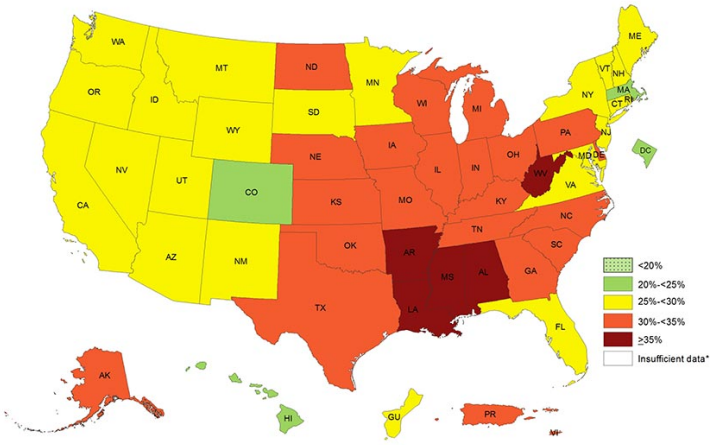
A high BMI can be an indicator of high body fatness. BMI can be used as a screening tool but is not diagnostic of the body fatness or health of an individual.

To determine if a high BMI is a health risk, a healthcare provider would need to perform further assessments. These assessments might include skinfold thickness measurements, evaluations of diet, physical activity, family history, and other appropriate health screenings.

## What are the BMI trends for adults in the United States?

The prevalence of adult BMI greater than or equal to 30 $kg/m^2$ (obese status) has greatly increased since the 1970s. Recently, however, this trend has leveled off, except for older women. Obesity has continued to increase in adult women who are age 60 years and older.

**Prevalence of Self-Reported Obesity Among U.S. Adults by State and Territory, BRFSS, 2016**




## Why is BMI used to measure overweight and obesity?

BMI can be used for population assessment of overweight and obesity. Because calculation requires only height and weight, it is inexpensive and easy to use for clinicians and for the general public. BMI can be used as a screening tool for body fatness but is not diagnostic.

To see the formula based on either kilograms and meters or pounds and inches, visit How is BMI calculated?

## What are some of the other ways to assess excess body fatness besides BMI?

Other methods to measure body fatness include skinfold thickness measurements (with calipers), underwater weighing, bioelectrical impedance, dual-energy x-ray absorptiometry (DXA), and isotope dilution [1,2,3]. However, these methods are not always readily available, and they are either expensive or need to be conducted by highly trained personnel. Furthermore, many of these methods can be difficult to standardize across observers or machines, complicating comparisons across studies and time periods.

## How is BMI interpreted for adults?

For adults 20 years old and older, BMI is interpreted using standard weight status categories. These categories are the same for men and women of all body types and ages.

The standard weight status categories associated with BMI ranges for adults are shown in the following table.

| BMI | Weight Status |
|---|---|
| Below 18.5 | Underweight |
| 18.5 – 24.9 | Normal or Healthy Weight |
| 25.0 – 29.9 | Overweight |
| 30.0 and Above | Obese |

For example, here are the weight ranges, the corresponding BMI ranges, and the weight status categories for a person who is 5′ 9″.

| Height | Weight Range | BMI | Weight Status |
|---|---|---|---|
| 5′ 9″ | 124 lbs or less | Below 18.5 | Underweight |
| | 125 lbs to 168 lbs | 18.5 to 24.9 | Normal or Healthy Weight |
| | 169 lbs to 202 lbs | 25.0 to 29.9 | Overweight |
| | 203 lbs or more | 30 or higher | Obese |

For children and teens, the interpretation of BMI depends upon age and sex.

For adults, the interpretation of BMI does not depend on sex or age.

### How good is BMI as an indicator of body fatness?

The correlation between the BMI and body fatness is fairly strong, but even if 2 people have the same BMI, their level of body fatness may differ.

In general:

- At the same BMI, women tend to have more body fat than men.
- At the same BMI, Blacks have less body fat than do Whites, and Asians have more body fat than do Whites
- At the same BMI, older people, on average, tend to have more body fat than younger adults.
- At the same BMI, athletes have less body fat than do non-athletes.

The accuracy of BMI as an indicator of body fatness also appears to be higher in persons with higher levels of BMI and body fatness. While, a person with a very high BMI (e.g., 35 $kg/m^2$) is very likely to have high body fat, a relatively high BMI can be the results of either high body fat or high lean body mass (muscle and bone). A trained healthcare provider should perform appropriate health assessments in order to evaluate an individual's health status and risks.

### If an athlete or other person with a lot of muscle has a BMI over 25, is that person still considered to be overweight?

According to the BMI weight status categories, anyone with a BMI between 25 and 29.9 would be classified as overweight and anyone with a BMI over 30 would be classified as obese.

However, athletes may have a high BMI because of increased muscularity rather than increased body fatness. In general, a person who has a high BMI is likely to have body fatness and would be considered to be overweight or obese, but this may not apply to athletes. A trained healthcare provider should perform appropriate health assessments in order to evaluate an individual's health status and risks.

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# 8.4: Health Effects of Overweight and Obesity

People who are overweight or obese, compared to those with a normal or healthy weight, are at increased risk for many serious diseases and health conditions. The more body fat that you have and the more you weigh, the more likely you are to develop:

- All causes of death (mortality)
- High blood pressure (Hypertension)
- High LDL cholesterol, low HDL cholesterol, or high levels of triglycerides (Dyslipidemia)
- Type 2 diabetes
- Coronary heart disease
- Stroke
- Gallbladder disease
- Osteoarthritis (a breakdown of cartilage and bone within a joint)
- Sleep apnea and breathing problems
- Some cancers (endometrial, breast, colon, kidney, gallbladder, and liver)
- Low quality of life
- Mental illness such as clinical depression, anxiety, and other mental disorders
- Body pain and difficulty with physical functioning

Your weight is the result of many factors. These factors include environment, family history and genetics, metabolism (the way your body changes food and oxygen into energy), behavior or habits, and more.

You can't change some factors, such as family history. However, you can change other factors, such as your lifestyle habits.

For example, follow a healthy eating plan and keep your calorie needs in mind. Be physically active and try to limit the amount of time that you're inactive.

As shown in the video below, it is important to remember that obesity happens one pound at a time, and even relatively small weight gains can negatively affect one's health and well-being.




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- Obesity happens one pound at a time - Video. **Authored by**: National Heart, Lung, and Blood Institute. **Provided by**: National Institutes of Health. **Located at**: https://www.nhlbi.nih.gov/health/health-topics/topics/obe. **License**: *Public Domain: No Known Copyright*

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# CHAPTER OVERVIEW

## 9: Module 5A- Mental and Emotional Health


9.1: Mental Health Overview
9.2: Psychological Constructs
9.3: Anxiety Disorders
9.4: Depression
9.5: Suicide Prevention
9.6: Eating Disorders


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# 9.1: Mental Health Overview

## What Is Mental Health?

Mental health includes our emotional, psychological, and social well-being. It affects how we think, feel, and act. It also helps determine how we handle stress, relate to others, and make choices. Mental health is important at every stage of life, from childhood and adolescence through adulthood.

Over the course of your life, if you experience mental health problems, your thinking, mood, and behavior could be affected. Many factors contribute to mental health problems, including:

- Biological factors, such as genes or brain chemistry
- Life experiences, such as trauma or abuse
- Family history of mental health problems

Mental health problems are common but help is available. People with mental health problems can get better and many recover completely.

## Early Warning Signs

Not sure if you or someone you know is living with mental health problems? Experiencing one or more of the following feelings or behaviors can be an early warning sign of a problem:

- Eating or sleeping too much or too little
- Pulling away from people and usual activities
- Having low or no energy
- Feeling numb or like nothing matters
- Having unexplained aches and pains
- Feeling helpless or hopeless
- Smoking, drinking, or using drugs more than usual
- Feeling unusually confused, forgetful, on edge, angry, upset, worried, or scared
- Yelling or fighting with family and friends
- Experiencing severe mood swings that cause problems in relationships
- Having persistent thoughts and memories you can’t get out of your head
- Hearing voices or believing things that are not true
- Thinking of harming yourself or others
- Inability to perform daily tasks like taking care of your kids or getting to work or school

Learn more about specific mental health problems and where to find help.

## Mental Health and Wellness

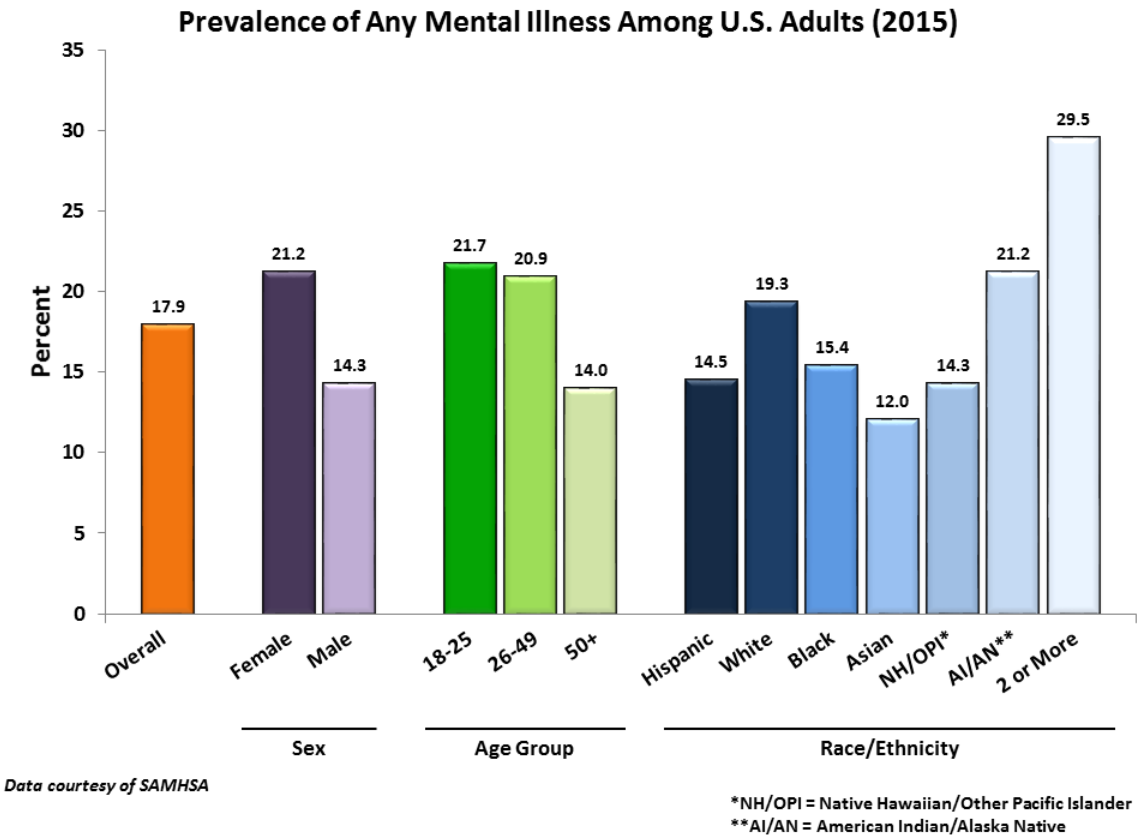
Positive mental health allows people to:

- Realize their full potential
- Cope with the stresses of life
- Work productively
- Make meaningful contributions to their communities

Ways to maintain positive mental health include:

- Getting professional help if you need it
- Connecting with others
- Staying positive
- Getting physically active
- Helping others
- Getting enough sleep
- Developing coping skills

Mental illnesses are common in the United States. In 2015, there were an estimated 43.4 million adults aged 18 or older in the United States with any mental illness (AMI) within the past year. This number represented 17.9% of all U.S. adults.




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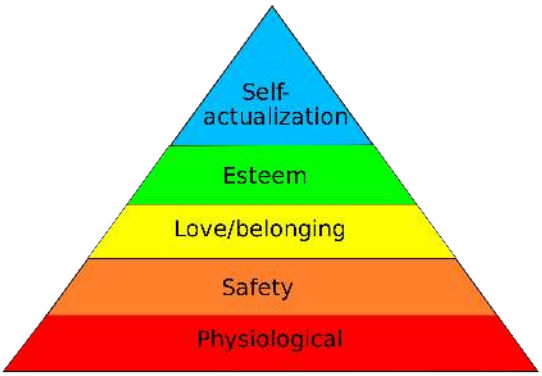
- What is Mental Health?. **Authored by**: MentalHealth.gov. **Provided by**: U.S. Department of Health and Human Services. **Located at**: https://www.mentalhealth.gov/basics/what-is-mental-health/index.html. **License**: *Public Domain: No Known Copyright*
- Chart: Prevalence of Any Mental Illness Among U.S. Adults (2015). **Authored by**: National Institute of Mental Health. **Located at**: https://www.nimh.nih.gov/health/statistics/prevalence/any-mental-illness-ami-among-us-adults.shtml. **License**: *Public Domain: No Known Copyright*

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# 9.2: Psychological Constructs

## Maslow's Hierarchy of Needs

- Maslow's hierarchy of needs is often portrayed in the shape of a pyramid, with the greatest and most fundamental levels of needs at the bottom, and the need for self-actualization at the top.
- The order of needs as categorized by Maslow are physiological; safety; love and belonging; esteem; and self-actualization.
- Maslow acknowledged that many different levels of motivation are likely to be present in a human all at once. His focus in discussing the hierarchy was to identify the basic types of motivation and the order that they generally progress as lower needs are reasonably well met.




### Physiological Needs

Physiological needs are generally obvious because they are required for survival. If requirements are not met, the body cannot continue to function. Air, water, food, clothing, and shelter are the basic physiological needs.

### Safety Needs

Once physical needs are satisfied, individual safety takes precedence. Safety and Security needs include:

- Personal and family safety
- Financial security
- Health and well-being

### Love/belonging Needs

After physiological and safety needs are fulfilled, the third layer of human needs are interpersonal. This involves feelings of belongingness. Deficiencies in interpersonal needs, due to neglect, shunning, ostracism, etc., can impact an individual's ability to form and maintain emotionally significant relationships in general, such as:

- Friendship
- Intimacy
- Family

Humans need to feel a sense of belonging and acceptance, whether it comes from larger community affiliations or simply a few close friends. Without these connections, many people become susceptible to loneliness, social anxiety, and clinical depression. This need for belonging can sometimes overcome physiological and security needs. For example, an anorexic may ignore the need to eat and the security of health for a feeling of control and belonging.

### Esteem

Esteem represents the normal human desire to be accepted and valued by others. People need to engage themselves to gain recognition and have an activity or activities that give the person a sense of contribution, to feel self-valued, be it in a profession or hobby. Imbalances at this level can result in low self-esteem or an inferiority complex. Many people with low self-esteem will not be able to improve their view of themselves simply by receiving fame, respect, and glory externally, but must first accept themselves internally. Psychological imbalances, such as depression, can prevent one from obtaining self-esteem on both levels.

### Self-actualization

This level of need refers to what a person's full potential is and the realization of that potential. Maslow describes this level as the desire to accomplish everything that one can, to become the most that one can be. Individuals may perceive or focus on this need very specifically. For example, one individual may have the strong desire to become an ideal parent. In another, the desire may be expressed athletically. For others, it may be expressed in paintings, pictures, or inventions. Maslow believed that to acquire this level of need, the person must adequately achieve the previous needs.

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## Freud's Defense Mechanisms

**Defense mechanisms** are psychological mechanisms aimed at reducing anxiety. They were first discussed by Sigmund Freud as part of his psychoanalytic theory and further developed by his daughter, Anna Freud. Often **unconscious**, defense mechanisms are used to protect an individual from psychological pain or anxiety.

While such mechanisms may seem to be helpful in the short term, they can easily become a substitute for addressing the underlying cause and lead to additional problems. The solution, therefore, is to address the underlying causes of the pain these mechanisms are used to alleviate.

Here are a few examples:

| Defense Mechanism | Description | Example |
|---|---|---|
| Repression | Unknowingly placing an unpleasant memory or thought in the unconscious | Not remembering a traumatic event such as being sexually abused as a child |
| Regression | Reverting back to an immature behavior from an earlier stage of development | Throwing temper tantrums as an adult when you don't get your way |
| Displacement | Redirecting feelings or actions from the intended source to a safer, substitute target | Taking your anger towards your boss out on family members by yelling at them in place of your boss |
| Sublimation | Replacing socially unacceptable impulses with socially acceptable behavior | Channeling aggressiveness into playing football |
| Reaction Formation | Overacting in the opposite way to one's true feelings | Being overly protective of an unwanted child |
| Projection | Attributing one's own unacceptable feelings and thoughts to others and not yourself | Accusing your boy/girlfriend of cheating on you because you have thought about cheating on him/her |
| Rationalization | Justifying actions, thoughts, or unwanted outcomes with excuses or faulty logic | Blaming the teaching style of a professor for why you failed an exam |

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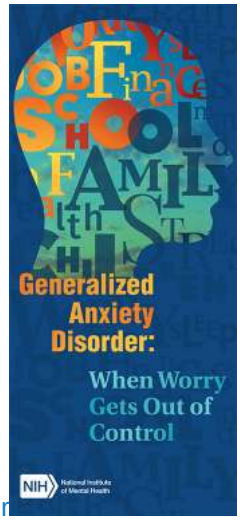
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# 9.3: Anxiety Disorders

Occasional anxiety is a normal part of life. You might feel anxious when faced with a problem at work, before taking a test, or making an important decision. But anxiety disorders involve more than temporary worry or fear. For a person with an anxiety disorder, the anxiety does not go away and can get worse over time. The feelings can interfere with daily activities such as job performance, school work, and relationships. There are several different types of anxiety disorders. Examples include generalized anxiety disorder, panic disorder, and social anxiety disorder.

## Signs and Symptoms




### Generalized Anxiety Disorder

People with generalized anxiety disorder (GAD) display excessive anxiety or worry about everyday problems that lingers for months—even when there is little or no reason to worry about them. People with GAD find it difficult to control their anxiety and stay focused on daily tasks.

Generalized anxiety disorder symptoms include:

- Restlessness or feeling wound-up or on edge
- Being easily fatigued
- Difficulty concentrating or having their minds go blank
- Irritability
- Muscle tension
- Difficulty controlling the worry
- Sleep problems (difficulty falling or staying asleep or restless, unsatisfying sleep)

Excessive worry or anxiety about everyday issues that lasts for **6 months or more** may indicate generalized anxiety disorder.

### Panic Disorder

People with panic disorder have recurrent unexpected panic attacks, which are sudden periods of intense fear that may include palpitations, pounding heart, or accelerated heart rate; sweating; trembling or shaking; sensations of shortness of breath, smothering, or choking; and feeling of impending doom.

Panic disorder symptoms include:

- Sudden and repeated attacks of intense fear
- Feelings of being out of control during a panic attack
- Intense worries about when the next attack will happen
- Fear or avoidance of places where panic attacks have occurred in the past

### Social Anxiety Disorder

People with social anxiety disorder (sometimes called “social phobia”) have a marked fear of social or performance situations in which they expect to feel embarrassed, judged, rejected, or fearful of offending others.

Social anxiety disorder symptoms include:

- Feeling highly anxious about being with other people and having a hard time talking to them
- Feeling very self-conscious in front of other people and worried about feeling humiliated, embarrassed, or rejected, or fearful of offending others
- Being very afraid that other people will judge them
- Worrying for days or weeks before an event where other people will be
- Staying away from places where there are other people
- Having a hard time making friends and keeping friends
- Blushing, sweating, or trembling around other people
- Feeling nauseous or sick to your stomach when other people are around

Evaluation for an anxiety disorder often begins with a visit to a primary care provider. Some physical health conditions, such as an overactive thyroid or low blood sugar, as well as taking certain medications, can imitate or worsen an anxiety disorder. A thorough mental health evaluation is also helpful, because anxiety disorders often co-exist with other related conditions, such as depression or obsessive-compulsive disorder.

## Risk Factors

Researchers are finding that genetic and environmental factors, frequently in interaction with one another, are risk factors for anxiety disorders. Specific factors include:

- Shyness, or behavioral inhibition, in childhood
- Being female
- Having few economic resources
- Being divorced or widowed
- Exposure to stressful life events in childhood and adulthood
- Anxiety disorders in close biological relatives
- Parental history of mental disorders
- Elevated afternoon cortisol levels in the saliva (specifically for social anxiety disorder)

## Treatments and Therapies

Anxiety disorders are generally treated with psychotherapy, medication, or both.

### Psychotherapy

Psychotherapy or “talk therapy” can help people with anxiety disorders. To be effective, psychotherapy must be directed at the person’s specific anxieties and tailored to his or her needs. A typical “side effect” of psychotherapy is temporary discomfort involved with thinking about confronting feared situations.

### Cognitive Behavioral Therapy (CBT)

CBT is a type of psychotherapy that can help people with anxiety disorders. It teaches a person different ways of thinking, behaving, and reacting to anxiety-producing and fearful situations. CBT can also help people learn and practice social skills, which is vital for treating social anxiety disorder.

Two specific stand-alone components of CBT used to treat social anxiety disorder are **cognitive therapy** and **exposure therapy**. Cognitive therapy focuses on identifying, challenging, and then neutralizing unhelpful thoughts underlying anxiety disorders.

Exposure therapy focuses on confronting the fears underlying an anxiety disorder in order to help people engage in activities they have been avoiding. Exposure therapy is used along with relaxation exercises and/or imagery. One study, called a meta-analysis because it pulls together all of the previous studies and calculates the statistical magnitude of the combined effects, found that cognitive therapy was superior to exposure therapy for treating social anxiety disorder.

CBT may be conducted individually or with a group of people who have similar problems. Group therapy is particularly effective for social anxiety disorder. Often “homework” is assigned for participants to complete between sessions.

## Stress-Management Techniques

Stress management techniques and meditation can help people with anxiety disorders calm themselves and may enhance the effects of therapy. While there is evidence that aerobic exercise has a calming effect, the quality of the studies is not strong enough to support its use as treatment. Since caffeine, certain illicit drugs, and even some over-the-counter cold medications can aggravate the symptoms of anxiety disorders, avoiding them should be considered. Check with your physician or pharmacist before taking any additional medications.

The family can be important in the recovery of a person with an anxiety disorder. Ideally, the family should be supportive but not help perpetuate their loved one's symptoms. Talking with a trusted friend or member of the clergy can also provide support, but it is not necessarily a sufficient alternative to care from an expert clinician.

## Medication

Medication does not cure anxiety disorders but often relieves symptoms. Medication can only be prescribed by a medical doctor (such as a psychiatrist or a primary care provider), but a few states allow psychologists to prescribe psychiatric medications.

Medications are sometimes used as the initial treatment of an anxiety disorder, or are used only if there is insufficient response to a course of psychotherapy. In research studies, it is common for patients treated with a combination of psychotherapy and medication to have better outcomes than those treated with only one or the other.

The most common classes of medications used to combat anxiety disorders are antidepressants, anti-anxiety drugs, and beta-blockers (visit Mental Health Medications). Be aware that some medications are effective only if they are taken regularly and that symptoms may recur if the medication is stopped.

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# 9.4: Depression

Depression (**major depressive disorder** or clinical depression) is a common but serious mood disorder. It causes severe symptoms that affect how you feel, think, and handle daily activities, such as sleeping, eating, or working. To be diagnosed with depression, the **symptoms must be present for at least two weeks**. Some forms of depression are slightly different, or they may develop under unique circumstances, such as:

- **Persistent depressive disorder** (also called dysthymia) is a depressed mood that **lasts for at least two years.** A person diagnosed with persistent depressive disorder may have episodes of major depression along with periods of less severe symptoms, but symptoms must last for two years to be considered persistent depressive disorder.
- **Perinatal depression** is much more serious than the "baby blues" (relatively mild depressive and anxiety symptoms that typically clear within two weeks after delivery) that many women experience after giving birth. Women with perinatal depression experience full-blown major depression during pregnancy or after delivery (postpartum depression). The feelings of extreme sadness, anxiety, and exhaustion that accompany perinatal depression may make it difficult for these new mothers to complete daily care activities for themselves and/or for their babies.
- **Psychotic depression** occurs when a person has severe depression plus some form of psychosis, such as having disturbing false fixed beliefs (delusions) or hearing or seeing upsetting things that others cannot hear or see (hallucinations). The psychotic symptoms typically have a depressive "theme," such as delusions of guilt, poverty, or illness.
- **Seasonal affective disorder** is characterized by the onset of depression during the winter months, when there is less natural sunlight. This depression generally lifts during spring and summer. Winter depression, typically accompanied by social withdrawal, increased sleep, and weight gain, predictably returns every year in seasonal affective disorder.
- **Bipolar disorder** is different from depression, but it is included in this list is because someone with bipolar disorder experiences episodes of extremely low moods that meet the criteria for major depression (called "bipolar depression"). But a person with bipolar disorder also experiences extreme high – euphoric or irritable – moods called "mania" or a less severe form called "hypomania."

## Signs and Symptoms

If you have been experiencing some of the following signs and symptoms most of the day, nearly every day, for at least two weeks, you may be suffering from depression:

- Persistent sad, anxious, or "empty" mood
- Feelings of hopelessness, or pessimism
- Irritability
- Feelings of guilt, worthlessness, or helplessness
- Loss of interest or pleasure in hobbies and activities
- Decreased energy or fatigue
- Moving or talking more slowly
- Feeling restless or having trouble sitting still
- Difficulty concentrating, remembering, or making decisions
- Difficulty sleeping, early-morning awakening, or oversleeping
- Appetite and/or weight changes
- Thoughts of death or suicide, or suicide attempts
- Aches or pains, headaches, cramps, or digestive problems without a clear physical cause and/or that do not ease even with treatment

Not everyone who is depressed experiences every symptom. Some people experience only a few symptoms while others may experience many. Several persistent symptoms in addition to low mood are required for a diagnosis of major depression, but people with only a few – but distressing – symptoms may benefit from treatment of their "subsyndromal" depression. The severity and frequency of symptoms and how long they last will vary depending on the individual and his or her particular illness. Symptoms may also vary depending on the stage of the illness.

## Risk Factors

Depression is one of the most common mental disorders in the U.S. Current research suggests that depression is caused by a combination of genetic, biological, environmental, and psychological factors.

Depression can happen at any age, but often begins in adulthood. Depression is now recognized as occurring in children and adolescents, although it sometimes presents with more prominent irritability than low mood. Many chronic mood and anxiety disorders in adults begin as high levels of anxiety in children.

Depression, especially in midlife or older adults, can co-occur with other serious medical illnesses, such as diabetes, cancer, heart disease, and Parkinson's disease. These conditions are often worse when depression is present. Sometimes medications taken for these physical illnesses may cause side effects that contribute to depression. A doctor experienced in treating these complicated illnesses can help work out the best treatment strategy.

Risk factors include:

- Personal or family history of depression
- Major life changes, trauma, or stress
- Certain physical illnesses and medications

## Treatment and Therapies

Depression, even the most severe cases, can be treated. The earlier that treatment can begin, the more effective it is. Depression is usually treated with medications, psychotherapy, or a combination of the two. If these treatments do not reduce symptoms, electroconvulsive therapy (ECT) and other brain stimulation therapies may be options to explore.

**Quick Tip:** No two people are affected the same way by depression and there is no "one-size-fits-all" for treatment. It may take some trial and error to find the treatment that works best for you.

**Please Note:** In some cases, children, teenagers, and young adults under 25 may experience an increase in suicidal thoughts or behavior when taking antidepressants, especially in the first few weeks after starting or when the dose is changed. This warning (referred to as a **Black Box warning**) from the U.S. Food and Drug Administration (FDA) also says that patients of all ages taking antidepressants should be watched closely, especially during the first few weeks of treatment.

### Beyond Treatment: Things You Can Do

Here are other tips that may help you or a loved one during treatment for depression:

- Try to be active and exercise.
- Set realistic goals for yourself.
- Try to spend time with other people and confide in a trusted friend or relative.
- Try not to isolate yourself, and let others help you.
- Expect your mood to improve gradually, not immediately.
- Postpone important decisions, such as getting married or divorced, or changing jobs until you feel better. Discuss decisions with others who know you well and have a more objective view of your situation.
- Continue to educate yourself about depression.

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# 9.5: Suicide Prevention

## If You Know Someone in Crisis

Call the toll-free National Suicide Prevention Lifeline at **1-800-273-TALK (8255),** 24 hours a day, 7 days a week. The service is available to everyone. The deaf and hard of hearing can contact the Lifeline via TTY at 1-800-799-4889. All calls are confidential.






## Introduction

Suicide is a major public health concern. Over 40,000 people die by suicide each year in the United States. Suicide is complicated and tragic but it is often preventable. Knowing the warning signs for suicide and how to get help can help save lives.

## Signs and Symptoms

The behaviors listed below may be signs that someone is thinking about suicide:

- Talking about wanting to die or wanting to kill themselves
- Talking about feeling empty, hopeless, or having no reason to live
- Making a plan or looking for a way to kill themselves, such as searching online, stockpiling pills, or buying a gun
- Talking about great guilt or shame
- Talking about feeling trapped or feeling that there are no solutions
- Feeling unbearable pain (emotional pain or physical pain)
- Talking about being a burden to others
- Using alcohol or drugs more often
- Acting anxious or agitated
- Withdrawing from family and friends
- Changing eating and/or sleeping habits
- Showing rage or talking about seeking revenge
- Taking great risks that could lead to death, such as driving extremely fast
- Talking or thinking about death often
- Displaying extreme mood swings, suddenly changing from very sad to very calm or happy
- Giving away important possessions
- Saying goodbye to friends and family
- Putting affairs in order, making a will

## Risk Factors

Suicide does not discriminate. People of all genders, ages, and ethnicities can be at risk. Suicidal behavior is complex and there is no single cause. In fact, many different factors contribute to someone making a suicide attempt. But people most at risk tend to share certain characteristics. The main risk factors for suicide are:

- Depression, other mental disorders, or substance abuse disorder
- Certain medical conditions
- Chronic pain
- A prior suicide attempt
- Family history of a mental disorder or substance abuse
- Family history of suicide
- Family violence, including physical or sexual abuse
- Having guns or other firearms in the home
- Having recently been released from prison or jail
- Being exposed to others' suicidal behavior, such as that of family members, peers, or celebrities

Many people have some of these risk factors but do not attempt suicide. It is important to note that suicide is not a normal response to stress. **Suicidal thoughts or actions are a sign of extreme distress, not a harmless bid for attention, and should not be ignored.**

### Do gender and age affect suicide risk?

Men are more likely to die by suicide than women, but women are more likely to *attempt* suicide. Men are more likely to use deadlier methods, such as firearms or suffocation. Women are more likely than men to attempt suicide by poisoning. The most recent figures released by the CDC show that the highest rate of suicide deaths among women is found between ages 45 and 64, while the highest rate for men occurs at ages 75+. Children and young adults also are at risk for suicide. Suicide is the second leading cause of death for young people ages 15 to 34.

### What about different racial/ethnic groups?

The CDC reports that among racial and ethnic groups, American Indians and Alaska Natives tend to have the highest rate of suicides, followed by non-Hispanic Whites. African Americans tend to have the lowest suicide rate, while Hispanics tend to have the second lowest rate.

## 5 Action Steps for Helping Someone in Emotional Pain

1. **Ask:** "Are you thinking about killing yourself?" It's not an easy question but studies show that asking at-risk individuals if they are suicidal does not increase suicides or suicidal thoughts.
2. **Keep them safe:** Reducing a suicidal person's access to highly lethal items or places is an important part of suicide prevention. While this is not always easy, asking if the at-risk person has a plan and removing or disabling the lethal means can make a difference.
3. **Be there:** Listen carefully and learn what the individual is thinking and feeling. Findings suggest acknowledging and talking about suicide may in fact reduce rather than increase suicidal thoughts.
4. **Help them connect:** Save the National Suicide Prevention Lifeline's number in your phone so it's there when you need it: 1-800-8255 (TALK). You can also help make a connection with a trusted individual like a family member, friend, spiritual advisor, or mental health professional.
5. **Stay Connected:** Staying in touch after a crisis or after being discharged from care can make a difference. Studies have shown the number of suicide deaths goes down when someone follows up with the at-risk person.

## Treatments and Therapies

Research has shown that there are multiple risk factors for suicide and that these factors may vary with age, gender, physical and mental well-being, and with individual experiences. Treatments and therapies for people with suicidal thoughts or actions will vary as well. NIMH has focused research on strategies that have worked well for mental health conditions related to suicide such as depression and anxiety.

### Psychotherapies

Multiple types of psychosocial interventions have been found to be beneficial for individuals who have attempted suicide. These types of interventions may prevent someone from making another attempt. Psychotherapy, or "talk therapy," is one type of psychosocial intervention and can effectively reduce suicide risk.

One type of psychotherapy is called cognitive behavioral therapy (CBT). CBT can help people learn new ways of dealing with stressful experiences through training. CBT helps individuals recognize their own thought patterns and consider alternative actions when thoughts of suicide arise.

Another type of psychotherapy, called dialectical behavior therapy (DBT), has been shown to reduce the rate of suicide among people with borderline personality disorder, a serious mental illness characterized by unstable moods, relationships, self-image, and behavior. A therapist trained in DBT helps a person recognize when his or her feelings or actions are disruptive or unhealthy, and teaches the skills needed to deal better with upsetting situations.

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# 9.6: Eating Disorders

## What are eating disorders?




The eating disorders anorexia nervosa, bulimia nervosa, and binge-eating disorder, and their variants, all feature serious disturbances in eating behavior and weight regulation. They are associated with a wide range of adverse psychological, physical, and social consequences. A person with an eating disorder may start out just eating smaller or larger amounts of food, but at some point, their urge to eat less or more spirals out of control. Severe distress or concern about body weight or shape, or extreme efforts to manage weight or food intake, also may characterize an eating disorder.

Eating disorders are real, treatable medical illnesses. They frequently coexist with other illnesses such as depression, substance abuse, or anxiety disorders. Other symptoms can become life-threatening if a person does not receive treatment, which is reflected by anorexia being associated with the highest mortality rate of any psychiatric disorder.

Eating disorders affect both genders, although rates among women and girls are 2½ times greater than among men and boys. Eating disorders frequently appear during the teen years or young adulthood but also may develop during childhood or later in life.

## What are the different types of eating disorders?

### *Anorexia nervosa*

Many people with anorexia nervosa see themselves as overweight, even when they are clearly underweight. Eating, food, and weight control become obsessions. People with anorexia nervosa typically weigh themselves repeatedly, portion food carefully, and eat very small quantities of only certain foods. Some people with anorexia nervosa also may engage in binge eating followed by extreme dieting, excessive exercise, self-induced vomiting, or misuse of laxatives, diuretics, or enemas.

Symptoms of anorexia nervosa include:

- Extremely low body weight
- Severe food restriction
- Relentless pursuit of thinness and unwillingness to maintain a normal or healthy weight
- Intense fear of gaining weight
- Distorted body image and self-esteem that is heavily influenced by perceptions of body weight and shape, or a denial of the seriousness of low body weight
- Lack of menstruation among girls and women.

Some who have anorexia nervosa recover with treatment after only one episode. Others get well but have relapses. Still others have a more chronic, or long-lasting, form of anorexia nervosa, in which their health declines as they battle the illness.

Other symptoms and medical complications may develop over time, including:

- Thinning of the bones (osteopenia or osteoporosis)
- Brittle hair and nails
- Dry and yellowish skin
- Growth of fine hair all over the body (lanugo)
- Mild anemia, muscle wasting, and weakness
- Severe constipation
- Low blood pressure, or slowed breathing and pulse
- Damage to the structure and function of the heart
- Brain damage
- Multi-organ failure
- Drop in internal body temperature, causing a person to feel cold all the time
- Lethargy, sluggishness, or feeling tired all the time
- Infertility.

### *Bulimia nervosa*

People with bulimia nervosa have recurrent and frequent episodes of eating unusually large amounts of food and feel a lack of control over these episodes. This binge eating is followed by behavior that compensates for the overeating such as forced vomiting,

excessive use of laxatives or diuretics, fasting, excessive exercise, or a combination of these behaviors.

Unlike anorexia nervosa, people with bulimia nervosa usually maintain what is considered a healthy or normal weight, while some are slightly overweight. But like people with anorexia nervosa, they often fear gaining weight, want desperately to lose weight, and are intensely unhappy with their body size and shape. Usually, bulimic behavior is done secretly because it is often accompanied by feelings of disgust or shame. The binge eating and purging cycle can happen anywhere from several times a week to many times a day.

Other symptoms include:

- Chronically inflamed and sore throat
- Swollen salivary glands in the neck and jaw area
- Worn tooth enamel, and increasingly sensitive and decaying teeth as a result of exposure to stomach acid
- Acid reflux disorder and other gastrointestinal problems
- Intestinal distress and irritation from laxative abuse
- Severe dehydration from purging of fluids
- Electrolyte imbalance—too low or too high levels of sodium, calcium, potassium, and other minerals that can lead to a heart attack or stroke.

### *Binge-eating disorder*

People with binge-eating disorder lose control over their eating. Unlike bulimia nervosa, periods of binge eating are not followed by compensatory behaviors like purging, excessive exercise, or fasting. As a result, people with binge-eating disorder often are overweight or obese. People with binge-eating disorder who are obese are at higher risk for developing cardiovascular disease and high blood pressure. They also experience guilt, shame, and distress about their binge eating, which can lead to more binge eating.

## How are eating disorders treated?

Typical treatment goals include restoring adequate nutrition, bringing weight to a healthy level, reducing excessive exercise, and stopping binging and purging behaviors. Specific forms of psychotherapy, or talk therapy—including a family-based therapy called the Maudsley approach and cognitive behavioral approaches—have been shown to be useful for treating specific eating disorders. Evidence also suggests that antidepressant medications approved by the U.S. Food and Drug Administration may help for bulimia nervosa and also may be effective for treating co-occurring anxiety or depression for other eating disorders.

Treatment plans often are tailored to individual needs and may include one or more of the following:

- Individual, group, or family psychotherapy
- Medical care and monitoring
- Nutritional counseling
- Medications (for example, antidepressants).

Some patients also may need to be hospitalized to treat problems caused by malnutrition or to ensure they eat enough if they are very underweight. Complete recovery is possible.

## For information about additional mental health topics, go to the National Institute of Mental Health.

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# CHAPTER OVERVIEW

## 10: Module 5B- Violence and Injury


10.1: Factors That Influence Violence
10.2: Intimate Partner Violence
10.3: Risk Factors for Intimate Partner Violence
10.4: Protecting Yourself from Relationship Violence
10.5: Unintentional Injuries


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# 10.1: Factors That Influence Violence

## The Social-Ecological Model: A Framework for Prevention




The ultimate goal is to stop violence before it begins. Prevention requires understanding the factors that influence violence. CDC uses a four-level social-ecological model to better understand violence and the effect of potential prevention strategies. This model considers the complex interplay between individual, relationship, community, and societal factors. It allows us to understand the range of factors that put people at risk for violence or protect them from experiencing or perpetrating violence. The overlapping rings in the model illustrate how factors at one level influence factors at another level.

Besides helping to clarifying these factors, the model also suggests that in order to prevent violence, it is necessary to act across multiple levels of the model at the same time. This approach is more likely to sustain prevention efforts over time than any single intervention.

### Individual

The first level identifies biological and personal history factors that increase the likelihood of becoming a victim or perpetrator of violence. Some of these factors are age, education, income, substance use, or history of abuse. Prevention strategies at this level are often designed to promote attitudes, beliefs, and behaviors that ultimately prevent violence. Specific approaches may include education and life skills training.

### Relationship

The second level examines close relationships that may increase the risk of experiencing violence as a victim or perpetrator. A person's closest social circle-peers, partners and family members-influences their behavior and contributes to their range of experience. Prevention strategies at this level may include parenting or family-focused prevention programs, and mentoring and peer programs designed to reduce conflict, foster problem solving skills, and promote healthy relationships.

### Community

The third level explores the settings, such as schools, workplaces, and neighborhoods, in which social relationships occur and seeks to identify the characteristics of these settings that are associated with becoming victims or perpetrators of violence. Prevention strategies at this level are typically designed to impact the social and physical environment – for example, by reducing social isolation, improving economic and housing opportunities in neighborhoods, as well as the climate, processes, and policies within school and workplace settings.

### Societal

The fourth level looks at the broad societal factors that help create a climate in which violence is encouraged or inhibited. These factors include social and cultural norms that support violence as an acceptable way to resolve conflicts. Other large societal factors include the health, economic, educational and social policies that help to maintain economic or social inequalities between groups in society.




## What are Social Norms?

Social norms refer to values, beliefs, attitudes, and/or behaviors shared by a group of people. They are often based on what people believe to be normal, typical, or appropriate. Social norms can function as unspoken rules or guidelines for how people behave, and for how people are expected to behave. People generally follow social norms because they want to fit in with the people around them.

Social norms can result in positive or negative outcomes. Sometimes social norms help people behave in ways that keep themselves – and others – safe and healthy.

Other times, social norms can have the opposite effect, and can lead people to behave in harmful ways.

### Social Norms and Violence

Social norms can affect nearly any aspect of our lives. They contribute to our clothing choices, how we speak, our music preferences, and our beliefs about certain social issues. They can also affect our attitudes, beliefs, and behaviors related to violence.

The way we react to violence may be based on what we see other people do, or how we think other people would act. In other words, our reactions are based on what we believe is normal or appropriate.

### Misperceptions

People often misperceive (or misunderstand) social norms and overestimate the number of people who behave in unhealthy ways or who accept unhealthy behavior. Researchers have studied college students' misperceptions of social norms related to alcohol use. They've found that most college students do not enjoy heavy drinking. However, they tend to think that heavy drinking is the norm among their peers and overdrink to fit in.

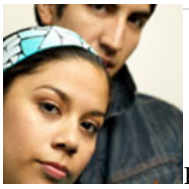
Misperceptions can be harmful when a person alters their own beliefs and behaviors based on a false assumption about other people's beliefs and behaviors.

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# 10.2: Intimate Partner Violence



Intimate partner violence (IPV) is a serious, preventable public health problem that affects millions of Americans. The term “intimate partner violence” describes physical, sexual, or psychological harm by a current or former partner or spouse. This type of violence can occur among heterosexual or same-sex couples and does not require sexual intimacy.
The goal is to stop IPV before it begins. There is a lot to learn about how to prevent IPV. We do know that strategies that promote healthy behaviors in relationships are important. Programs that teach young people skills for dating can prevent violence. These programs can stop violence in dating relationships before it occurs.IPV can vary in frequency and severity. It occurs on a continuum, ranging from one episode that might or might not have lasting impact to chronic and severe episodes over a period of years. There are four main types of IPV:

- **Physical violence** is the intentional use of physical force with the potential for causing death, disability, injury, or harm. Physical violence includes, but is not limited to, scratching; pushing; shoving; throwing; grabbing; biting; choking; shaking; aggressive hair pulling; slapping; punching; hitting; burning; use of a weapon; and use of restraints or one’s body, size, or strength against another person. Physical violence also includes coercing other people to commit any of the above acts.
- **Sexual violence** is divided into five categories. Any of these acts constitute sexual violence, whether attempted or completed. Additionally all of these acts occur without the victim’s freely given consent, including cases in which the victim is unable to consent due to being too intoxicated (e.g., incapacitation, lack of consciousness, or lack of awareness) through their voluntary or involuntary use of alcohol or drugs.
    - **Rape or penetration of victim –** This includes completed or attempted, forced or alcohol/drug-facilitated unwanted vaginal, oral, or anal insertion. Forced penetration occurs through the perpetrator’s use of physical force against the victim or threats to physically harm the victim.
    - **Victim was made to penetrate someone else –** This includes completed or attempted, forced or alcohol/drug-facilitated incidents when the victim was made to sexually penetrate a perpetrator or someone else without the victim’s consent.
    - **Non-physically pressured unwanted penetration –** This includes incidents in which the victim was pressured verbally or through intimidation or misuse of authority to consent or acquiesce to being penetrated.
    - **Unwanted sexual contact –** This includes intentional touching of the victim or making the victim touch the perpetrator, either directly or through the clothing, on the genitalia, anus, groin, breast, inner thigh, or buttocks without the victim’s consent
    - **Non-contact unwanted sexual experiences –** This includes unwanted sexual events that are not of a physical nature that occur without the victim’s consent. Examples include unwanted exposure to sexual situations (e.g., pornography); verbal or behavioral sexual harassment; threats of sexual violence to accomplish some other end; and /or unwanted filming, taking or disseminating photographs of a sexual nature of another person.
- **Stalking** is a pattern of repeated, unwanted, attention and contact that causes fear or concern for one’s own safety or the safety of someone else (e.g., family member or friend). Some examples include repeated, unwanted phone calls, emails, or texts; leaving cards, letters, flowers, or other items when the victim does not want them; watching or following from a distance; spying; approaching or showing up in places when the victim does not want to see them; sneaking into the victim’s home or car; damaging the victim’s personal property; harming or threatening the victim’s pet; and making threats to physically harm the victim.
- **Psychological Aggression** is the use of verbal and non-verbal communication with the intent to harm another person mentally or emotionally, and/or to exert control over another person. Psychological aggression can include expressive aggression (e.g., name-calling, humiliating); coercive control (e.g., limiting access to transportation, money, friends, and family; excessive monitoring of whereabouts); threats of physical or sexual violence; control of reproductive or sexual health (e.g., refusal to use birth control; coerced pregnancy termination); exploitation of victim’s vulnerability (e.g., immigration status, disability); exploitation of perpetrator’s vulnerability; and presenting false information to the victim with the intent of making them doubt their own memory or perception (e.g., mind games).

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# 10.3: Risk Factors for Intimate Partner Violence

Persons with certain risk factors are more likely to become perpetrators or victims of intimate partner violence (IPV). Those risk factors contribute to IPV but might not be direct causes. Not everyone who is identified as “at risk” becomes involved in violence.

A combination of individual, relational, community, and societal factors contribute to the risk of becoming an IPV perpetrator or victim. Understanding these multilevel factors can help identify various opportunities for prevention.

## Risk Factors for Intimate Partner Violence

### Individual Risk Factors

- Low self-esteem
- Low income
- Low academic achievement
- Young age
- Aggressive or delinquent behavior as a youth
- Heavy alcohol and drug use
- Depression
- Anger and hostility
- Antisocial personality traits
- Borderline personality traits
- Prior history of being physically abusive
- Having few friends and being isolated from other people
- Unemployment
- Emotional dependence and insecurity
- Belief in strict gender roles (e.g., male dominance and aggression in relationships)
- Desire for power and control in relationships
- Perpetrating psychological aggression
- Seeing or being a victim of physical or psychological abuse (consistently one of the strongest predictors of perpetration)
- History of experiencing poor parenting as a child
- History of experiencing physical discipline as a child

### Relationship Factors

- Marital conflict-fights, tension, and other struggles
- Marital instability-divorces or separations
- Dominance and control of the relationship by one partner over the other
- Economic stress
- Unhealthy family relationships and interactions

### Community Factors

- Poverty and associated factors (e.g., overcrowding)
- Low social capital-lack of institutions, relationships, and norms that shape a community’s social interactions
- Weak community sanctions against IPV (e.g., unwillingness of neighbors to intervene in situations where they witness violence)

### Societal Factors

- Traditional gender norms (e.g., women should stay at home, not enter workforce, and be submissive; men support the family and make the decisions)

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# 10.4: Protecting Yourself from Relationship Violence

It can be hard to know if your relationship is headed down the wrong path. While it's not always possible to prevent relationship violence, there are steps you can take to protect yourself.

If you think your partner might be controlling or abusive, it's important to:

- Trust your feelings. If something doesn't seem right, take it seriously.
- Learn the warning signs of someone who might become controlling or violent.
- Get help. Talk to experts in relationship violence.

If your partner is controlling or abusive, it's better to get help now than to wait. Controlling or violent relationships usually get worse over time.

Remember: if your partner hurts you, it's not your fault.

## What is relationship violence?

Relationship violence is when one person in a relationship is abusive or controlling toward the other person – especially when they disagree about something.

Relationship violence is sometimes called dating violence, **domestic violence**, or **intimate partner violence**. In some relationships, both partners act in abusive or controlling ways.

When many people think about relationship violence, they think about physical violence, like hitting or pushing. But people can also use other methods, like threats or insults, to control their partners.

Relationship violence can include:

- Physical violence, like pushing, hitting, or throwing things
- Sexual violence, like forcing or trying to force someone to do something sexual
- Threats of physical or sexual violence, which may include threatening to hurt another person or a pet
- Emotional abuse, like embarrassing a partner or keeping that person away from family and friends

If you feel controlled by or afraid of your partner – even if you haven't been hurt physically – trust yourself. There are people who can help you figure out what to do next.

## How do I know if my relationship might become violent?

Relationship violence can start slowly and be hard to recognize at first. For example, when people first start dating, it's common to want to spend a lot of time together. But spending less time with other people can also be a sign that your partner is trying to control your time.

Try asking yourself these questions:

- Does my partner respect me?
- Does my partner blame me for everything that goes wrong?
- Does my partner make most of the decisions in our relationship?
- Am I ever afraid to tell my partner something?
- Do I ever feel forced to do things that I don't want to do?
- Have I ever done anything sexual with my partner when I didn't want to?
- Does my partner promise to change and then keep doing the same things?

Get more information about the signs of abusive relationships.

## What if I'm not sure if my relationship is violent?

It's okay if you aren't sure – you can still get help. Domestic violence agencies have counselors who are experts at helping people with questions about their relationships. You don't even have to give your name.

If you have questions about your relationship, call the National Domestic Violence Hotline at 1-800-799-SAFE (1-800-799-7233) or chat online with a trained advocate.

If you are in danger right now, call 911.

## Take Action!

If you think your partner is controlling or abusive, take steps to protect yourself.

### Trust your instincts.

You are the expert on your life and relationships. If you think your relationship is unhealthy or you are worried about your safety, trust your gut.

### Plan for your safety.

If you are in a relationship with someone who is violent or might become violent, make a plan to keep yourself safe. This is important whether you are planning to leave your partner or not.

### Start with a phone call.

If you need help or have questions about your relationship, call the National Domestic Violence Hotline at 1-800-799-SAFE (1-800-799-7233). You'll be able to find a domestic violence agency near you or talk to a counselor over the phone. **If you are in danger right now, call 911.**

### What kind of help can I get?

Domestic violence agencies provide:

- Emotional support
- Safety planning
- A safe place to stay in an emergency
- Legal help
- Help with housing

### What about cost?

Domestic violence agencies offer free services, like hotlines, counseling, and help finding resources such as housing or lawyers.

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# 10.5: Unintentional Injuries

## Distracted Driving

Each day in the United States, over 8 people are killed and 1,161 injured in crashes that are reported to 

involve a distracted driver.

Distracted driving is driving while doing another activity that takes your attention away from driving. Distracted driving can increase the chance of a motor vehicle crash.

### What are the types of distraction?

There are three main types of distraction:

- Visual: taking your eyes off the road;
- Manual: taking your hands off the wheel; and
- Cognitive: taking your mind off of driving.

### Distracted driving activities

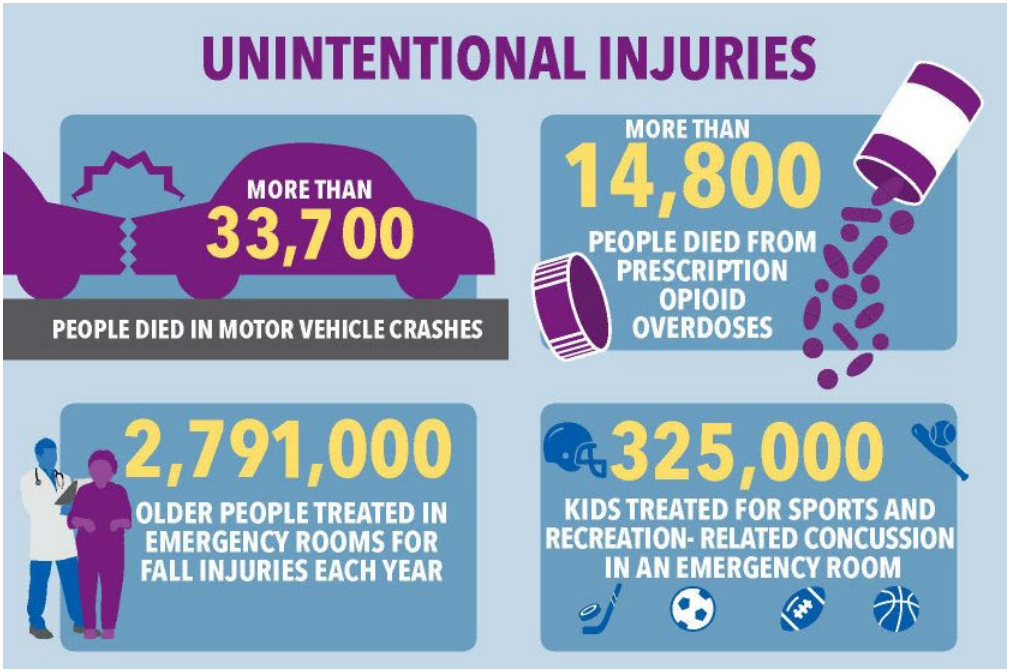
Distracted driving activities include things like using a cell phone, texting, applying makeup, and eating. Using in-vehicle technologies (such as navigation systems) can also be sources of distraction. While any of these distractions can endanger the driver and others, texting while driving is especially dangerous because it combines all three types of distraction.

### Young adult and teen drivers

- Drivers under the age of 20 have the highest proportion of distraction-related fatal crashes.
- The national The Youth Risk Behavior Surveillance System (YRBSS) monitors health-risk behaviors among high school students, including sending texts while driving.
  - In 2013, more than two out of five students who drove in the past 30 days sent a text or email while driving.
  - Those who text while driving are nearly twice as likely to ride with a driver who has been drinking.
  - Students who frequently text while driving are more likely to ride with a drinking driver or drink and drive than students who text while driving less frequently.

### What is being done?

- Many states are enacting laws—such as banning texting while driving, or using graduated driver licensing systems for teen drivers—to help raise awareness about the dangers of distracted driving and to keep it from occurring. However, the effectiveness of cell phone and texting laws on decreasing distracted driving-related crashes requires further study. The Insurance Institute for Highway Safety keeps track of such laws.




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# CHAPTER OVERVIEW

## 11: Module 6A- Physical Activity


11.1: Physical Activity Guidelines for Adults
11.2: Target Heart Rate Zone
11.3: Health Related Components of Physical Fitness
11.4: Health Benefits of Physical Activity
11.5: Developing a Personal Exercise Program


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# 11.1: Physical Activity Guidelines for Adults

Adults who are physically active are healthier and less likely to develop many chronic diseases than adults who are inactive. They also have better fitness, including a healthier body size and composition. These benefits are gained by men and women and people of all races and ethnicities who have been studied.

Adults gain most of these health benefits when they do the equivalent of at least 150 minutes of moderate intensity aerobic physical activity (2 hours and 30 minutes) each week. Adults gain additional and more extensive health and fitness benefits with even more physical activity. Muscle-strengthening activities also provide health benefits and are an important part of an adult's overall physical activity plan.

## Key Recommendations:

**Avoid Inactivity**
All adults should avoid inactivity. Some physical activity is better than none, and adults who participate in any amount of physical activity gain some health benefits.

**Do Aerobic Activity**
For substantial health benefits, adults should do at least one of the following:

- 150 minutes (2 hours and 30 minutes) each week of moderate-intensity aerobic physical activity (such as brisk walking or tennis)
- 75 minutes (1 hour and 15 minutes) each week of vigorous-intensity aerobic physical activity (such as jogging or swimming laps)
- An equivalent combination of moderate- and vigorous-intensity aerobic physical activity

Aerobic activity should be performed in episodes of at least 10 minutes, and preferably, it should be spread throughout the week.

For additional and more extensive health benefits, adults should increase their aerobic physical activity to one of the following:

- Increase moderate-intensity aerobic physical activity to 300 minutes (5 hours) each week
- Increase vigorous-intensity aerobic physical activity for 150 minutes (2 hours and 30 minutes) each week
- An equivalent combination of moderate- and vigorous-intensity activity

Additional health benefits are gained by engaging in physical activity beyond this amount.

**Strengthen Muscles**
Do muscle-strengthening activities (such as lifting weights or using resistance bands) that are moderate or high intensity and involve all major muscle groups on 2 or more days a week.

### Examples of Different Aerobic Physical Activities and Intensities

| Moderate Intensity |
| --- |
| • Walking briskly (3 miles per hour or faster, but not race-walking)<br>• Water aerobics<br>• Bicycling slower than 10 miles per hour<br>• Tennis (doubles)<br>• Ballroom dancing<br>• General gardening |

| Vigorous Intensity |
| --- |
| |

- Racewalking, jogging, or running
- Swimming laps
- Tennis (singles)
- Aerobic dancing
- Bicycling 10 miles per hour or faster
- Jumping rope
- Heavy gardening (continuous digging or hoeing, with heart rate increases)
- Hiking uphill or with a heavy backpack

### Muscle-Strengthening Activity

Muscle-strengthening activities provide additional benefits not found with aerobic activity. The benefits of muscle-strengthening activity include increased bone strength and muscular fitness. Muscle-strengthening activities can also help maintain muscle mass during a program of weight loss.

Muscle-strengthening activities make muscles do more work than they are accustomed to doing. That is, they overload the muscles. Resistance training, including weight training, is a familiar example of muscle-strengthening activity. Other examples include working with resistance bands, doing calisthenics that use body weight for resistance (such as push-ups, pull-ups, and sit-ups), carrying heavy loads, and heavy gardening (such as digging or hoeing).

Muscle-strengthening activities count if they involve a moderate to high level of intensity or effort and work the major muscle groups of the body: the legs, hips, back, chest, abdomen, shoulders, and arms. Muscle strengthening activities for all the major muscle groups should be done at least 2 days a week.

No specific amount of time is recommended for muscle strengthening, but muscle-strengthening exercises should be performed to the point at which it would be difficult to do another repetition without help. When resistance training is used to enhance muscle strength, one set of 8 to 12 repetitions of each exercise is effective, although two or three sets may be more effective. Development of muscle strength and endurance is progressive over time. Increases in the amount of weight or the days a week of exercising will result in stronger muscles.

Click here to view a summary

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To review the key recommendations, as well as learn more about “what counts” as moderate or vigorous intensity aerobic activity, watch the videos below:

https://youtu.be/lEutFrar1dI
https://youtu.be/GEvJlmpZCoM

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- Videos - Physical Activity Guidelines. **Authored by**: CDC. **Located at**: https://youtu.be/GEvJlmpZCoM. **License**: *Public Domain: No Known Copyright*

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# 11.2: Target Heart Rate Zone

**Target Heart Rate and Estimated Maximum Heart Rate**

One way of monitoring physical activity intensity is to determine whether a person's pulse or heart rate is within the target zone **during physical activity**.

**For moderate-intensity physical activity**, a person's target heart rate should be 50 to 70% of his or her maximum heart rate. This maximum rate is based on the person's age. An estimate of a person's maximum age-related heart rate can be obtained by subtracting the person's age from 220. For example, for a 50-year-old person, the estimated maximum age-related heart rate would be calculated as 220 – 50 years = 170 **beats per minute (bpm)**. The 50% and 70% levels would be:

- 50% level: 170 x 0.50 = 85 bpm, and
- 70% level: 170 x 0.70 = 119 bpm

Thus, moderate-intensity physical activity for a 50-year-old person will require that the heart rate remains between 85 and 119 bpm during physical activity.

**For vigorous-intensity physical activity**, a person's target heart rate should be 70 to 85% of his or her maximum heart rate. To calculate this range, follow the same formula as used above, except change "50 and 70%" to "70 and 85%". For example, for a 35-year-old person, the estimated maximum age-related heart rate would be calculated as 220 – 35 years = 185 beats per minute (bpm). The 70% and 85% levels would be:

- 70% level: 185 x 0.70 = 130 bpm, and
- 85% level: 185 x 0.85 = 157 bpm

Thus, vigorous-intensity physical activity for a 35-year-old person will require that the heart rate remains between 130 and 157 bpm during physical activity.

## Taking Your Heart Rate



Generally, to determine whether you are exercising within the heart rate target zone, you must stop exercising briefly to take your pulse. You can take the pulse at the neck, the wrist, or the chest. We recommend the wrist. You can feel the radial pulse on the artery of the wrist in line with the thumb. Place the tips of the index and middle fingers over the artery and press lightly. Do not use the thumb. Take a full 60-second count of the heartbeats, or take for 30 seconds and multiply by 2. Start the count on a beat, which is counted as "zero." If this number falls between 85 and 119 bpm in the case of the 50-year-old person, he or she is active within the target range for moderate-intensity activity.

When starting an exercise program, calculating a target heart rate zone can be very beneficial to ensure that you are exercising safely and effectively. Heart rates are referred to as "beats per minute" or *bpm*.

**220 – Age = Maximum Heart Rate**

Finding Your Target Heart Rate Zone:

| Age | Target Heart Rate Zone: 50-85% | Maximum Heart Rate: 100% |
|---|---|---|
| 20 | 100-170 beats per min. | 200 beats per min. |
| 25 | 98-166 beats per min. | 195 beats per min. |
| 30 | 95-162 beats per min. | 190 beats per min. |
| 35 | 93-157 beats per min. | 185 beats per min. |
| 40 | 90-153 beats per min. | 180 beats per min. |
| 45 | 88-149 beats per min. | 175 beats per min. |
| 50 | 85-145 beats per min. | 170 beats per min. |
| 55 | 83-140 beats per min. | 165 beats per min. |
| 60 | 80-136 beats per min. | 160 beats per min. |

| | | |
|---|---|---|
| 65 | 78-132 beats per min. | 155 beats per min. |
| 70 | 75-128 beats per min. | 150 beats per min. |

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# 11.3: Health Related Components of Physical Fitness

## Examining the Relationship Between Physical Activity and Health

In many studies covering a wide range of issues, researchers have focused on **exercise**, as well as on the more broadly defined concept of physical activity. Exercise is a form of physical activity that is planned, structured, repetitive, and performed with the goal of improving health or fitness. So, although all exercise is physical activity, not all physical activity is exercise.

Studies have examined the role of physical activity in many groups—men and women, children, teens, adults, older adults, people with disabilities, and women during pregnancy and the postpartum period. These studies have focused on the role that physical activity plays in many health outcomes, including:

- Premature (early) death;
- Diseases such as coronary heart disease, stroke, some cancers, type 2 diabetes, osteoporosis, and depression;
- Risk factors for disease, such as high blood pressure and high blood cholesterol;
- **Physical fitness**, such as **aerobic capacity**, and muscle **strength** and endurance
- Functional capacity (the ability to engage in activities needed for daily living);
- Mental health, such as depression and cognitive function; and
- Injuries or sudden heart attacks.

These studies have also prompted questions as to what type and how much physical activity is needed for various health benefits. To answer this question, investigators have studied three main kinds of physical activity: aerobic, muscle-strengthening, and bone-strengthening.

### Aerobic Activity

In this kind of physical activity (also called cardiorespiratory fitness), the body's large muscles move in a rhythmic manner for a sustained period of time. Brisk walking, running, bicycling, jumping rope, and swimming are all examples.

Aerobic activity causes a person's heart to beat faster than usual.

Aerobic physical activity has three components:

- **Intensity**, or how hard a person works to do the activity. The intensities most often examined are moderate intensity (equivalent in effort to brisk walking) and vigorous intensity (equivalent in effort to running or jogging);
- **Frequency**, or how often a person does aerobic activity; and
- **Duration**, or how long a person does an activity in any one session.

### Muscle-Strengthening Activity

This kind of activity, which includes **resistance training** and lifting weights, causes the body's muscles to work or hold against an applied force or weight. These activities often involve relatively heavy objects, such as weights, which are lifted multiple times to train various muscle groups. Muscle-strengthening activity can also be done by using elastic bands or body weight for resistance (climbing a tree or doing push-ups, for example).

Muscle-strengthening activity also has three components:

- **Intensity**, or how much weight or force is used relative to how much a person is able to lift;
- **Frequency**, or how often a person does muscle strengthening activity; and
- **Repetitions**, or how many times a person lifts a weight (analogous to duration for aerobic activity). The effects of muscle-strengthening activity are limited to the muscles doing the work. It's important to work all the major muscle groups of the body: the legs, hips, back, abdomen, chest, shoulders, and arms.

### Bone-Strengthening Activity

This kind of activity (sometimes called weight-bearing or weight-loading activity) produces a force on the bones that promotes bone growth and strength. This force is commonly produced by impact with the ground. Examples of bone-strengthening activity include jumping jacks, running, brisk walking, and weight-lifting exercises. As these examples illustrate, bone-strengthening activities can also be aerobic and muscle strengthening.

## Overall Components of Physical Fitness

### 5 Main Components of Physical Fitness

- Cardiorespiratory fitness – ability to sustain aerobic activity for a prolonged period of time
- Muscular strength – amount of force a muscle is able to exert in one contraction
- Muscular endurance – ability of the muscle to continue to perform without fatigue
- Flexibility – ability to move joints freely through their full range of motion
- Body Composition – the relative proportions of fat mass and lean mass in the body

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# 11.4: Health Benefits of Physical Activity

Regular physical activity is one of the most important things you can do for your health. It can help:

- Control your weight
- Reduce your risk of cardiovascular disease
- Reduce your risk for type 2 diabetes and metabolic syndrome
- Reduce your risk of some cancers
- Strengthen your bones and muscles
- Improve your mental health and mood
- Improve your ability to do daily activities and prevent falls
- Increase your chances of living longer

If you're not sure about becoming active or boosting your level of physical activity because you're afraid of getting hurt, the good news is that **moderate-intensity aerobic activity**, like brisk walking, is generally **safe for most people**.

**Start slowly.** Cardiac events, such as a heart attack, are rare during physical activity. But the risk does go up when you suddenly become much more active than usual. For example, you can put yourself at risk if you don't usually get much physical activity and then all of a sudden do vigorous-intensity aerobic activity, like shoveling snow. That's why it's important to start slowly and gradually increase your level of activity.

**If you have a chronic health condition** such as arthritis, diabetes, or heart disease, talk with your doctor to find out if your condition limits, in any way, your ability to be active. Then, work with your doctor to come up with a physical activity plan that matches your abilities. If your condition stops you from meeting the minimum *Guidelines*, try to do as much as you can. What's important is that you avoid being inactive. Even 60 minutes a week of moderate-intensity aerobic activity is good for you.

**The bottom line is –** the health benefits of physical activity far outweigh the risks of getting hurt.

If you want to know more about how physical activity improves your health, the section below gives more detail on what research studies have found.

## HomeControl Your Weight

Looking to get to or stay at a healthy weight? Both diet and physical activity play a critical role in controlling your weight. You gain weight when the calories you burn, including those burned during physical activity, are less than the calories you eat or drink. When it comes to weight management, people vary greatly in how much physical activity they need. You may need to be more active than others to achieve or maintain a healthy weight.

**To maintain your weight:** Work your way up to 150 minutes of moderate-intensity aerobic activity, 75 minutes of vigorous-intensity aerobic activity, or an equivalent mix of the two each week. Strong scientific evidence shows that physical activity can help you maintain your weight over time. However, the exact amount of physical activity needed to do this is not clear since it varies greatly from person to person. It's possible that you may need to do more than the equivalent of 150 minutes of moderate-intensity activity a week to maintain your weight.

**To lose weight and keep it off:** You will need a high amount of physical activity unless you also adjust your diet and reduce the amount of calories you're eating and drinking. Getting to and staying at a healthy weight requires both regular physical activity and a healthy eating plan. The CDC has some great tools and information about nutrition, physical activity and weight loss. For more information, visit Healthy Weight.

## HomeReduce Your Risk of Cardiovascular Disease

Heart disease and stroke are two of the leading causes of death in the United States. But following the Guidelines and getting at least 150 minutes a week (2 hours and 30 minutes) of moderate-intensity aerobic activity can put you at a lower risk for these diseases. You can reduce your risk even further with more physical activity. Regular physical activity can also lower your blood pressure and improve your cholesterol levels.

## HomeReduce Your Risk of Type 2 Diabetes and Metabolic Syndrome

Regular physical activity can reduce your risk of developing type 2 diabetes and metabolic syndrome. Metabolic syndrome is a condition in which you have some combination of too much fat around the waist, high blood pressure, low HDL cholesterol, high

triglycerides, or high blood sugar. Research shows that lower rates of these conditions are seen with 120 to 150 minutes (2 hours to 2 hours and 30 minutes) a week of at least moderate-intensity aerobic activity. And the more physical activity you do, the lower your risk will be.

**Already have type 2 diabetes?** Regular physical activity can help control your blood glucose levels. To find out more, visit Managing Diabetes.

## HomeReduce Your Risk of Some Cancers

Being physically active lowers your risk for two types of cancer: colon and breast. Research shows that:

- Physically active people have a lower risk of colon cancer than do people who are not active.
- Physically active women have a lower risk of breast cancer than do people who are not active.

**Reduce your risk of endometrial and lung cancer**. Although the research is not yet final, some findings suggest that your risk of endometrial cancer and lung cancer may be lower if you get regular physical activity compared to people who are not active.

**Improve your quality of life.** If you are a cancer survivor, research shows that getting regular physical activity not only helps give you a better quality of life, but also improves your physical fitness.

## HomeStrengthen Your Bones and Muscles

As you age, it's important to protect your bones, joints and muscles. Not only do they support your body and help you move, but keeping bones, joints and muscles healthy can help ensure that you're able to do your daily activities and be physically active. Research shows that doing **aerobic, muscle-strengthening and bone-strengthening physical activity** of at least a moderately-intense level **can slow the loss of bone density** that comes with age.

**Hip fracture** is a serious health condition that can have life-changing negative effects, especially if you're an older adult. But research shows that people who do 120 to 300 minutes of at least moderate-intensity aerobic activity each week have a lower risk of hip fracture.

**Regular physical activity helps with arthritis** and other conditions affecting the joints. If you have arthritis, research shows that doing 130 to 150 (2 hours and 10 minutes to 2 hours and 30 minutes) a week of moderate-intensity, low-impact aerobic activity can not only improve your ability to manage pain and do everyday tasks, but it can also make your quality of life better.

**Build strong, healthy muscles**. Muscle-strengthening activities can help you increase or maintain your muscle mass and strength. Slowly increasing the amount of weight and number of repetitions you do will give you even more benefits, no matter your age.

## HomeImprove Your Mental Health and Mood

Regular physical activity can help keep your thinking, learning, and judgment skills sharp as you age. It can also reduce your risk of depression and may help you sleep better. Research has shown that doing aerobic or a mix of aerobic and muscle-strengthening activities 3 to 5 times a week for 30 to 60 minutes can give you these mental health benefits. Some scientific evidence has also shown that even lower levels of physical activity can be beneficial.

## HomeImprove Your Ability to do Daily Activities and Prevent Falls

A functional limitation is a loss of the ability to do everyday activities such as climbing stairs, grocery shopping, or playing with your grandchildren.

**How does this relate to physical activity?** If you're a physically active middle-aged or older adult, you have a lower risk of functional limitations than people who are inactive

**Already have trouble doing some of your everyday activities?** Aerobic and muscle-strengthening activities can help improve your ability to do these types of tasks.

**Are you an older adult who is at risk for falls?** Research shows that doing **balance** and **muscle-strengthening activities** each week along with **moderate-intensity aerobic activity**, like brisk walking, can help reduce your risk of falling.

## HomeIncrease Your Chances of Living Longer

Science shows that physical activity can reduce your risk of dying early from the leading causes of death, like heart disease and some cancers. This is remarkable in two ways:

1. Only a few lifestyle choices have as large an impact on your health as physical activity. People who are physically active for about 7 hours a week have a 40 percent lower risk of dying early than those who are active for less than 30 minutes a week.
2. You don’t have to do high amounts of activity or vigorous-intensity activity to reduce your risk of premature death. You can put yourself at lower risk of dying early by doing at least 150 minutes a week of moderate-intensity aerobic activity.

**Everyone can gain the health benefits of physical activity** – age, ethnicity, shape or size do not matter.

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# 11.5: Developing a Personal Exercise Program

## Make Physical Activity a Regular Part of the Day



Choose activities that you enjoy and can do regularly. Fitting activity into a daily routine can be easy — such as taking a brisk 10 minute walk to and from the parking lot, bus stop, or subway station. Or, join an exercise class. Keep it interesting by trying something different on alternate days. Every little bit adds up and doing something is better than doing nothing.

Be physically active at least 10 minutes at a time, because shorter bursts of activity will not have the same health benefits. For example, walk your dog for 10 minutes before and after work, and go for a 10-minute walk at lunchtime. That adds up to 30 minutes of moderate exercise for the day. If you don't have a dog to walk, then you could take a brisk 10-minute walk to and from the parking lot or bus stop before and after work or class.

## Gradually Increase Your Level of Physical Activity

Inactive adults or those who don't yet do 150 minutes of physical activity a week should work gradually toward this goal. The initial amount of activity should be at a light or moderate intensity, for short periods of time, with the sessions spread throughout the week. The good news is that "some is better than none."

To reduce risk of injury, it is important to increase the amount of physical activity gradually over a period of weeks to months. For example, an inactive person could start with a walking program consisting of 5 minutes of walking several times each day, 5 to 6 days a week. The length of time could then gradually be increased to 10 minutes per session, 3 times a day, and the walking speed could be increased (to ultimately meet the time and intensity guidelines).

Muscle-strengthening activities should also be gradually increased over time. Initially, these activities can be done just 1 day a week starting at a light or moderate level of effort. Over time, the number of days a week can be increased to 2, and then possibly to more than 2. Each week, the level of effort (intensity) can be increased slightly until it becomes moderate to high.

### Warm-up and Cool-down

Commonly, the warm-up and cool-down involve doing an activity at a slower speed or lower intensity. A warm-up before moderate- or vigorous-intensity aerobic activity allows a gradual increase in heart rate and breathing at the start of the episode of activity. A cool-down after activity allows a gradual decrease at the end of the episode. Time spent doing warm-up and cool-down may count toward meeting the aerobic activity guidelines if the activity is at least moderate intensity (for example, walking briskly as a warm-up before jogging). A warm-up for muscle-strengthening activity commonly involves doing exercises with lighter weight. Stretching is often incorporated during the warm-up and cool-down, and is helpful for reducing the risk of injury, as well as improving flexibility.

## Ways to Get Moving

- Many activities can be worked into your daily routine so that you don't have to go to the gym or an exercise class.
- Always be prepared. Keep a pair of walking or running shoes and some comfortable clothes readily available.
- Walk (briskly)! Do it in your neighborhood, find a local trail, or go to the mall and walk around before you shop. Walk during your lunch break, in between classes, or to do your errands. Take the stairs instead of the elevator. Park in the farthest parking spot and take an extended route to your classroom, office, or store.
- Make exercise a social event. Walk with friends, a family member, or even join a walking group to make it more fun. Take dancing lessons, or a Zumba class.
- Get a jump rope! Jumping rope is an inexpensive exercise that can be done anywhere.
- Add calisthenics (jumping jacks, push-ups, squats, crunches, etc.) to the mix for muscle strengthening.
- Participate in a sport such as tennis, softball, basketball or touch football. Play golf, but push or carry your golf bag rather than ride in a golf cart. Keep your activities interesting by trying something different on alternate days.

- Do household chores that increase your heart rate. Vacuuming, mopping, and sweeping can get your heart pumping. Mow the lawn with a push mower, garden/shovel, rake leaves, or wash and wax your car.
- Make exercise a family activity. Get outdoors and hike, ride bikes, skate, swim, go canoeing, kayaking, or just take a brisk walk together.

### Achieving Target Levels of Physical Activity

**Key Points**:

- Going to the gym is NOT required for achieving the recommended guidelines
- Incorporating more brisk walking throughout the day can add up to reaching your goals – just be sure it occurs for at least **10 minutes** at a time
- Getting started is the first important step – gradually work your way to the recommended levels

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# CHAPTER OVERVIEW

## 12: Module 6B- Stress Management


12.1: Stress Overview
12.2: Yerkes-Dodson Law
12.3: The Stress Response
12.4: Health Effects of Stress
12.5: Managing Stress


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# 12.1: Stress Overview




Stress — just the word may be enough to set your nerves on edge. Everyone feels stressed from time to time. Some people may cope with stress more effectively or recover from stressful events quicker than others. It's important to know your limits when it comes to stress to avoid more serious health effects.

## What is stress?

Stress can be defined as the brain's response to any demand. Many things can trigger this response, including change. Changes can be positive or negative, as well as real or perceived. They may be recurring, short-term, or long-term and may include things like commuting to and from school or work every day, traveling for a yearly vacation, or moving to another home. Changes can be mild and relatively harmless, such as winning a race, watching a scary movie, or riding a rollercoaster. Some changes are major, such as marriage or divorce, serious illness, or a car accident. Other changes are extreme, such as exposure to violence, and can lead to traumatic stress reactions.

## How does stress affect the body?

Not all stress is bad. All humans and animals have a stress response, which can be life-saving in some situations. The nerve chemicals and hormones released during stressful times prepares us to face a threat or flee to safety. When you face a dangerous situation, your pulse quickens, you breathe faster, your muscles tense, your brain uses more oxygen and increases activity—all functions aimed at survival.

However, with chronic stress, those same nerve chemicals that are life-saving in short bursts can suppress functions that aren't needed for immediate survival. Your immunity is lowered and your digestive, excretory, and reproductive systems stop working normally. Once the threat has passed, other body systems act to restore normal functioning. Problems occur if the stress response goes on too long, such as when the source of stress is constant, or if the response continues after the danger has subsided.

## How does stress affect your overall health?

There are at least three different types of stress, all of which carry physical and mental health risks:

- Routine stress related to the pressures of work, family and other daily responsibilities.
- Stress brought about by a sudden negative change, such as losing a job, divorce, or illness.
- Traumatic stress, experienced in an event like a major accident, war, assault, or a natural disaster where one may be seriously hurt or in danger of being killed.

The body responds to each type of stress in similar ways. Different people may feel it in different ways. For example, some people experience mainly digestive symptoms, while others may have headaches, sleeplessness, depressed mood, anger and irritability. People under chronic stress are prone to more frequent and severe viral infections, such as the flu or common cold, and vaccines, such as the flu shot, are less effective for them.

Of all the types of stress, changes in health from routine stress may be hardest to notice at first. Because the source of stress tends to be more constant than in cases of acute or traumatic stress, the body gets no clear signal to return to normal functioning. Over time, continued strain on your body from routine stress may lead to serious health problems, such as heart disease, high blood pressure, diabetes, depression, anxiety disorder, and other illnesses.

## How can I cope with stress?

The effects of stress tend to build up over time. Taking practical steps to maintain your health and outlook can reduce or prevent these effects. The following are some tips that may help you to cope with stress:

- Seek help from a qualified mental health care provider if you are overwhelmed, feel you cannot cope, have suicidal thoughts, or are using drugs or alcohol to cope.
- Get proper health care for existing or new health problems.
- Stay in touch with people who can provide emotional and other support. Ask for help from friends, family, or community organizations to reduce stress due to work burdens or family issues, such as caring for a loved one.
- Recognize signs of your body's response to stress, such as difficulty sleeping, increased alcohol and other substance use, being easily angered, feeling depressed, and having low energy.
- Set priorities – decide what must get done and what can wait, and learn to say no to new tasks if they are putting you into overload.
- Note what you have accomplished at the end of the day, not what you have been unable to do.
- Avoid dwelling on problems. If you can't do this on your own, seek help from a qualified mental health professional who can guide you.
- Exercise regularly – just 30 minutes per day of walking can help boost mood and reduce stress.
- Schedule regular times for healthy and relaxing activities.
- Explore stress coping programs, which may incorporate meditation, yoga, tai chi, or other related exercises.

**If you or someone you know is overwhelmed by stress, ask for help from a health professional. If you or someone close to you is in crisis, call the toll-free, 24-hour National Suicide Prevention Lifeline at 1-800-273-TALK (1-800-273-8255).**

## Key Takeaway

We all have stress sometimes. For some people, it happens before having to speak in public. For other people, it might be before a first date. What causes stress for you may not be stressful for someone else. Sometimes stress is helpful—it can encourage you to meet a deadline or get things done. But feeling stressed for an extended amount of time can take a toll on your mental and physical health. Even though it may seem hard to find ways to de-stress with all the things you have to do, it's important to find those ways. Your health depends on it.

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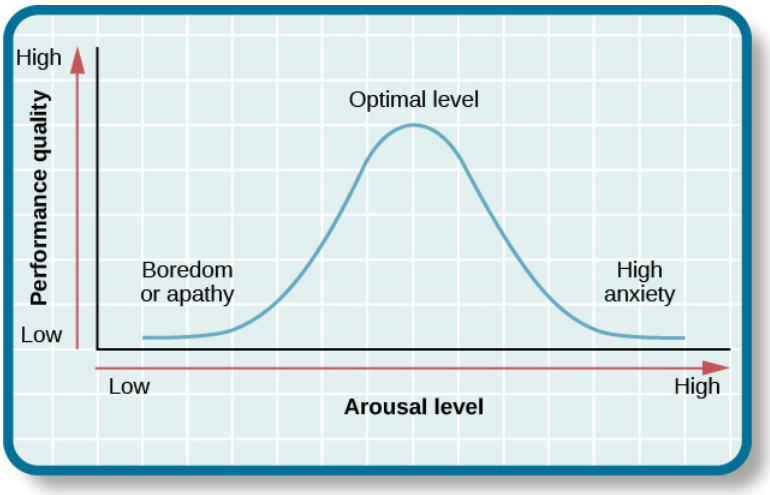
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# 12.2: Yerkes-Dodson Law

## Optimal Levels of Arousal (i.e. Stress)

Theories of learning assert that there is an optimal level of arousal (stress) that we all try to maintain. If we are under-aroused, we become bored and will seek out some sort of stimulation. On the other hand, if we are over-aroused, we will engage in behaviors to reduce our arousal/stress. Research shows that moderate arousal is generally best; when arousal (stress) is very high or very low, performance tends to suffer. The **Yerkes–Dodson law** is an empirical relationship between arousal and performance, originally developed by psychologists Robert M. Yerkes and John Dillingham Dodson in 1908. The law dictates that performance increases with physiological or mental arousal, but only up to a point. When levels of arousal become too high, performance decreases. The process is often illustrated graphically as a bell-shaped curve which increases and then decreases with higher levels of arousal.




Most students have experienced this need to maintain optimal levels of arousal (stress) over the course of their academic career. Think about how much stress students experience toward the end of spring semester—they feel overwhelmed with work and yearn for the rest and relaxation of summer break. Their arousal/stress level may be too high. Once they finish the semester, however, it doesn't take too long before they begin to feel bored; their arousal level is too low and their level of performance or productivity is also typically lower. Generally, by the time fall semester starts, many students are ready to return to school. This is an example of how arousal theory works.

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# 12.3: The Stress Response

The **fight-or-flight response** (also called the **stress response**) is a physiological reaction that occurs in response to a perceived threat or danger. This enables the body to take action quickly, and is intended to keep us out of (physical) harm's way. Unfortunately for our health, this response also occurs when we are not in any immediate physical danger, but are still experiencing stress. For example, this can happen when someone is running late for an appointment or class, and is feeling stressed about trying to get there.

The physical changes that occur during this response can cause wear and tear within the body if the perception of stress persists. Here are a few examples of such bodily changes:

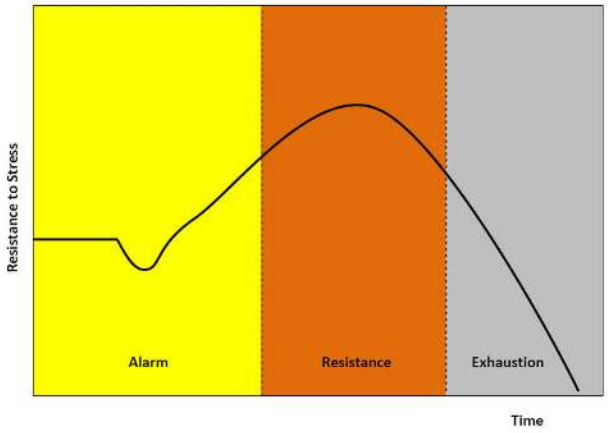
- Heart rate increases
- Blood pressure increases
- Blood sugar (i.e. glucose) levels rise
- Respiration rate increases
- Muscles tense up
- Perspiration increases
- Pupils dilate

For additional information about how these physiological changes occur, click here to read more.

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The fight-or-flight response is also recognized as the first stage of the General Adaptation Syndrome.

## General Adaptation Syndrome




Stages of the General Adaptation Syndrome

**Homeostasis** is a state of physiological calmness or balance, and occurs when our bodily functions are running smoothly in conjunction with low stress levels. When exposed to stressors, this causes an imbalance to occur as the body responds to the perceived threat, and then tries to return to normal functioning.

The **general adaptation syndrome (GAS)**, developed by Hans Selye, describes the pattern of responses that the body goes through after being prompted by a stressor. There are three stages: alarm, resistance, and exhaustion.

- **Alarm** – This occurs when we first perceive something as stressful, and then the body initiates the fight-or-flight response (as discussed earlier).
- **Resistance** – If the perceived stress continues, the body stays activated at a higher metabolic level in an effort to offset the persistent stress. The body cannot maintain this level indefinitely, and its resources will eventually deplete.
- **Exhaustion** – Prolonged exposure to the stressor will result in the depletion of the body's resources, and the resulting wear and tear will suppress the immune system and cause bodily functions to deteriorate. This can lead to a variety of health issues and illnesses, including heart disease, digestive problems, depression, and diabetes.

These changes will occur in the body regardless of whether the perceived stressor is considered eustress (positive or pleasant) or distress (negative or unpleasant). Ultimately, this means that we need to take active steps in managing all of our stressors, as it can

build up and potentially cause harm to our health otherwise.

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# 12.4: Health Effects of Stress

Stress is a feeling you get when faced with a challenge. In small doses, stress can be good for you because it makes you more alert and gives you a burst of energy. For instance, if you start to cross the street and see a car about to run you over, that jolt you feel helps you to jump out of the way before you get hit. But feeling stressed for a long time can take a toll on your mental and physical health. Even though it may seem hard to find ways to de-stress with all the things you have to do, it's important to find those ways. Your health depends on it.

## HomeWhat are the most common causes of stress?

Stress happens when people feel like they don't have the tools to manage all of the demands in their lives. Stress can be short-term or long-term. Missing the bus or arguing with your spouse or partner can cause short-term stress. Money problems or trouble at work can cause long-term stress. Even happy events, like having a baby or getting married can cause stress. Some of the most common stressful life events include:

- Death of a spouse
- Death of a close family member
- Divorce
- Losing your job
- Major personal illness or injury
- Marital separation
- Marriage
- Pregnancy
- Retirement
- Spending time in jail

## HomeWhat are some common signs of stress?

Everyone responds to stress a little differently. Your symptoms may be different from someone else's. Here are some of the signs to look for:

- Not eating or eating too much
- Feeling like you have no control
- Needing to have too much control
- Forgetfulness
- Headaches
- Lack of energy
- Lack of focus
- Trouble getting things done
- Poor self-esteem
- Short temper
- Trouble sleeping
- Upset stomach
- Back pain
- General aches and pains

These symptoms may also be signs of depression or anxiety, which can be caused by long-term stress.

## HomeCan stress affect my health?

The body responds to stress by releasing stress hormones. These hormones make blood pressure, heart rate, and blood sugar levels go up. Long-term stress can help cause a variety of health problems, including:

- Mental health disorders, like depression and anxiety
- Obesity
- Heart disease
- High blood pressure

- Abnormal heart beats
- Menstrual problems
- Acne and other skin problems

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# 12.5: Managing Stress

## How can I help handle my stress?

Everyone has to deal with stress. There are steps you can take to help you handle stress in a positive way and keep it from making you sick. Try these tips to keep stress in check:

**Develop a new attitude**

- **Become a problem solver.** Make a list of the things that cause you stress. From your list, figure out which problems you can solve now and which are beyond your control for the moment. From your list of problems that you can solve now, start with the little ones. Learn how to calmly look at a problem, think of possible solutions, and take action to solve the problem. Being able to solve small problems will give you confidence to tackle the big ones. And feeling confident that you can solve problems will go a long way to helping you feel less stressed.
- **Be flexible**. Sometimes, it's not worth the stress to argue. Give in once in awhile or meet people halfway.
- **Get organized**. Think ahead about how you're going to spend your time. Write a to-do list. Figure out what's most important to do and do those things first.
- **Set limits**. When it comes to things like work and family, figure out what you can really do. There are only so many hours in the day. Set limits for yourself and others. Don't be afraid to say NO to requests for your time and energy.

**Relax**

- **Take deep breaths**. If you're feeling stressed, taking a few deep breaths makes you breathe slower and helps your muscles relax.
- **Stretch**. Stretching can also help relax your muscles and make you feel less tense.
- **Massage tense muscles**. Having someone massage the muscles in the back of your neck and upper back can help you feel less tense.
- **Take time to do something you want to do**. We all have lots of things that we have to do. But often we don't take the time to do the things that we really want to do. It could be listening to music, reading a good book, or going to a movie. Think of this as an order from your doctor, so you won't feel guilty!

**Take care of your body**

- **Get enough sleep**. Getting enough sleep helps you recover from the stresses of the day. Also, being well-rested helps you think better so that you are prepared to handle problems as they come up. Most adults need 7 to 9 hours of sleep a night to feel rested.
- **Eat right**. Try to fuel up with fruits, vegetables, beans, and whole grains. Don't be fooled by the jolt you get from caffeine or high-sugar snack foods. Your energy will wear off, and you could wind up feeling more tired than you did before.
- **Get moving**. Getting physical activity can not only help relax your tense muscles but improve your mood. Research shows that physical activity can help relieve symptoms of depression and anxiety.
- **Don't deal with stress in unhealthy ways**. This includes drinking too much alcohol, using drugs, smoking, or overeating.

**Connect with others**

- **Share your stress**. Talking about your problems with friends or family members can sometimes help you feel better. They might also help you see your problems in a new way and suggest solutions that you hadn't thought of.
- **Get help from a professional if you need it**. If you feel that you can no longer cope, talk to your doctor. She or he may suggest counseling to help you learn better ways to deal with stress. Your doctor may also prescribe medicines, such as antidepressants or sleep aids.
- **Help others**. Volunteering in your community can help you make new friends and feel better about yourself.

## What Are Relaxation Techniques?

Relaxation techniques include a number of practices such as *progressive relaxation*, *guided imagery*, *biofeedback*, self-hypnosis, and deep breathing exercises. The goal is similar in all: to produce the body's natural relaxation response, characterized by slower breathing, lower blood pressure, and a feeling of increased well-being.

Meditation and practices that include *meditation* with movement, such as yoga and tai chi, can also promote relaxation. You can find additional information about these practices on the NCCIH web site.

## What Is Meditation?

Meditation is a *mind and body practice* that has a long history of use for increasing calmness and physical relaxation, improving psychological balance, coping with illness, and enhancing overall health and well-being. Mind and body practices focus on the interactions among the brain, mind, body, and behavior.

There are many types of meditation, but most have four elements in common: a quiet location with as few distractions as possible; a specific, comfortable posture (sitting, lying down, walking, or in other positions); a focus of attention (a specially chosen word or set of words, an object, or the sensations of the breath); and an open attitude (letting distractions come and go naturally without judging them).

## What the Science Says About the Effectiveness of Meditation

Many studies have investigated meditation for different conditions, and there's evidence that it may reduce blood pressure as well as symptoms of irritable bowel syndrome and flare-ups in people who have had ulcerative colitis. It may ease symptoms of anxiety and depression, and may help people with insomnia.

No matter which techniques or strategies you select to help cope with stress more effectively, keep in mind that it takes time and effort to reap the benefits from them.

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# CHAPTER OVERVIEW

## 13: Module 7- Cancer

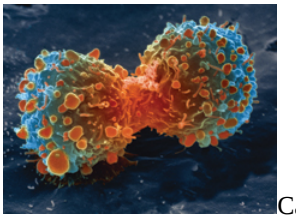

13.1: Cancer Overview
13.2: Types of Cancer
13.3: Risk Factors for Cancer
13.4: Cancer Prevention


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# 13.1: Cancer Overview

## What Is Cancer?



Cancer is the name given to a collection of related diseases. In all types of cancer, some of the body's cells begin to divide without stopping and spread into surrounding tissues.

Cancer can start almost anywhere in the human body, which is made up of trillions of cells. Normally, human cells grow and divide to form new cells as the body needs them. When cells grow old or become damaged, they die, and new cells take their place.

When cancer develops, however, this orderly process breaks down. As cells become more and more abnormal, old or damaged cells survive when they should die, and new cells form when they are not needed. These extra cells can divide without stopping and may form growths called tumors.

Cancerous tumors are malignant, which means they can spread into, or invade, nearby tissues. In addition, as these tumors grow, some cancer cells can break off and travel to distant places in the body through the blood or the lymph system and form new tumors far from the original tumor.

Unlike malignant tumors, benign tumors do not spread into, or invade, nearby tissues. Benign tumors can sometimes be quite large, however. When removed, they usually don't grow back, whereas malignant tumors sometimes do. Unlike most benign tumors elsewhere in the body, benign brain tumors can be life threatening.

## How Cancer Arises

Cancer is caused by changes to genes that control the way our cells function, especially how they grow and divide.

Genetic changes that cause cancer can be inherited from our parents. They can also arise during a person's lifetime as a result of errors that occur as cells divide or because of damage to DNA caused by certain environmental exposures. Cancer-causing environmental exposures include substances, such as the chemicals in tobacco smoke, and radiation, such as ultraviolet rays from the sun.

## When Cancer Spreads

In metastasis, cancer cells break away from where they first formed (primary cancer), travel through the blood or lymph system, and form new tumors (metastatic tumors) in other parts of the body. The metastatic tumor is the same type of cancer as the primary tumor.

A cancer that has spread from the place where it first started to another place in the body is called metastatic cancer. **The process by which cancer cells spread to other parts of the body is called metastasis**.

Metastatic cancer has the same name and the same type of cancer cells as the original, or primary, cancer. For example, breast cancer that spreads to and forms a metastatic tumor in the lung is metastatic breast cancer, not lung cancer.

Under a microscope, metastatic cancer cells generally look the same as cells of the original cancer. Moreover, metastatic cancer cells and cells of the original cancer usually have some molecular features in common, such as the presence of specific chromosome changes.

## Tissue Changes That Are Not Cancer

Not every change in the body's tissues is cancer. Some tissue changes may develop into cancer if they are not treated, however. Here are some examples of tissue changes that are not cancer but, in some cases, are monitored:

Hyperplasia occurs when cells within a tissue divide faster than normal and extra cells build up, or proliferate. However, the cells and the way the tissue is organized look normal under a microscope. Hyperplasia can be caused by several factors or conditions, including chronic irritation.

Dysplasia is a more serious condition than hyperplasia. In dysplasia, there is also a buildup of extra cells. But the cells look abnormal and there are changes in how the tissue is organized. In general, the more abnormal the cells and tissue look, the greater the chance that cancer will form.

Some types of dysplasia may need to be monitored or treated. An example of dysplasia is an abnormal mole (called a dysplastic nevus) that forms on the skin. A dysplastic nevus can turn into melanoma, although most do not.

Normal cells may become cancer cells. Before cancer cells form in tissues of the body, the cells go through abnormal changes called hyperplasia and dysplasia. In hyperplasia, there is an increase in the number of cells in an organ or tissue that appear normal under a microscope. In dysplasia, the cells look abnormal under a microscope but are not cancer. Hyperplasia and dysplasia may or may not become cancer.
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# 13.2: Types of Cancer

There are more than 100 types of cancer. Types of cancer are usually named for the organs or tissues where the cancers form. For example, lung cancer starts in cells of the lung, and brain cancer starts in cells of the brain. Cancers also may be described by the type of cell that formed them, such as an epithelial cell or a squamous cell.

## Common Cancer Types

This list of common cancer types includes cancers that are diagnosed with the greatest frequency in the United States, excluding non-melanoma skin cancers:

Bladder Cancer
Breast Cancer
Colon and Rectal Cancer
Endometrial Cancer
Kidney Cancer
Leukemia
Lung Cancer
Melanoma
Non-Hodgkin Lymphoma
Pancreatic Cancer
Prostate Cancer
Thyroid Cancer

Cancer incidence and mortality statistics reported by the American Cancer Society and other resources were used to create the list. To qualify as a common cancer for the list, the estimated annual incidence for 2016 had to be 40,000 cases or more.

The most common type of cancer on the list is breast cancer, with more than 249,000 new cases expected in the United States in 2016. The next most common cancers are lung cancer and prostate cancer.

Because colon and rectal cancers are often referred to as “colorectal cancers,” these two cancer types are combined for the list. For 2016, the estimated number of new cases of colon cancer and rectal cancer are 95,270 and 39,220, respectively, adding to a total of 134,490 new cases of colorectal cancer.

The following table gives the estimated numbers of new cases and deaths for each common cancer type:

| Cancer Type | Estimated New Cases | Estimated Deaths |
|---|---|---|
| Bladder | 76,960 | 16,390 |
| Breast (Female – Male) | 246,660 – 2,600 | 40,450 – 440 |
| Colon and Rectal (Combined) | 134,490 | 49,190 |
| Endometrial | 60,050 | 10,470 |
| Kidney (Renal Cell and Renal Pelvis) Cancer | 62,700 | 14,240 |
| Leukemia (All Types) | 60,140 | 24,400 |
| Lung (Including Bronchus) | 224,390 | 158,080 |
| Melanoma | 76,380 | 10,130 |
| Non-Hodgkin Lymphoma | 72,580 | 20,150 |
| Pancreatic | 53,070 | 41,780 |
| Prostate | 180,890 | 26,120 |
| Thyroid | 64,300 | 1,980 |

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# 13.3: Risk Factors for Cancer

It is usually not possible to know exactly why one person develops cancer and another doesn't. But research has shown that certain risk factors may increase a person's chances of developing cancer. (There are also factors that are linked to a lower risk of cancer. These are called protective factors.)

Cancer risk factors include exposure to chemicals or other substances, as well as certain behaviors. They also include things people cannot control, like age and family history. A family history of certain cancers can be a sign of a possible inherited cancer syndrome.

Most cancer risk (and protective) factors are initially identified in epidemiology studies. In these studies, scientists look at large groups of people and compare those who develop cancer with those who don't. These studies may show that the people who develop cancer are more or less likely to behave in certain ways or to be exposed to certain substances than those who do not develop cancer.

Such studies, on their own, cannot prove that a behavior or substance causes cancer. For example, the finding could be a result of chance, or the true risk factor could be something other than the suspected risk factor. But findings of this type sometimes get attention in the media, and this can lead to wrong ideas about how cancer starts and spreads.

When many studies all point to a similar association between a potential risk factor and an increased risk of cancer, and when a possible mechanism exists that could explain how the risk factor could actually cause cancer, scientists can be more confident about the relationship between the two.

The list below includes the most studied known or suspected risk factors for cancer. Although some of these risk factors can be avoided, others—such as growing older—cannot. Limiting your exposure to avoidable risk factors may lower your risk of developing certain cancers. **Click on each risk factor below** to find out more:

- Age
- Alcohol




- Cancer-Causing Substances
- Chronic Inflammation
- Diet
- Hormones
- Immunosuppression
- Infectious Agents
- Obesity
- Radiation
- Sunlight
- Tobacco

## Tobacco

Tobacco use is a leading cause of cancer and of death from cancer. People who use tobacco products or who are regularly around environmental tobacco smoke (also called secondhand smoke) have an increased risk of cancer because tobacco products and secondhand smoke have many chemicals that damage DNA.

Tobacco use causes many types of cancer, including cancer of the lung, larynx (voice box), mouth, esophagus, throat, bladder, kidney, liver, stomach, pancreas, colon and rectum, and cervix, as well as acute myeloid leukemia. People who use smokeless

tobacco (snuff or chewing tobacco) have increased risks of cancers of the mouth, esophagus, and pancreas.

There is no safe level of tobacco use. People who use any type of tobacco product are strongly urged to quit. People who quit smoking, regardless of their age, have substantial gains in life expectancy compared with those who continue to smoke. Also, quitting smoking at the time of a cancer diagnosis reduces the risk of death.

Scientists believe that cigarette smoking causes about **30% of all cancer deaths** in the United States.

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# 13.4: Cancer Prevention

## How Can Cancer Be Prevented?

The number of new cancer cases can be reduced and many cancer deaths can be prevented. Research shows that screening for cervical and colorectal cancers as recommended helps prevent these diseases by finding precancerous lesions so they can be treated before they become cancerous. Screening for cervical, colorectal, and breast cancers also helps find these diseases at an early stage, when treatment works best.

Vaccines (shots) also help lower cancer risk. The human papillomavirus (HPV) vaccine helps prevent most cervical cancers and several other kinds of cancer, and the hepatitis B vaccine can help lower liver cancer risk.

A person's cancer risk can be reduced with healthy choices like avoiding tobacco, limiting alcohol use, protecting your skin from the sun and avoiding indoor tanning, eating a diet rich in fruits and vegetables, keeping a healthy weight, and being physically active.

## Avoiding Tobacco

### Cigarette Smoking

Lung cancer is the leading cause of cancer death, and cigarette smoking causes almost all cases. Compared to nonsmokers, current smokers are about 25 times more likely to die from lung cancer. Smoking causes about 80% to 90% of lung cancer deaths. Smoking also causes cancer of the mouth and throat, esophagus, stomach, colon, rectum, liver, pancreas, voicebox (larynx), trachea, bronchus, kidney and renal pelvis, urinary bladder, and cervix, and causes acute myeloid leukemia.

Visit smokefree.gov to learn how you can quit smoking.

### Secondhand Smoke

Adults who are exposed to secondhand smoke at home or at work increase their risk of developing lung cancer by 20% to 30%. Concentrations of many cancer-causing and toxic chemicals are higher in secondhand smoke than in the smoke inhaled by smokers.

## Protecting Your Skin

Skin cancer is the most common kind of cancer in the United States. Exposure to ultraviolet (UV) rays from the sun and tanning beds appears to be the most important environmental factor involved with developing skin cancer. To help prevent skin cancer while still having fun outdoors, protect yourself by seeking shade, applying sunscreen, and wearing sun-protective clothing, a hat, and sunglasses. For more information, visit What Can I Do to Reduce My Risk of Skin Cancer?

### Detecting Melanoma

Melanoma is the most serious type of skin cancer. Often the first sign of melanoma is a change in the size, shape, color, or feel of a mole. Most melanomas have a black or black-blue area. Melanoma may also appear as a new mole. It may be black, abnormal, or "ugly looking."

Thinking of "**ABCDE**" can help you remember what to watch for:

- **A**symmetry – the shape of one half does not match the other
- **B**order – the edges are ragged, blurred or irregular
- **C**olor – the color is uneven and may include shades of black, brown and tan
- **D**iameter – there is a change in size, usually an increase (larger than 6 millimeters or about 1/4 inch)
- **E**volving – the mole has changed (in size, color, shape; it may start to itch or bleed) over the past few weeks or months

## Limiting Alcohol Intake

Drinking alcohol raises the risk of some cancers. Drinking any kind of alcohol can contribute to cancers of the mouth and throat, larynx (voice box), esophagus, colon and rectum, liver, and breast (in women). The less alcohol you drink, the lower the risk of cancer.

Studies around the world have shown that drinking alcohol regularly increases the risk of getting mouth, voice box, and throat cancers.

A large number of studies provide strong evidence that drinking alcohol is a risk factor for primary liver cancer, and more than 100 studies have found an increased risk of breast cancer with increasing alcohol intake. The link between alcohol consumption and colorectal (colon) cancer has been reported in more than 50 studies.

## Keeping a Healthy Weight

Research has shown that being overweight or obese substantially raises a person's risk of getting endometrial (uterine), breast, prostate, and colorectal cancers. Overweight is defined as a body mass index (BMI) of 25 to 29, and obesity is defined as a BMI of 30 or higher. Learn how to choose a healthy diet at Healthy Eating for a Healthy Weight, and read about exercise at Physical Activity for a Healthy Weight.

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# CHAPTER OVERVIEW

## 14: Module 8- Cardiovascular Disease


14.1: Heart Disease and Stroke Facts
14.2: Coronary Artery Disease (CAD)
14.3: Types of Stroke
14.4: Metabolic Syndrome
14.5: Cholesterol Management


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# 14.1: Heart Disease and Stroke Facts

## Heart Disease Facts

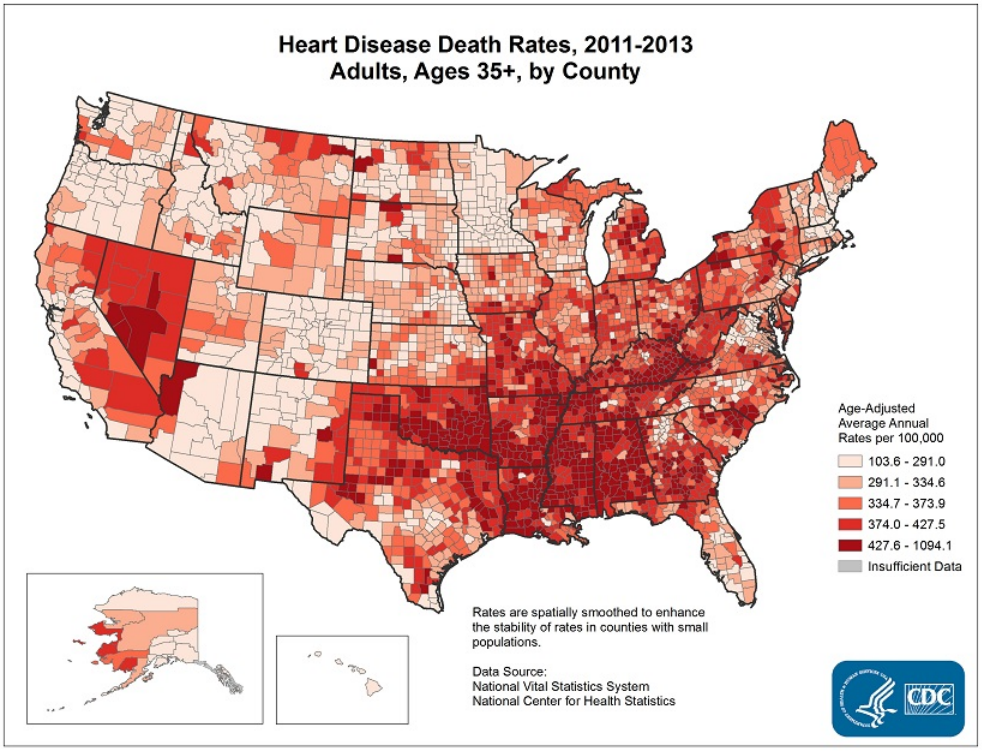
- Heart disease is the **leading cause** of death for both men and women.
- About **610,000 Americans** die from heart disease each year—that's **1 in every 4 deaths**.
- Coronary heart disease is the most common type of heart disease, killing about **365,000 people** in 2014.
- In the United States, someone has a heart attack **every 42 seconds**. Each minute, someone in the United States dies from a heart disease-related event.
- Heart disease is the **leading cause** of death for people of most racial/ethnic groups in the United States, including African Americans, Hispanics, and whites. For Asian Americans or Pacific Islanders and American Indians or Alaska Natives, heart disease is second only to cancer.
- Heart disease costs the United States about **$207 billion** each year. This total includes the cost of health care services, medications, and lost productivity.

### Risk Factors

High blood pressure, high LDL cholesterol, and smoking are key risk factors for heart disease. About **half of Americans** (49%) have at least one of these three risk factors.

Several other medical conditions and lifestyle choices can also put people at a higher risk for heart disease, including:

- Diabetes
- Overweight and obesity
- Poor diet
- Physical inactivity
- Excessive alcohol use



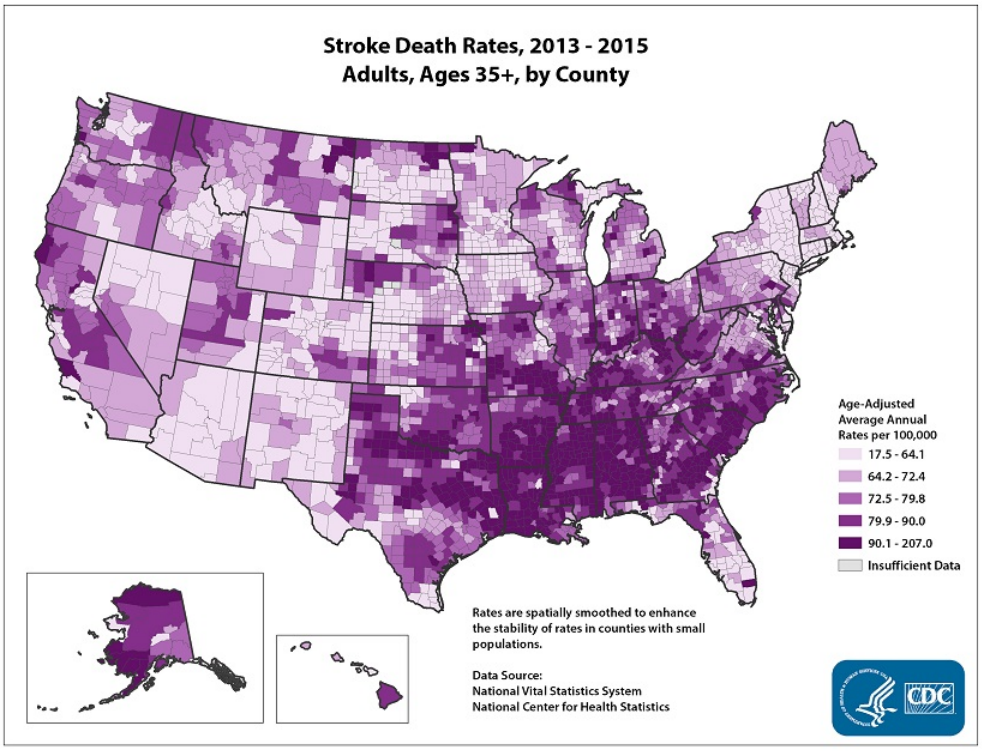

## Stroke Facts

- Stroke is the fifth leading cause of death in the United States, killing more than **130,000 Americans** each year—that's **1 of every 20 deaths**.

- A stroke, sometimes called a brain attack, occurs when a clot blocks the blood supply to the brain or when a blood vessel in the brain bursts.
- Someone in the United States has a stroke every **40 seconds**. Every **four minutes**, someone dies of stroke.
- Every year, about **795,000 people** in the United States have a stroke. About 610,000 of these are first or new strokes; 185,000 are recurrent strokes.
- Stroke is an important cause of disability. Stroke reduces mobility in more than half of stroke survivors age 65 and over.
- Stroke costs the nation **$33 billion** annually, including the cost of health care services, medications, and lost productivity.
- You can't control some stroke risk factors, like heredity, age, gender, and ethnicity. Some medical conditions—including high blood pressure, high cholesterol, heart disease, diabetes, overweight or obesity, and previous stroke or transient ischemic attack (TIA)—can also raise your stroke risk. Avoiding smoking and drinking too much alcohol, eating a balanced diet, and getting exercise are all choices you can make to reduce your risk.

## Common Stroke Warning Signs and Symptoms

- Sudden numbness or weakness of the face, arm, or leg—especially on one side of the body.
- Sudden confusion, trouble speaking or understanding.
- Sudden trouble seeing in one or both eyes.
- Sudden trouble walking, dizziness, loss of balance or coordination.
- Sudden severe headache with no known cause.




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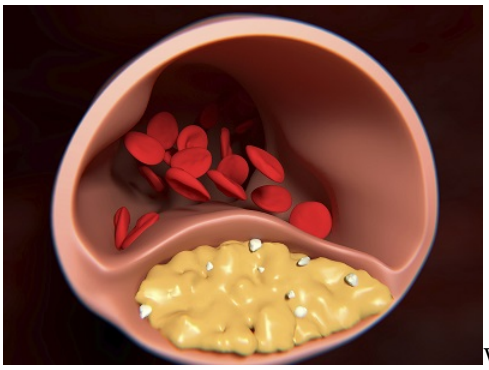
# 14.2: Coronary Artery Disease (CAD)

Coronary artery disease (CAD) is the most common type of heart disease in the United States. For some people, the first sign of CAD is a heart attack. Therefore, taking steps to reduce your risk for CAD is essential.

Research suggests that CAD (also referred to as coronary heart disease, abbreviated CHD) starts when certain factors damage the inner layers of the coronary arteries. These factors include:

- Smoking
- High levels of certain fats and cholesterol in the blood
- High blood pressure
- High levels of sugar in the blood due to insulin resistance or diabetes

## Causes of CAD



When damage occurs, your body starts a healing process. The healing may cause plaque to build up where the arteries are damaged. Plaque is made up of deposits of cholesterol and other substances in the artery. This progression of plaque build up is called **atherosclerosis**.

The buildup of plaque in the coronary arteries may start in childhood. Over time, plaque can narrow or block some of your coronary arteries. This reduces the flow of oxygen-rich blood to your heart muscle.

Eventually, an area of plaque can rupture (break open). If this happens, blood cell fragments called platelets will stick to the site of the injury and may clump together to form blood clots. Blood clots narrow the coronary arteries even more and worsen angina (chest discomfort or pain) or cause a heart attack.

Over time, CAD can weaken the heart muscle. This may lead to heart failure, a serious condition where the heart can't pump blood the way that it should. An irregular heartbeat, or arrhythmia, also can develop.

If you or a loved one has CAD, watch this video to learn how to actively manage it while also reducing further risk:



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## Other Conditions Related to Heart Disease

Coronary artery disease is the most common type of heart disease, but there are many other conditions that affect the heart:

**Acute coronary syndrome** is a term that includes heart attack and unstable angina.

**Angina,** a symptom of coronary artery disease, is chest pain or discomfort that occurs when the heart muscle is not getting enough blood. Angina may feel like pressure or a squeezing pain in the chest. The pain also may occur in the shoulders, arms, neck, jaw, or back. It may feel like indigestion.

There are two forms of angina—stable or unstable:

- **Stable angina** happens during physical activity or under mental or emotional stress.
- **Unstable angina** is chest pain that occurs even while at rest, without apparent reason. This type of angina is a medical emergency.

**Aortic aneurysm and dissection** are conditions that can affect the aorta, the major artery that carries blood from the heart to the body. An aneurysm is an enlargement in the aorta that can rupture or burst. A dissection is a tear in the aorta. Both of these conditions are medical emergencies.

**Arrhythmias** are irregular or unusually fast or slow heartbeats. Arrhythmias can be serious. One example is called ventricular fibrillation. This type of arrhythmia causes an abnormal heart rhythm that leads to death unless treated right away with an electrical shock to the heart (called defibrillation). Other arrhythmias are less severe but can develop into more serious conditions, such as atrial fibrillation, which can cause a stroke.

**Atherosclerosis** occurs when plaque builds up in the arteries that supply blood to the heart (called coronary arteries). Plaque is made up of cholesterol deposits. Plaque buildup causes arteries to narrow over time.

**Atrial fibrillation** is a type of arrhythmia that can cause rapid, irregular beating of the heart's upper chambers. Blood may pool and clot inside the heart, increasing the risk for heart attack and stroke.

**Cardiomyopathy** occurs when the heart muscle becomes enlarged or stiff. This can lead to inadequate heart pumping (or weak heart pump) or other problems. Cardiomyopathy has many causes, including family history of the disease, prior heart attacks, uncontrolled high blood pressure, and viral or bacterial infections.

**Congenital heart defects** are problems with the heart that are present at birth. They are the most common type of major birth defect. Examples include abnormal heart valves or holes in the heart's walls that divide the heart's chambers. Congenital heart defects range from minor to severe.

**Heart failure** is often called congestive heart failure because of fluid buildup in the lungs, liver, gastrointestinal tract, and the arms and legs. Heart failure is a serious condition that occurs when the heart can't pump enough blood to meet the body's needs. It does not mean that the heart has stopped but that muscle is too weak to pump enough blood. The majority of heart failure cases are chronic, or long-term heart failures.

The only cure for heart failure is a heart transplant. However, heart failure can be managed with medications or medical procedures.

**Peripheral arterial disease (PAD)** occurs when the arteries that supply blood to the arms and legs (the periphery) become narrow or stiff. PAD usually results from atherosclerosis, the buildup of plaque and narrowing of the arteries. With this condition, blood flow and oxygen to the arm and leg muscles are low or even fully blocked. Signs and symptoms include leg pain, numbness, and swelling in the ankles and feet.

**Rheumatic heart disease** is damage to the heart valves caused by a bacterial (streptococcal) infection called rheumatic fever.

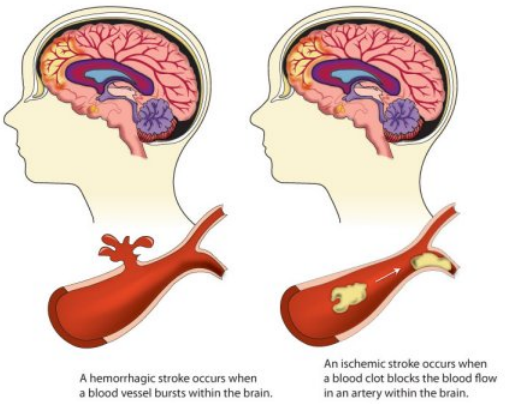
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# 14.3: Types of Stroke




The main types of stroke are:

- Ischemic stroke.
- Hemorrhagic stroke.
- Transient ischemic attack (a warning or “mini-stroke”).

## Ischemic Stroke

Most strokes (85%) are ischemic strokes. If you have an ischemic stroke, the artery that supplies oxygen-rich blood to the brain becomes blocked.

Blood clots often cause the blockages that lead to ischemic strokes.

## Hemorrhagic Stroke

A hemorrhagic stroke occurs when an artery in the brain leaks blood or ruptures (breaks open). The leaked blood puts too much pressure on brain cells, which damages them.

High blood pressure and aneurysms—balloon-like bulges in an artery that can stretch and burst—are examples of conditions that can cause a hemorrhagic stroke.

There are two types of hemorrhagic strokes:

- **Intracerebral hemorrhage** is the most common type of hemorrhagic stroke. It occurs when an artery in the brain bursts, flooding the surrounding tissue with blood.
- **Subarachnoid hemorrhage** is a less common type of hemorrhagic stroke. It refers to bleeding in the area between the brain and the thin tissues that cover it.

## Transient Ischemic Attack (TIA)

A transient ischemic attack (TIA) is sometimes called a “mini-stroke.” It is different from the major types of stroke because blood flow to the brain is blocked for only a short time—usually no more than 5 minutes.

It is important to know that:

- A TIA is a warning sign of a future stroke.
- A TIA is a medical emergency, just like a major stroke.
- Strokes and TIAs require emergency care. **Call 9-1-1** right away if you feel signs of a stroke or see symptoms in someone around you.
- There is no way to know in the beginning whether symptoms are from a TIA or from a major type of stroke.
- Like ischemic strokes, blood clots often cause TIAs.
- More than a third of people who have a TIA end up having a major stroke within 1 year if they don’t receive treatment, and 10%-15% will have a major stroke within 3 months of a TIA.

Recognizing and treating TIAs can reduce the risk of a major stroke. If you have a TIA, your health care team can find the cause and take steps to prevent a major stroke.

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# 14.4: Metabolic Syndrome

## What Is Metabolic Syndrome?

Metabolic syndrome is the name for a group of risk factors that raises your risk for heart disease and other health problems, such as diabetes and stroke.

The term “metabolic” refers to the biochemical processes involved in the body’s normal functioning. Risk factors are traits, conditions, or habits that increase your chance of developing a disease.

In this article, “heart disease” refers to coronary heart disease (CHD). CHD (also called coronary artery disease, abbreviated CAD) is a condition in which a waxy substance called plaque builds up inside the coronary (heart) arteries.

Plaque hardens and narrows the arteries, reducing blood flow to your heart muscle. This can lead to chest pain, a heart attack, heart damage, or even death.

## Metabolic Risk Factors

The five conditions described below are metabolic risk factors. You can have any one of these risk factors by itself, but they tend to occur together. You must have at least three metabolic risk factors to be diagnosed with metabolic syndrome.

### A Large Waistline

Having a large waistline means that you carry excess weight around your waist (abdominal obesity). This is also called having an “apple-shaped” figure. Your doctor will measure your waist to find out whether you have a large waistline.

**A waist measurement of 35 inches or more for women or 40 inches or more for men** is a metabolic risk factor. A large waistline means you’re at increased risk for heart disease and other health problems.

### A High Triglyceride Level

Triglycerides are a type of fat found in the blood. **A triglyceride level of 150 mg/dL or higher** (or being on medicine to treat high triglycerides) is a metabolic risk factor. (The mg/dL is milligrams per deciliter—the units used to measure triglycerides, cholesterol, and blood sugar.)

### A Low HDL Cholesterol Level

HDL cholesterol sometimes is called “good” cholesterol. This is because it helps remove cholesterol from your arteries.

**An HDL cholesterol level of less than 50 mg/dL for women and less than 40 mg/dL for men** (or being on medicine to treat low HDL cholesterol) is a metabolic risk factor.

### High Blood Pressure

**A blood pressure of 130/85 mmHg or higher** (or being on medicine to treat high blood pressure) is a metabolic risk factor. (The mmHg is millimeters of mercury—the units used to measure blood pressure.)

If only one of your two blood pressure numbers is high, you’re still at risk for metabolic syndrome.

### High Fasting Blood Sugar

A normal fasting blood sugar level is less than 100 mg/dL. A fasting blood sugar level between 100–125 mg/dL is considered prediabetes. A fasting blood sugar level of 126 mg/dL or higher is considered diabetes.

**A fasting blood sugar level of 100 mg/dL or higher** (or being on medicine to treat high blood sugar) is a metabolic risk factor.

About 85 percent of people who have type 2 diabetes—the most common type of diabetes—also have metabolic syndrome. These people have a much higher risk for heart disease than the 15 percent of people who have type 2 diabetes without metabolic syndrome.

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# 14.5: Cholesterol Management

## What Is Cholesterol?

To understand high blood cholesterol, it helps to learn about cholesterol. Cholesterol is a waxy, fat-like substance that's found in all cells of the body. Your body needs some cholesterol to make hormones, vitamin D, and substances that help you digest foods. Your body makes all the cholesterol it needs. However, cholesterol also is found in some of the foods you eat. Cholesterol travels through your bloodstream in small packages called lipoproteins. These packages are made of fat (lipid) on the inside and proteins on the outside.

Two kinds of lipoproteins carry cholesterol throughout your body: low-density lipoproteins (LDL) and high-density lipoproteins (HDL). Having healthy levels of both types of lipoproteins is important.

LDL cholesterol sometimes is called "bad" cholesterol. A high LDL level leads to a buildup of cholesterol in your arteries. (Arteries are blood vessels that carry blood from your heart to your body.)

HDL cholesterol sometimes is called "good" cholesterol. This is because it carries cholesterol from other parts of your body back to your liver. Your liver removes the cholesterol from your body.

## What Is High Blood Cholesterol?

High blood cholesterol is a condition in which you have too much cholesterol in your blood. By itself, the condition usually has no signs or symptoms. Thus, many people don't know that their cholesterol levels are too high.

People who have high blood cholesterol have a greater chance of getting coronary heart disease, also called coronary artery disease. (In this article, the term "heart disease" refers to coronary heart disease.) The higher the level of LDL cholesterol in your blood, the GREATER your chance is of getting heart disease. The higher the level of HDL cholesterol in your blood, the LOWER your chance is of getting heart disease.

Coronary heart disease is a condition in which plaque builds up inside the coronary (heart) arteries. Plaque is made up of cholesterol, fat, calcium, and other substances found in the blood. When plaque builds up in the arteries, the condition is called atherosclerosis.

## What Causes High Blood Cholesterol?

Many factors can affect the cholesterol levels in your blood. You can control some factors, but not others.

## Factors You Can Control

### Diet

Cholesterol is found in foods that come from animal sources, such as egg yolks, meat, and cheese. Some foods have fats that raise your cholesterol level.

For example, **saturated fat raises your low-density lipoprotein (LDL) cholesterol level more than anything else in your diet**. Saturated fat is found in some meats, dairy products, chocolate, baked goods, and deep-fried and processed foods.

*Trans* fatty acids (*trans* fats) raise your LDL cholesterol and lower your high-density lipoprotein (HDL) cholesterol. *Trans* fats are made when hydrogen is added to vegetable oil to harden it. *Trans* fats are found in some fried and processed foods.

Limiting foods with cholesterol, saturated fat, and *trans* fats can help you control your cholesterol levels.

### Physical Activity and Weight

Lack of physical activity can lead to weight gain. Being overweight tends to raise your LDL level, lower your HDL level, and increase your total cholesterol level. (Total cholesterol is a measure of the total amount of cholesterol in your blood, including LDL and HDL.)

Routine physical activity can help you lose weight and lower your LDL cholesterol. Being physically active also can help you raise your HDL cholesterol level.

## Factors You Can't Control

### Heredity

High blood cholesterol can run in families. An inherited condition called familial hypercholesterolemia causes very high LDL cholesterol. ("Inherited" means the condition is passed from parents to children through genes.) This condition begins at birth, and it may cause a heart attack at an early age.

### Age and Sex

Starting at puberty, men often have lower levels of HDL cholesterol than women. As women and men age, their LDL cholesterol levels often rise. Before age 55, women usually have lower LDL cholesterol levels than men. However, after age 55, women can have higher LDL levels than men.

## How Is High Blood Cholesterol Diagnosed?

Your doctor will diagnose high blood cholesterol by checking the cholesterol levels in your blood. A blood test called a lipoprotein panel can measure your cholesterol levels. Before the test, you'll need to fast (not eat or drink anything but water) for 9 to 12 hours.

The lipoprotein panel will give your doctor information about your:

- Total cholesterol. Total cholesterol is a measure of the total amount of cholesterol in your blood, including low-density lipoprotein (LDL) cholesterol and high-density lipoprotein (HDL) cholesterol.
- LDL cholesterol. LDL, or "bad," cholesterol is the main source of cholesterol buildup and blockages in the arteries.
- HDL cholesterol. HDL, or "good," cholesterol helps remove cholesterol from your arteries.
- Triglycerides (tri-GLIH-seh-rides). Triglycerides are a type of fat found in your blood. Some studies suggest that a high level of triglycerides in the blood may raise the risk of coronary heart disease, especially in women.

If it's not possible to have a lipoprotein panel, knowing your total cholesterol and HDL cholesterol can give you a general idea about your cholesterol levels.

Testing for total and HDL cholesterol does not require fasting. If your total cholesterol is 200 mg/dL or more, or if your HDL cholesterol is less than 40 mg/dL, your doctor will likely recommend that you have a lipoprotein panel. (Cholesterol is measured as milligrams (mg) of cholesterol per deciliter (dL) of blood.)

The tables below show total, LDL, and HDL cholesterol levels and their corresponding categories. See how your cholesterol numbers compare to the numbers in the tables below.

| Total Cholesterol Level | Total Cholesterol Category |
|---|---|
| Less than 200 mg/dL | Desirable |
| 200–239 mg/dL | Borderline high |
| 240 mg/dL and higher | High |

| LDL Cholesterol Level | LDL Cholesterol Category |
|---|---|
| Less than 100 mg/dL | Optimal |
| 100–129 mg/dL | Near optimal/above optimal |
| 130–159 mg/dL | Borderline high |
| 160–189 mg/dL | High |
| 190 mg/dL and higher | Very high |

| HDL Cholesterol Level | HDL Cholesterol Category |
|---|---|
| Less than 40 mg/dL | A major risk factor for heart disease |
| 40–59 mg/dL | The higher, the better |

| | |
|---|---|
| 60 mg/dL and higher | Considered protective against heart disease |

Triglycerides also can raise your risk for heart disease. If your triglyceride level is borderline high (150–199 mg/dL) or high (200 mg/dL or higher), you may need treatment.

## How Is High Blood Cholesterol Treated?

High blood cholesterol is treated with lifestyle changes and medicines. The main goal of treatment is to lower your low-density lipoprotein (LDL) cholesterol level enough to reduce your risk for coronary heart disease, heart attack, and other related health problems.

Your risk for heart disease and heart attack goes up as your LDL cholesterol level rises and your number of heart disease risk factors increases.

Some people are at high risk for heart attacks because they already have heart disease. Other people are at high risk for heart disease because they have diabetes or more than one heart disease risk factor.

Talk with your doctor about lowering your cholesterol and your risk for heart disease. Also, check the list to find out whether you have risk factors that affect your LDL cholesterol goal:

- Cigarette smoking
- High blood pressure (140/90 mmHg or higher), or you're on medicine to treat high blood pressure
- Low high-density lipoprotein (HDL) cholesterol (less than 40 mg/dL)
- Family history of early heart disease (heart disease in father or brother before age 55; heart disease in mother or sister before age 65)
- Age (men 45 years or older; women 55 years or older)

## Lowering Cholesterol Using Therapeutic Lifestyle Changes

TLC is a set of lifestyle changes that can help you lower your LDL cholesterol. The main parts of the TLC program are a healthy diet, weight management, and physical activity.

### The TLC Diet

With the TLC diet, less than 7 percent of your daily calories should come from saturated fat. This kind of fat is found in some meats, dairy products, chocolate, baked goods, and deep-fried and processed foods.

No more than 25 to 35 percent of your daily calories should come from all fats, including saturated, *trans*, monounsaturated, and polyunsaturated fats.

You also should have less than 200 mg a day of cholesterol. The amounts of cholesterol and the types of fat in prepared foods can be found on the foods' Nutrition Facts labels.

**Foods high in soluble fiber** also are part of the TLC diet. They help prevent the digestive tract from absorbing cholesterol. These foods include:

- Whole-grain cereals such as oatmeal and oat bran
- Fruits such as apples, bananas, oranges, pears, and prunes
- Legumes such as kidney beans, lentils, chick peas, black-eyed peas, and lima beans

A diet rich in fruits and vegetables can increase important cholesterol-lowering compounds in your diet. These compounds, called plant stanols or sterols, work like soluble fiber.

A healthy diet also includes some types of fish, such as salmon, tuna (canned or fresh), and mackerel. These fish are a good source of omega-3 fatty acids. These acids may help protect the heart from blood clots and inflammation and reduce the risk of heart attack. Try to have about two fish meals every week.

You also should try to limit the amount of sodium (salt) that you eat. This means choosing low-salt and "no added salt" foods and seasonings at the table or while cooking. The Nutrition Facts label on food packaging shows the amount of sodium in the item.

Try to limit drinks with alcohol. Too much alcohol will raise your blood pressure and triglyceride level. (Triglycerides are a type of fat found in the blood.) Alcohol also adds extra calories, which will cause weight gain.

Men should have no more than two drinks containing alcohol a day. Women should have no more than one drink containing alcohol a day. One drink is a glass of wine, beer, or a small amount of hard liquor.

### Weight Management

If you're overweight or obese, losing weight can help lower LDL cholesterol. Maintaining a healthy weight is especially important if you have a condition called metabolic syndrome.

Metabolic syndrome is the name for a group of risk factors that raise your risk for heart disease and other health problems, such as diabetes and stroke.

The five metabolic risk factors are a large waistline (abdominal obesity), a high triglyceride level, a low HDL cholesterol level, high blood pressure, and high blood sugar. Metabolic syndrome is diagnosed if you have at least three of these metabolic risk factors.

### Physical Activity

Routine physical activity can lower LDL cholesterol and triglycerides and raise your HDL cholesterol level.

People gain health benefits from as little as 60 minutes of moderate-intensity aerobic activity per week (however, 150 minutes per week is the recommendation). The more active you are, the more you will benefit.

### Cholesterol-Lowering Medicines

In addition to lifestyle changes, your doctor may prescribe medicines to help lower your cholesterol. Even with medicines, you should continue the TLC program.

Medicines can help control high blood cholesterol, but they don't cure it.

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# CHAPTER OVERVIEW

## 15: Assessing Your Wellness


15.1: Unit 2 Overview and Objectives

15.2: Reading Links- Assessing Your Wellness

15.3: Video- Six Stages of Change

15.4: Assessment- Wellness Quiz and Stages of Change Strategies


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# 15.1: Unit 2 Overview and Objectives

**Overview**

Now that you know have taken the first steps, you can chart your path and map out your journey. In fitness and wellness, we begin with baseline assessments (pre-tests) that will tell you where you are now, and will allow you to monitor your progress as you move toward your goal.

**Learning Objectives**

At the end of unit, you will be able to:

- Articulate the current physical activity recommendations for optimal health and fitness
- Discuss chronic health problems that are affected by sedentary behaviors and nutrition choices
- Describe the health-related components of fitness and how they differ from each other
- Explain the principles of physical adaptation to training including specificity, progressive overload, reversibility, and individual differences.
- List the steps to maintain safety when designing a well-rounded and effective exercise program
- Explain the four dimensions represented by the acronym FITT Describe the basic anatomy and physiology of the cardiorespiratory system and how it is affected by exercise
- Define energy production and the energy systems Outline the benefits you obtain from cardiorespiratory endurance exercise
- Assess your cardiorespiratory endurance level and set appropriate goals
- Apply the FITT dimensions (frequency, intensity, time [duration], and type) to the development of a cardiorespiratory endurance program
- List basic exercise-related first aid principles and steps to prevent exercise injuries
- Outline the benefits of flexibility exercises
- Identify the factors that influence joint flexibility
- Explain how the different types of stretching exercises work
- Assess your flexibility level and set appropriate goals
- Apply the FITT dimensions to the development of a flexibility program and select safe stretching exercises for major joints
- Describe strategies to prevent and manage low-back pain

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# 15.2: Reading Links- Assessing Your Wellness

## Purpose

This section focuses on important information about health and wellness. Topics include dimensions of health/wellness, behavior change theories, strategies to promote lifelong wellness, and how to create SMART goals among others.

## Directions

The rest of this chapter contains your reading for this section.

Additionally, information on these external sources will be useful to deepen your understanding:

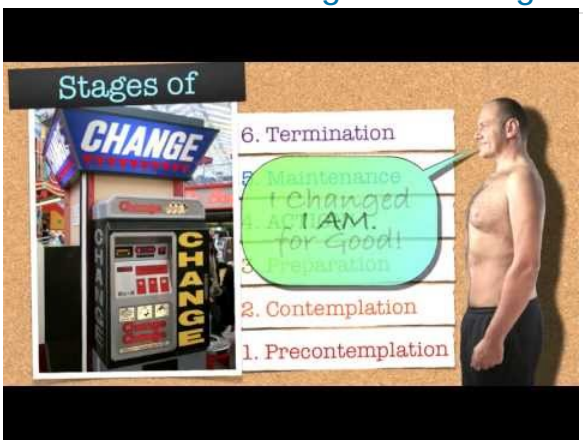
- American Council on Fitness's "Fit Goals: Reaching Your Goals the SMART way"
- American Council on Fitness's "Part V: Program Design and Implementation" (read pgs. 270-272)
- American Council on Fitness's Podcast "Episode 4: Know Where You're Going"

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# 15.3: Video- Six Stages of Change




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# 15.4: Assessment- Wellness Quiz and Stages of Change Strategies

## Purpose

This assignment aims to evaluate your wellness in a number of areas and help you design strategies to improve your overall wellness. Take the wellness quiz and reflect on your results. Then use your results from the wellness assessment and the information about the stages of change theory from the readings to formulate behavior change strategies.

## Directions

- Take Simon Fraser University's wellness quiz and reflect on your results
- Open the Wellness Quiz and Stages of Change Strategies document attached and type in the following information:
  - Brief reflection about your wellness quiz answers;
  - List three of your current behaviors you would like to modify;
  - State the stage of change that currently applies to each behavior;
  - List a specific strategy you will use to modify each behavior (keep in mind the strategy must be appropriate to the stage of change you listed on item "b").
  - You may use Simon Fraser University's health and wellness guide for students to help you create specific behavior modification strategies
- Save the document and upload to the course.

## Grading

This assignment is worth 10 points maximum.

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# CHAPTER OVERVIEW

## 16: Introduction to Fitness and Wellness


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# 16.1: Introduction to Fitness and Wellness Readings

## Purpose

The readings will help you understand the key tems used in this unit and give you a basic introduction to the topics covered.

## Directions

- Read Module key terms, sections one and two of this document: Health-Related Fitness Overview
  This overview document was created by Mr. Travis M. Erickson, MS, CSCS*D, Lecturer for the Appalachian State University department of Health, Leisure, and Exercise Science (ericksontm@appstate.edu).
- Read all the information under the blue heading “Chronic disease prevention” in this article: Chronic Disease Prevention – Encyclopedia of Fitness (Avritt, Julie Jordan. “Chronic Disease Prevention.” *The Gale Encyclopedia of Fitness*. Ed. Jacqueline L. Longe. Vol. 1. Detroit: Gale, 2012. 172-176. *Gale Virtual Reference Library*. Retrieved from http://go.galegroup.com/ps/i.do?id=G...acb5f8d8a28a4d)
- Read Warm Up and Cool Down (Alic, Margaret. “Warm-Up and Cool Down.” *The Gale Encyclopedia of Fitness*. Ed. Jacqueline L. Longe. Vol. 2. Detroit: Gale, 2012. 900-903. *Gale Virtual Reference Library*. Retrieved fromhttp://go.galegroup.com/ps/i.do?...05a9ef11a3b848)
  - Before you start planning your exercise program, it is important to have a better understanding of the acute physiological changes that occur during exercise and how the warm up ad cool down periods can help you transition from rest to exercise and vice versa. All the information contained in this article is important, however, pay special attention to any information that is new to you. For instance, notice how static stretching is not recommended during the warm-up period, but dynamic stretching is a good option (you will learn more about the different types of stretching next week). In addition, note how any type of stretching should only be performed after the muscles have been properly warmed, thus stretching cold muscles is not safe practice. This is usually new information for most students and contrary to popular belief, but it is based on scientific evidence and I encourage you to incorporate this information in your own warm up and cool down plans.

**Important Information**

Since we utilize various open sources for this class, and some of these sources are aimed at the general public, you may notice some inconsistencies in how the terminology is used. For this reason, I want you to keep in mind the following definitions as you read the various materials this week.

- Health-related components of fitness: components of fitness that are necessary for good health. We will go over each one of these components in detail in the upcoming weeks. They are cardiorespiratory (CR) endurance (also called aerobic endurance), flexibility, muscular strength, muscular endurance, and body composition.
  1. **CR endurance** (aerobic endurance): The ability of the heart, blood vessels, and lungs to work together to accomplish three goals: 1) deliver oxygen to body tissues; 2) deliver nutrients; 3) remove waste products. CR endurance exercises involve large muscle groups in prolonged, dynamic movement (ex. running, swimming, etc)
  2. **Flexibility**: The ability of moving a joint through the range of motion.
  3. **Muscular strength**: The ability of muscles to exert maximal effort.
  4. **Muscular endurance**: The ability of muscles to exert submaximal effort repetitively (contract over and over again or hold a contraction for a long time).
  5. **Body composition**: The percentage of the body composed of lean tissue (muscle, bone, fluids, etc.) and fat tissue.

There are also other components of fitness related to sports performance rather than just health. They are called skill-related components of fitness or motor fitness and include power, speed, agility, balance, and coordination. For the purpose of this class we will focus mainly on the health-related components of fitness.

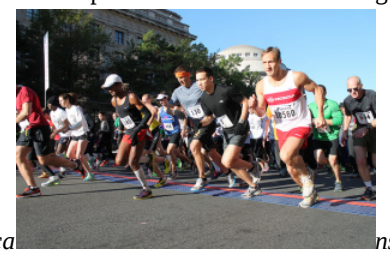
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# 16.2: Introducing the 2008 Physical Activity Guidelines for Americans

Being physically active is one of the most important steps that Americans of all ages can take to improve their health. This



inaugural *Physical Activity Guidelines for America**ns* provides science-based guidance to help Americans aged 6 and older improve their health through appropriate physical activity. The U.S. Department of Health and Human Services (HHS) issues the *Physical Activity Guidelines for Americans.* The content of the *Physical Activity Guidelines* complements the *Dietary Guidelines for Americans,* a joint effort of HHS and the U.S. Department of Agriculture (USDA). Together, the two documents provide guidance on the importance of being physically active and eating a healthy diet to promote good health and reduce the risk of chronic diseases. This chapter provides background information about the rationale and process for developing the Guidelines. It then discusses several issues that provide the framework for understanding the Guidelines. The chapter also explains how these Guidelines fit in with other published physical activity recommendations and how they should be used in practice.

## Why and How the Guidelines Were Developed

### *The Rationale for Physical Activity Guidelines*

We clearly know enough now to recommend that all Americans should engage in regular physical activity to improve overall health and to reduce risk of many health problems. Physical activity is a leading example of how lifestyle choices have a profound effect on health. The choices we make about other lifestyle factors, such as diet, smoking, and alcohol use, also have important and independent effects on our health.

The primary audiences for the *Physical Activity Guidelines for Americans* are policymakers and health professionals. The Guidelines are designed to provide information and guidance on the types and amounts of physical activity that provide substantial health benefits. This information may also be useful to interested members of the public. The main idea behind the Guidelines is that regular physical activity over months and years can produce long-term health benefits. Realizing these benefits requires physical activity each week.

These Guidelines are necessary because of the importance of physical activity to the health of Americans, whose current inactivity puts them at unnecessary risk. *Healthy People 2010* set objectives for increasing the level of physical activity in Americans over the decade from 2000 to 2010. Unfortunately, the latest information shows that inactivity among American adults and youth remains relatively high and that little progress has been made in meeting these objectives.

### *The Development of the Physical Activity Guidelines for Americans*

Since 1995 the *Dietary Guidelines for Americans* has included advice on physical activity. However, with the development of a firm science base on the health benefits of physical activity, HHS began to consider whether separate physical activity guidelines were appropriate. With the help of the Institute of Medicine, HHS convened a workshop in October 2006 to address this question. The workshop's report, *Adequacy of Evidence for Physical Activity Guidelines Development* (http://www.nap.edu/catalog.php?record_id=11819), affirmed that advances in the science of physical activity and health justified the creation of separate physical activity guidelines.

The steps used to develop the *Physical Activity Guidelines for Americans* were similar to those used for the *Dietary Guidelines for Americans.* In 2007 HHS Secretary Mike Leavitt appointed an external scientific advisory committee called the Physical Activity Guidelines Advisory Committee. The Advisory Committee conducted an extensive analysis of the scientific information on physical activity and health. The *Physical Activity Guidelines Advisory Committee Report, 2008* and meeting summaries are available at http://www.health.gov/PAGuidelines/.

HHS primarily used the Advisory Committee's report but also considered comments from the public and Government agencies when writing the Guidelines. The Guidelines will be widely promoted through various communications strategies, such as materials for the public, Web sites, and partnerships with organizations that promote physical activity.

## The Framework for the Physical Activity Guidelines for Americans

The Advisory Committee report provided the content and conceptual underpinning for the Guidelines. The main elements of this framework are described in the following sections.

### *Baseline Activity Versus Health-Enhancing Physical Activity*

Physical activity has been defined as any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level. However, in this document, the term “physical activity” will generally refer to bodily movement that enhances health. Bodily movement can be divided into two categories:

- Baseline activity refers to the light-intensity activities of daily life, such as standing, walking slowly, and lifting lightweight objects. People vary in how much baseline activity they do. People who do only baseline activity are considered to be inactive. They may do very short episodes of moderate- or vigorous-intensity activity, such as climbing a few flights of stairs, but these episodes aren’t long enough to count toward meeting the Guidelines. The Guidelines don’t comment on how variations in types and amounts of baseline physical activity might affect health, as this was not addressed by the Advisory Committee report.
- Health-enhancing physical activity is activity that, when added to baseline activity, produces health benefits. In this document, the term “physical activity” generally refers to health-enhancing physical activity. Brisk walking, jumping rope, dancing, lifting weights, climbing on playground equipment at recess, and doing yoga are all examples of physical activity. Some people (such as postal carriers or carpenters on construction sites) may get enough physical activity on the job to meet the Guidelines.

We don’t understand enough about whether doing more baseline activity results in health benefits. Even so, efforts to promote baseline activities are justifiable. After all, baseline activities are normal lifestyle activities. Encouraging Americans to increase their baseline activity is sensible for several reasons:

- Increasing baseline activity burns calories, which can help in maintaining a healthy body weight.
- Some baseline activities are weight-bearing and may improve bone health.
- There are reasons other than health to encourage more baseline activity. For example, walking short distances instead of driving can help reduce traffic congestion and the resulting air pollution.
- Encouraging baseline activities helps build a culture where physical activity in general is the social norm.
- Short episodes of activity are appropriate for people who were inactive and have started to gradually increase their level of activity, and for older adults whose activity may be limited by chronic conditions.

The availability of infrastructure to support short episodes of activity is therefore important. For example, people should have the option of using sidewalks and paths to walk between buildings at a worksite, rather than having to drive. People should also have the option of taking the stairs instead of using an elevator.

### *Health Benefits Versus Other Reasons To Be Physically Active*



Although the Guidelines focus on the health benefits of physical activity, these benefits are not the only reason why people are active. Physical activity gives people a chance to have fun, be with friends and family, enjoy the outdoors, improve their personal appearance, and improve their fitness so that they can participate in more intensive physical activity or sporting events. Some people are active because they feel it gives them certain health benefits (such as feeling more energetic) that aren’t yet conclusively proven for the general population.

The Guidelines encourage people to be physically active for any and all reasons that are meaningful for them. Nothing in the Guidelines is intended to mean that health benefits are the only reason to do physical activity.

### *Focus on Disease Prevention*

The Guidelines focus on preventive effects of physical activity, which include lowering the risk of developing chronic diseases such as heart disease and type 2 diabetes.

Physical activity also has beneficial therapeutic effects and is commonly recommended as part of the treatment for medical conditions. The Advisory Committee report did not review the therapeutic effects of activity, and the Guidelines do not discuss the use of physical activity as medical treatment.

### Health-Related Versus Performance-Related Fitness

The Guidelines focus on reducing the risk of chronic disease and promoting *health-related* fitness, particularly cardiovascular and muscular fitness. People can gain this kind of fitness by doing the amount and types of activities recommended in the Guidelines.

The Guidelines do not address the types and amounts of activity necessary to improve *performance-related* fitness. Athletes need this kind of fitness when they compete. Medical screening issues for competitive athletes also are outside the scope of the Guidelines.

People who are interested in training programs to increase performance-related fitness should seek advice from other sources. Generally, these people do much more activity than required to meet the Guidelines.

### Lifespan Approach

The best way to be physically active is to be active for life. Therefore, the Guidelines take a lifespan approach and provide recommendations for three age groups: Children and Adolescents, Adults, and Older Adults.

The *Physical Activity Guidelines* are for Americans aged 6 and older. The Advisory Committee report did not review evidence for children younger than age 6. Physical activity in infants and young children is, of course, necessary for healthy growth and development. Children younger than 6 should be physically active in ways appropriate for their age and stage of development.

*Individualized Health Goals*

The Guidelines generally explain the amounts and types of physical activity needed for health benefits.

Within these overall parameters, individuals have many choices about appropriate types and amounts of activity.

To make these choices, American adults need to set personal goals for physical activity. Setting these goals involves questions like, “How physically fit do I want to be?” “How important is it to me to reduce my risk of heart disease and diabetes?” “How important is it to me to reduce my risk of falls and hip fracture?” “How much weight do I want to lose and keep off?”

People can meet the Guidelines and their own personal goals through different amounts and types of activity. Written materials, health-care providers, and fitness professionals can provide useful information and help people set and carry out specific goals.

### Four Levels of Physical Activity

The Advisory Committee report provides the basis for dividing the amount of aerobic physical activity an adult gets every week into four categories: inactive, low, medium, and high (see table below). This classification is useful because these categories provide a rule of thumb of how total amount of physical activity is related to health benefits. Low amounts of activity provide some benefits; medium amounts provide substantial benefits; and high amounts provide even greater benefits.

**Classification of Total Weekly Amounts of Aerobic Physical Activity Into Four Categories**

| Levels of Physical Activity | Range of Moderate-Intensity Minutes a Week | Summary of Overall Health Benefits | Comment |
|---|---|---|---|
| Inactive | No activity beyond baseline | None | Being inactive is unhealthy. |
| Low | Activity beyond baseline but fewer than 150 minutes a week | Some | Low levels of activity are clearly preferable to an inactive lifestyle. |

| | | | |
|---|---|---|---|
| Medium | 150 minutes to 300 minutes a week | Substantial | Activity at the high end of this range has additional and more extensive health benefits than activity at the low end. |
| High | More than 300 minutes a week | Additional | Current science does not allow researchers to identify an upper limit of activity above which there are no additional health benefits. |

- Inactive is no activity beyond baseline activities of daily living.
- Low activity is activity beyond baseline but fewer than 150 minutes (2 hours and 30 minutes) of moderate-intensity physical activity a week or the equivalent amount (75 minutes, or 1 hour and 15 minutes) of vigorous-intensity activity.
- Medium activity is 150 minutes to 300 (5 hours) minutes of moderate-intensity activity a week (or 75 to 150 minutes of vigorous-intensity physical activity a week). In scientific terms, this range is approximately equivalent to 500 to 1,000 metabolic equivalent (MET) minutes a week.
- High activity is more than the equivalent of 300 minutes of moderate-intensity physical activity a week.

For More Information Appendix 1 provides a detailed explanation of MET-minutes, a unit useful for describing the energy expenditure of a specific physical activity.

### *Relationship to Previous Public Health Recommendations*

In 1995 the Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM) published physical activity recommendations for public health. The report stated that adults should accumulate at least 30 minutes a day of moderate-intensity 

physical activity on most, preferably all, days per week. In 1996 *Physical Activity and Health: A Report of the Surgeon General* supported this same recommendation.

In order to track the percentage of adults who meet this guideline, CDC specified that “most” days per week was 5 days. Since 1995 the common recommendation has been that adults obtain at least 30 minutes of moderate-intensity physical activity on 5 or more days a week, for a total of at least 150 minutes a week.

The *Physical Activity Guidelines for Americans* affirms that it is acceptable to follow the CDC/ACSM recommendation and similar recommendations. However, according to the Advisory Committee report, the CDC/ACSM guideline was too specific. In other words, existing scientific evidence does not allow researchers to say, for example, whether the health benefits of 30 minutes on 5 days a week are any different from the health benefits of 50 minutes on 3 days a week. As a result, the new Guidelines allow a person to accumulate 150 minutes a week in various ways.

## Putting the Guidelines Into Practice

Although the Advisory Committee did not review strategies to promote physical activity, action is needed at the individual, community, and societal levels to help Americans become physically active. Publications such as the *Guide to Community Preventive Services* (http://www.thecommunityguide.org/pa/) and the recommendations of the U.S. Preventive Services Task Force (http://www.ahrq.gov/clinic/cps3dix.htm) summarize evidence-based strategies for promoting physical activity on the community level and through primary health care. Accordingly, the final chapter of the *Physical Activity Guidelines for Americans* provides only a brief discussion on promoting physical activity, and indicates how to link the Guidelines to action strategies.

### Assessing Whether Physical Activity Programs Are Consistent With the Guidelines

Programs that provide opportunities for physical activity, such as classes or community activities, can help people meet the Guidelines. These programs do not have to provide all, or even most, of the recommended weekly activity. For example, a mall walking program for older adults may meet only once a week yet provide useful amounts of activity, as long as people get the rest of their weekly recommended activity on other days.

Programs that are consistent with the Guidelines:

- Provide advice and education consistent with the Guidelines;
- Add episodes of activity that count toward meeting the Guidelines; and
- May also include activities, such as stretching or warming up and cooling down, whose health benefits are not yet proven but that are often used in effective physical activity programs.

### The Importance of Understandable Guidelines

HHS has tried to keep the *Physical Activity Guidelines* straightforward and clear, while remaining consistent with complex scientific information. In each chapter the key Guidelines are set apart from the text, in order to identify the most important information to communicate to the public. The messages contained in these Guidelines should be disseminated to the general public and to anyone involved in promoting physical activity.

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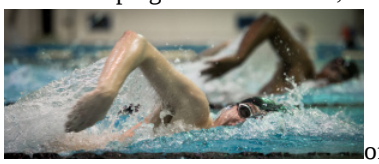
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# 16.3: Physical Activity Has Many Health Benefits

All Americans should be regularly physically active to improve overall health and fitness and to prevent many adverse health outcomes. The benefits of physical activity occur in generally healthy people, in people at risk of developing chronic diseases, and



in people with current chronic conditions or disabilities. This chapter gives an overview of research findings on physical activity and health. The box on page 8 provides a summary of these benefits. Physical activity affects many health conditions, and the specific amounts and types of activity that benefit each condition vary. In developing public health guidelines, the challenge is to integrate scientific information across all health benefits and identify a critical range of physical activity that appears to have an effect across the health benefits. One consistent finding from research studies is that once the health benefits from physical activity begin to accrue, additional amounts of activity provide additional benefits. Although some health benefits seem to begin with as little as 60 minutes (1 hour) a week, research shows that a total amount of 150 minutes (2 hours and 30 minutes) a week of moderate-intensity aerobic activity, such as brisk walking, consistently reduces the risk of many chronic diseases and other adverse health outcomes.

## Examining the Relationship Between Physical Activity and Health

In many studies covering a wide range of issues, researchers have focused on exercise, as well as on the more broadly defined concept of physical activity. Exercise is a form of physical activity that is planned, structured, repetitive, and performed with the goal of improving health or fitness. So, although all exercise is physical activity, not all physical activity is exercise.

Studies have examined the role of physical activity in many groups—men and women, children, teens, adults, older adults, people with disabilities, and women during pregnancy and the postpartum period. These studies have focused on the role that physical activity plays in many health outcomes, including:

- Premature (early) death;
- Diseases such as coronary heart disease, stroke, some cancers, type 2 diabetes, osteoporosis, and depression;
- Risk factors for disease, such as high blood pressure and high blood cholesterol;
- Physical fitness, such as aerobic capacity, and muscle strength and endurance;
- Functional capacity (the ability to engage in activities needed for daily living);
- Mental health, such as depression and cognitive function; and
- Injuries or sudden heart attacks.

These studies have also prompted questions as to what type and how much physical activity is needed for various health benefits. To answer this question, investigators have studied three main kinds of physical activity: aerobic, muscle-strengthening, and bone-strengthening. Investigators have also studied balance and flexibility activities. These latter two activities are addressed in Chapters 4, 5, and 6.

**The Health Benefits of Physical Activity—Major Research Findings**

- Regular physical activity reduces the risk of many adverse health outcomes.
- Some physical activity is better than none.
- For most health outcomes, additional benefits occur as the amount of physical activity increases through higher intensity, greater frequency, and/or longer duration.
- Most health benefits occur with at least 150 minutes a week of moderate-intensity physical activity, such as brisk walking. Additional benefits occur with more physical activity.
- Both aerobic (endurance) and muscle-strengthening (resistance) physical activity are beneficial.
- Health benefits occur for children and adolescents, young and middle-aged adults, older adults, and those in every studied racial and ethnic group.
- The health benefits of physical activity occur for people with disabilities.
- The benefits of physical activity far outweigh the possibility of adverse outcomes.

### *Aerobic Activity*

In this kind of physical activity (also called an endurance activity or cardio activity), the body's large muscles move in a rhythmic manner for a sustained period of time. Brisk walking, running, bicycling, jumping rope, and swimming are all examples.

Aerobic activity causes a person's heart to beat faster than usual.

Aerobic physical activity has three components:

- Intensity, or how hard a person works to do the activity. The intensities most often examined are moderate intensity (equivalent in effort to brisk walking) and vigorous intensity (equivalent in effort to running or jogging);
- Frequency, or how often a person does aerobic activity; and
- Duration, or how long a person does an activity in any one session.

Although these components make up a physical activity profile, research has shown that the total amount of physical activity (minutes of moderate-intensity physical activity, for example) is more important for achieving health benefits than is any one component (frequency, intensity, or duration).

### *Muscle-Strengthening Activity*

This kind of activity, which includes resistance training and lifting weights, causes the body's muscles to work or hold against an applied force or weight. These activities often involve relatively heavy objects, such as weights, which are lifted multiple times to train various muscle groups. Muscle-strengthening activity can also be done by using elastic bands or body weight for resistance (climbing a tree or doing push-ups, for example).

Muscle-strengthening activity also has three components:

- Intensity, or how much weight or force is used relative to how much a person is able to lift;
- Frequency, or how often a person does muscle-strengthening activity; and
- Repetitions, or how many times a person lifts a weight (analogous to duration for aerobic activity).

The effects of muscle-strengthening activity are limited to the muscles doing the work. It's important to work all the major muscle groups of the body: the legs, hips, back, abdomen, chest, shoulders, and arms.

### *Bone-Strengthening Activity*

This kind of activity (sometimes called weight-bearing or weight-loading activity) produces a force on the bones that promotes bone growth and strength. This force is commonly produced by impact with the ground. Examples of bone-strengthening activity include jumping jacks, running, brisk walking, and weight-lifting exercises. As these examples illustrate, bone-strengthening activities can also be aerobic and muscle strengthening.

## The Health Benefits of Physical Activity

Studies clearly demonstrate that participating in regular physical activity provides many health benefits. These benefits are summarized in the accompanying table. Many conditions affected by physical activity occur with increasing age, such as heart disease and cancer. Reducing risk of these conditions may require years of participation in regular physical activity. However, other benefits, such as increased cardiorespiratory fitness, increased muscular strength, and decreased depressive symptoms and blood pressure, require only a few weeks or months of participation in physical activity.

| Health Benefits Associated With Regular Physical Activity |
| --- |
| **Children and Adolescents** |
| |

**Strong evidence**
• Improved cardiorespiratory and muscular fitness
• Improved bone health
• Improved cardiovascular and metabolic health biomarkers
• Favorable body composition
**Moderate evidence**
• Reduced symptoms of depression

**Adults and Older Adults**

**Strong evidence**
• Lower risk of early death
• Lower risk of coronary heart disease
• Lower risk of stroke
• Lower risk of high blood pressure
• Lower risk of adverse blood lipid profile
• Lower risk of type 2 diabetes
• Lower risk of metabolic syndrome
• Lower risk of colon cancer
• Lower risk of breast cancer
• Prevention of weight gain
• Weight loss, particularly when combined with reduced calorie intake
• Improved cardiorespiratory and muscular fitness
• Prevention of falls
• Reduced depression
• Better cognitive function (for older adults)
**Moderate to strong evidence**
• Better functional health (for older adults)
• Reduced abdominal obesity
**Moderate evidence**
• Lower risk of hip fracture
• Lower risk of lung cancer
• Lower risk of endometrial cancer
• Weight maintenance after weight loss
• Increased bone density
• Improved sleep quality

*Note:* The Advisory Committee rated the evidence of health benefits of physical activity as strong, moderate, or weak. To do so, the Committee considered the type, number, and quality of studies available, as well as consistency of findings across studies that addressed each outcome. The Committee also considered evidence for causality and dose response in assigning the strength-of-evidence rating.

**The Beneficial Effects of Increasing Physical Activity: It's About Overload, Progression, and Specificity**

Overload is the physical stress placed on the body when physical activity is greater in amount or intensity than usual. The body's structures and functions respond and adapt to these stresses. For example, aerobic physical activity places a stress on the cardiorespiratory system and muscles, requiring the lungs to move more air and the heart to pump more blood and deliver it to the working muscles. This increase in demand increases the efficiency and capacity of the lungs, heart, circulatory system, and exercising muscles. In the same way, muscle-strengthening and bone-strengthening activities overload muscles and bones, making them stronger.

Progression is closely tied to overload. Once a person reaches a certain fitness level, he or she progresses to higher levels of physical activity by continued overload and adaptation. Small, progressive changes in overload help the body adapt to the additional stresses while minimizing the risk of injury.

Specificity means that the benefits of physical activity are specific to the body systems that are doing the work. For example, aerobic physical activity largely benefits the body's cardiovascular system.

The health benefits of physical activity are seen in children and adolescents, young and middle-aged adults, older adults, women and men, people of different races and ethnicities, and people with disabilities and chronic conditions. The health benefits of physical activity are generally independent of body weight. Adults of all sizes and shapes gain health and fitness benefits by being habitually physically active. The benefits of physical activity also outweigh the risk of injury and sudden heart attacks, two concerns that prevent many people from becoming physically active. The following sections provide more detail on what is known from research studies about the specific health benefits of physical activity and how much physical activity is needed to get the health benefits.

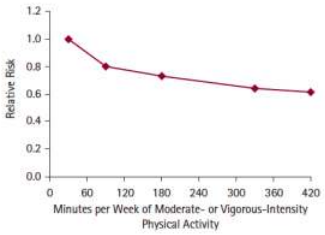
The following sections provide more detail on what is known from research studies about the specific health benefits of physical activity and how much physical activity is needed to get the health benefits.

### *Premature Death*

Strong scientific evidence shows that physical activity reduces the risk of premature death (dying earlier than the average age of death for a specific population group) from the leading causes of death, such as heart disease and some cancers, as well as from other causes of death. This effect is remarkable in two ways:

- First, only a few lifestyle choices have as large an effect on mortality as physical activity. It has been estimated that people who are physically active for approximately 7 hours a week have a 40 percent lower risk of dying early than those who are active for less than 30 minutes a week.
- Second, it is not necessary to do high amounts of activity or vigorous-intensity activity to reduce the risk of premature death. Studies show substantially lower risk when people do 150 minutes of at least moderate-intensity aerobic physical activity a week.

Research clearly demonstrates the importance of avoiding inactivity. Even low amounts of physical activity reduce the risk of dying prematurely. As the figure on page 1 1 shows, the most dramatic difference in risk is seen between those who are inactive (30 minutes a week) and those with low levels of activity (90 minutes or 1 hour and 30 minutes a week). The relative risk of dying prematurely continues to be lower with higher levels of reported moderate- or vigorous-intensity leisure-time physical activity. All adults can gain this health benefit of physical activity. Age, race, and ethnicity do not matter. Men and women younger than 65 years as well as older adults have lower rates of early death when they are physically active than when they are inactive. Physically active people of all body weights (normal weight, overweight, obese) also have lower rates of early death than do inactive people.




The Risk of Dying Prematurely Declines as People Become Physically Active

### *Cardiorespiratory Health*

The benefits of physical activity on cardiorespiratory health are some of the most extensively documented of all the health benefits. Cardiorespiratory health involves the health of the heart, lungs, and blood vessels.

Heart diseases and stroke are two of the leading causes of death in the United States. Risk factors that increase the likelihood of cardiovascular diseases include smoking, high blood pressure (called hypertension), type 2 diabetes, and high levels of certain blood lipids (such as low-density lipoprotein, or LDL, cholesterol). Low cardiorespiratory fitness also is a risk factor for heart disease.

 People who do moderate-or vigorous-intensity aerobic physical activity have a significantly lower risk of cardiovascular disease than do inactive people. Regularly active adults have lower rates of heart disease and stroke, and have lower blood pressure, better blood lipid profiles, and fitness. Significant reductions in risk of cardiovascular disease occur at activity levels equivalent to 150 minutes a week of moderate-intensity physical activity. Even greater benefits are seen with 200 minutes (3 hours and 20 minutes) a week. The evidence is strong that greater amounts of physical activity result in even further reductions in the risk of cardiovascular disease.

Everyone can gain the cardiovascular health benefits of physical activity. The amount of physical activity that provides favorable cardiorespiratory health and fitness outcomes is similar for adults of various ages, including older people, as well as for adults of various races and ethnicities. Aerobic exercise also improves cardiorespiratory fitness in individuals with some disabilities, including people who have lost the use of one or both legs and those with multiple sclerosis, stroke, spinal cord injury, and cognitive disabilities.

Moderate-intensity physical activity is safe for generally healthy women during pregnancy. It increases cardiorespiratory fitness without increasing the risk of early pregnancy loss, preterm delivery, or low birth weight. Physical activity during the postpartum period also improves cardiorespiratory fitness.

### *Metabolic Health*

Regular physical activity strongly reduces the risk of developing type 2 diabetes as well as the metabolic syndrome. The metabolic syndrome is defined as a condition in which people have some combination of high blood pressure, a large waistline (abdominal obesity), an adverse blood lipid profile (low levels of high-density lipoprotein [HDL] cholesterol, raised triglycerides), and impaired glucose tolerance.

People who regularly engage in at least moderate-intensity aerobic activity have a significantly lower risk of developing type 2 diabetes than do inactive people. Although some experts debate the usefulness of defining the metabolic syndrome, good evidence exists that physical activity reduces the risk of having this condition, as defined in various ways. Lower rates of these conditions are seen with 120 to 150 minutes (2 hours to 2 hours and 30 minutes) a week of at least moderate-intensity aerobic activity. As with cardiovascular health, additional levels of physical activity seem to lower risk even further. In addition, physical activity helps control blood glucose levels in persons who already have type 2 diabetes.

Physical activity also improves metabolic health in youth. Studies find this effect when young people participate in at least 3 days of vigorous aerobic activity a week. More physical activity is associated with improved metabolic health, but research has yet to determine the exact amount of improvement.

### *Obesity and Energy Balance*

Overweight and obesity occur when fewer calories are expended, including calories burned through physical activity, than are taken in through food and beverages. Physical activity and caloric intake both must be considered when trying to control body weight. Because of this role in energy balance, physical activity is a critical factor in determining whether a person can maintain a healthy body weight, lose excess body weight, or maintain successful weight loss. People vary a great deal in how much physical activity they need to achieve and maintain a healthy weight. Some need more physical activity than others to maintain a healthy body weight, to lose weight, or to keep weight off once it has been lost.

Strong scientific evidence shows that physical activity helps people maintain a stable weight over time. However, the optimal amount of physical activity needed to maintain weight is unclear. People vary greatly in how much physical activity results in weight stability. Many people need more than the equivalent of 150 minutes of moderate-intensity activity a week to maintain their weight.

Over short periods of time, such as a year, research shows that it is possible to achieve weight stability by doing the equivalent of 150 to 300 minutes (5 hours) a week of moderate-intensity walking at about a 4 mile-an-hour pace. Muscle-strengthening activities may help promote weight maintenance, although not to the same degree as aerobic activity.

People who want to lose a substantial (more than 5 percent of body weight) amount of weight and people who are trying to keep a significant amount of weight off once it has been lost need a high amount of physical activity unless they also reduce their caloric intake. Many people need to do more than 300 minutes of moderate-intensity activity a week to meet weight-control goals.

Regular physical activity also helps control the percentage of body fat in children and adolescents. Exercise training studies with overweight and obese youth have shown that they can reduce their body fatness by participating in physical activity that is at least moderate intensity on 3 to 5 days a week, for 30 to 60 minutes each time.

### *Musculoskeletal Health*

Bones, muscles, and joints support the body and help it move. Healthy bones, joints, and muscles are critical to the ability to do daily activities without physical limitations.

Preserving bone, joint, and muscle health is essential with increasing age. Studies show that the frequent decline in bone density that happens during aging can be slowed with regular physical activity. These effects are seen in people who participate in aerobic, muscle-strengthening, and bone-strengthening physical activity programs of moderate or vigorous intensity. The range of total



physical activity for these benefits varies widely. Important changes seem to begin at 90 minutes a week and continue up to 300 minutes a week.

Hip fracture is a serious health condition that can have life-changing negative effects for many older people. Physically active people, especially women, appear to have a lower risk of hip fracture than do inactive people. Research studies on physical activity to prevent hip fracture show that participating in 120 to 300 minutes a week of physical activity that is of at least moderate intensity is associated with a reduced risk. It is unclear, however, whether activity also lowers risk of fractures of the spine or other important areas of the skeleton.

Building strong, healthy bones is also important for children and adolescents. Along with having a healthy diet that includes adequate calcium and vitamin D, physical activity is critical for bone development in children and adolescents. Bone-strengthening physical activity done 3 or more days a week increases bone-mineral content and bone density in youth.

Regular physical activity also helps people with arthritis or other rheumatic conditions affecting the joints. Participation in 130 to 150 minutes (2 hours and 10 minutes to 2 hours and 30 minutes) a week of moderate-intensity, low-impact physical activity improves pain management, function, and quality of life. Researchers don’t yet know whether participation in physical activity, particularly at low to moderate intensity, reduces the risk of osteoarthritis. Very high levels of physical activity, however, may have extra risks. People who participate in very high levels of physical activity, such as elite or professional athletes, have a higher risk of hip and knee osteoarthritis, mostly due to the risk of injury involved in competing in some sports.

Progressive muscle-strengthening activities increase or preserve muscle mass, strength, and power. Higher amounts (through greater frequency or higher weights) improve muscle function to a greater degree. Improvements occur in younger and older adults. Resistance exercises also improve muscular strength in persons with such conditions as stroke, multiple sclerosis, cerebral palsy, spinal cord injury, and cognitive disability. Though it doesn’t increase muscle mass in the same way that muscle-strengthening activities do, aerobic activity may also help slow the loss of muscle with aging.

The bottom line is that the health benefits of physical activity far outweigh the risks of adverse events for almost everyone.

### *Functional Ability and Fall Prevention*

Functional ability is the capacity of a person to perform tasks or behaviors that enable him or her to carry out everyday activities, such as climbing stairs or walking on a sidewalk. Functional ability is key to a person’s ability to fulfill basic life roles, such as personal care, grocery shopping, or playing with the grandchildren. Loss of functional ability is referred to as functional limitation.

Middle-aged and older adults who are physically active have lower risk of functional limitations than do inactive adults. It appears that greater physical activity levels can further reduce risk of functional limitations.

Older adults who already have functional limitations also benefit from regular physical activity. Typically, studies of physical activity in adults with functional limitations tested a combination of aerobic and muscle-strengthening activities, making it difficult to assess the relative importance of each type of activity. However, both types of activity appear to provide benefit.

In older adults at risk of falls, strong evidence shows that regular physical activity is safe and reduces this risk. Reduction in falls is seen for participants in programs that include balance and moderate-intensity muscle-strengthening activities for 90 minutes a week plus moderate-intensity walking for about an hour a week. It's not known whether different combinations of type, amount, or frequency of activity can reduce falls to a greater degree. Tai chi exercises also may help prevent falls.

### *Cancer*

Physically active people have a significantly lower risk of colon cancer than do inactive people, and physically active women have a significantly lower risk of breast cancer. Research shows that a wide range of moderate-intensity physical activity—between 210 and 420 minutes a week (3 hours and 30 minutes to 7 hours)—is needed to significantly reduce the risk of colon and breast cancer; currently, 150 minutes a week does not appear to provide a major benefit. It also appears that greater amounts of physical activity lower risks of these cancers even further, although exactly how much lower is not clear.

Although not definitive, some research suggests that the risk of endometrial cancer in women and lung cancers in men and women also may be lower among those who are regularly active compared to those who are inactive.

Finally, cancer survivors have a better quality of life and improved physical fitness if they are physically active, compared to survivors who are inactive.

### *Mental Health*

Physically active adults have lower risk of depression and cognitive decline (declines with aging in thinking, learning, and judgment skills). Physical activity also may improve the quality of sleep. Whether physical activity reduces distress or anxiety is currently unclear.

Mental health benefits have been found in people who do aerobic or a combination of aerobic and muscle-strengthening activities 3 to 5 days a week for 30 to 60 minutes at a time. Some research has shown that even lower levels of physical activity also may provide some benefits.

Regular physical activity appears to reduce symptoms of anxiety and depression for children and adolescents. Whether physical activity improves self-esteem is not clear.

### *Adverse Events*

Some people hesitate to become active or increase their level of physical activity because they fear getting injured or having a heart attack. Studies of generally healthy people clearly show that moderate-intensity physical activity, such as brisk walking, has a low risk of such adverse events.

The risk of musculoskeletal injury increases with the total amount of physical activity. For example, a person who regularly runs 40 miles a week has a higher risk of injury than a person who runs 10 miles each week. However, people who are physically active may have fewer injuries from other causes, such as motor vehicle collisions or work-related injuries. Depending on the type and amount of activity that physically active people do, their overall injury rate may be lower than the overall injury rate for inactive people.

Participation in contact or collision sports, such as soccer or football, has a higher risk of injury than participation in non-contact physical activity, such as swimming or walking. However, when performing the same activity, people who are less fit are more likely to be injured than people who are fitter.

Cardiac events, such as a heart attack or sudden death during physical activity, are rare. However, the risk of such cardiac events does increase when a person suddenly becomes much more active than usual. The greatest risk occurs when an adult who is usually inactive engages in vigorous-intensity activity (such as shoveling snow). People who are regularly physically active have the lowest risk of cardiac events both while being active and overall.

The bottom line is that the health benefits of physical activity far outweigh the risks of adverse events for almost everyone.

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# 16.4: Active Adults



Adults who are physically active are healthier and less likely to develop many chronic diseases than adults who are inactive. They also have better fitness, including a healthier body size and composition. These benefits are gained by men and women and people of all races and ethnicities who have been studied. Adults gain most of these health benefits when they do the equivalent of at least 150 minutes of moderate-intensity aerobic physical activity (2 hours and 30 minutes) each week. Adults gain additional and more extensive health and fitness benefits with even more physical activity. Muscle-strengthening activities also provide health benefits and are an important part of an adult's overall physical activity plan. This chapter provides guidance for most men and women aged 18 to 64 years, and focuses on physical activity beyond baseline activity (the usual light or sedentary activities of daily living). Physical activity guidelines for women during pregnancy and the postpartum period and for adults with disabilities and select chronic conditions are discussed in Chapter 7—Additional Considerations for Some Adults.

## Explaining the Guidelines

The Guidelines for adults focus on two types of activity: aerobic and muscle-strengthening. Each type provides important health benefits, as explained in Chapter 2—Physical Activity Has Many Health Benefits.

### *Aerobic Activity*

Aerobic activities, also called endurance activities, are physical activities in which people move their large muscles in a rhythmic manner for a sustained period. Running, brisk walking, bicycling, playing basketball, dancing, and swimming are all examples of aerobic activities. Aerobic activity makes a person's heart beat more rapidly to meet the demands of the body's movement. Over time, regular aerobic activity makes the heart and cardiovascular system stronger and fitter.

The purpose of the aerobic activity does not affect whether it counts toward meeting the Guidelines. For example, physically active occupations can count toward meeting the Guidelines, as can active transportation choices (walking or bicycling). All types of aerobic activities can count as long as they are of sufficient intensity and duration. Time spent in muscle-strengthening activities does not count toward the aerobic activity guidelines. When putting the Guidelines into action, it's important to consider the total amount of activity, as well as how often to be active, for how long, and at what intensity.

**Key Guidelines for Adults**

- All adults should avoid inactivity. Some physical activity is better than none, and adults who participate in any amount of physical activity gain some health benefits.
- For substantial health benefits, adults should do at least 150 minutes (2 hours and 30 minutes) a week of moderate-intensity, or 75 minutes (1 hour and 15 minutes) a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity. Aerobic activity should be performed in episodes of at least 10 minutes, and preferably, it should be spread throughout the week.
- For additional and more extensive health benefits, adults should increase their aerobic physical activity to 300 minutes (5 hours) a week of moderate-intensity, or 150 minutes a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate-and vigorous-intensity activity. Additional health benefits are gained by engaging in physical activity beyond this amount.
- Adults should also do muscle-strengthening activities that are moderate or high intensity and involve all major muscle groups on 2 or more days a week, as these activities provide additional health benefits.

#### How Much Total Activity a Week?

When adults do the equivalent of 150 minutes of moderate-intensity aerobic activity each week, the benefits are *substantial*. These benefits include lower risk of premature death, coronary heart disease, stroke, hypertension, type 2 diabetes, and depression. Not all health benefits of physical activity occur at 150 minutes a week. As a person moves from 150 minutes a week toward 300 minutes (5 hours) a week, he or she gains *additional* health benefits. Additional benefits include lower risk of colon and breast cancer and

prevention of unhealthy weight gain. Also, as a person moves from 150 minutes a week toward 300 minutes a week, the benefits that occur at 150 minutes a week become *more extensive*. For example, a person who does 300 minutes a week has an even lower risk of heart disease or diabetes than a person who does 150 minutes a week.

The benefits continue to increase when a person does more than the equivalent of 300 minutes a week of moderate-intensity aerobic activity. For example, a person who does 420 minutes (7 hours) a week has an even lower risk of premature death than a person who does 150 to 300 minutes a week. Current science does not allow identifying an upper limit of total activity above which there are no additional health benefits.

## How Many Days a Week and for How Long?



Aerobic physical activity should preferably be spread throughout the week. Research studies consistently show that activity performed on at least 3 days a week produces health benefits. Spreading physical activity across at least 3 days a week may help to reduce the

risk of injury and avoid excessive fatigue. Both moderate- and vigorous-intensity aerobic activity should be performed in episodes of at least 10 minutes. Episodes of this duration are known to improve cardiovascular fitness and some risk factors for heart disease and type 2 diabetes.

## How Intense?

The Guidelines for adults focus on two levels of intensity: moderate-intensity activity and vigorous-intensity activity. To meet the Guidelines, adults can do either moderate-intensity or vigorous-intensity aerobic activities, or a combination of both. It takes less time to get the same benefit from vigorous-intensity activities as from moderate-intensity activities. A general rule of thumb is that 2 minutes of moderate-intensity activity counts the same as 1 minute of vigorous-intensity activity. For example, 30 minutes of moderate-intensity activity a week is roughly the same as 15 minutes of vigorous-intensity activity.

There are two ways to track the intensity of aerobic activity: absolute intensity and relative intensity.

- Absolute intensity is the amount of energy expended per minute of activity. The energy expenditure of light-intensity activity, for example, is 1.1 to 2.9 times the amount of energy expended when a person is at rest. Moderate-intensity activities expend 3.0 to 5.9 times the amount of energy expended at rest. The energy expenditure of vigorous-intensity activities is 6.0 or more times the energy expended at rest.
- Relative intensity is the level of effort required to do an activity. Less fit people generally require a higher level of effort than fitter people to do the same activity. Relative intensity can be estimated using a scale of 0 to 10, where sitting is 0 and the highest level of effort possible is 10. Moderate-intensity activity is a 5 or 6. Vigorous-intensity activity is a 7 or 8.

**Examples of Different Aerobic Physical Activities and Intensities**

| **Moderate Intensity** |
| --- |
| • Walking briskly (3 miles per hour or faster, but not race-walking)<br>• Water aerobics<br>• Bicycling slower than 10 miles per hour<br>• Tennis (doubles)<br>• Ballroom dancing<br>• General gardening |
| **Vigorous Intensity** |

- Racewalking, jogging, or running
- Swimming laps
- Tennis (singles)
- Aerobic dancing
- Bicycling 10 miles per hour or faster
- Jumping rope
- Heavy gardening (continuous digging or hoeing, with heart rate increases)
- Hiking uphill or with a heavy backpack

*Note:* This table provides several examples of activities classified as moderate-intensity or vigorous-intensity, based on absolute intensity. This list is not all-inclusive. Instead, the examples are meant to help people make choices.

The Guidelines for adults refer to absolute intensity because most studies demonstrating lower risks of clinical events (for example, premature death, cardiovascular disease, type 2 diabetes, cancer) have focused on measuring absolute intensity. That is, the Guidelines are based on the absolute amount of energy expended in physical activity that is associated with health benefits. The table lists some examples of activities classified as moderate-intensity or vigorous-intensity based on absolute intensity. Either absolute or relative intensity can be used to monitor progress in meeting the Guidelines.

For More Information

See Appendix 1 for more information on using absolute or relative intensity.

When using relative intensity, people pay attention to how physical activity affects their heart rate and breathing. As a rule of thumb, a person doing moderate-intensity aerobic activity can talk, but not sing, during the activity. A person doing vigorous-intensity activity cannot say more than a few words without pausing for a breath.

### *Muscle-Strengthening Activity*

Muscle-strengthening activities provide additional benefits not found with aerobic activity. The benefits of muscle-strengthening activity include increased bone strength and muscular fitness. Muscle-strengthening activities can also help maintain muscle mass during a program of weight loss.

Muscle-strengthening activities make muscles do more work than they are accustomed to doing. That is, they overload the muscles. Resistance training, including weight training, is a familiar example of muscle-strengthening activity. Other examples include working with resistance bands, doing calisthenics that use body weight for resistance (such as push-ups, pull-ups, and sit-ups), carrying heavy loads, and heavy gardening (such as digging or hoeing).

Muscle-strengthening activities count if they involve a moderate to high level of intensity or effort and work the major muscle groups of the body: the legs, hips, back, chest, abdomen, shoulders, and arms. Muscle-strengthening activities for all the major muscle groups should be done at least 2 days a week.

No specific amount of time is recommended for muscle strengthening, but muscle-strengthening exercises should be performed to the point at which it would be difficult to do another repetition without help. When resistance training is used to enhance muscle strength, one set of 8 to 12 repetitions of each exercise is effective, although two or three sets may be more effective. Development of muscle strength and endurance is progressive over time. Increases in the amount of weight or the days a week of exercising will result in stronger muscles.

## Meeting the Guidelines

Adults have many options for becoming physically active, increasing their physical activity, and staying active throughout their lives. In deciding how to meet the Guidelines, adults should think about how much physical activity they're already doing and how physically fit they are. Personal health and fitness goals are also important to consider. Examples provided later in the chapter illustrate how to include these goals in decisions to be active.

In general, healthy men and women who plan prudent increases in their weekly amounts of physical activity do not need to consult a health-care provider before becoming active.

### Inactive Adults

Inactive adults or those who don't yet do 150 minutes of physical activity a week should work gradually toward this goal. The initial amount of activity should be at a light or moderate intensity, for short periods of time, with the sessions spread throughout the week. The good news is that "some is better than none."

People gain some health benefits even when they do as little as 60 minutes a week of moderate-intensity aerobic physical activity.

For More Information See Chapter 6—Safe and Active, for more information on how to increase physical activity gradually.

To reduce risk of injury, it is important to increase the amount of physical activity gradually over a period of weeks to months. For example, an inactive person could start with a walking program consisting of 5 minutes of slow walking several times each day, 5 to 6 days a week. The length of time could then gradually be increased to 10 minutes per session, 3 times a day, and the walking speed could be increased slowly.

Muscle-strengthening activities should also be gradually increased over time. Initially, these activities can be done just 1 day a week starting at a light or moderate level of effort. Over time, the number of days a week can be increased to 2, and then possibly to more than 2. Each week, the level of effort (intensity) can be increased slightly until it becomes moderate to high.

### Active Adults



Adults who are already active and meet the minimum Guidelines (the equivalent of 150 minutes of moderate-intensity aerobic activity every week) can gain additional and more extensive health and fitness benefits by increasing physical activity above this amount. Most American adults should increase their aerobic activity to exceed the minimum level and move toward 300 minutes a week. Adults should also do muscle-strengthening activities on at least 2 days each week.

One time-efficient way to achieve greater fitness and health goals is to substitute vigorous-intensity aerobic activity for some moderate-intensity activity. Using the 2-to-1 rule of thumb, doing 150 minutes of vigorous-intensity aerobic activity a week provides about the same benefits as 300 minutes of moderate-intensity activity.

Adults are encouraged to do a variety of activities, as variety probably reduces risk of injury caused by doing too much of one kind of activity (this is called an overuse injury).

### Highly Active Adults

Adults who are highly active should maintain their activity level. These adults are also encouraged to do a variety of activities.

## Special Considerations

### Flexibility Activities

Flexibility is an important part of physical fitness. Some types of physical activity, such as dancing, require more flexibility than others. Stretching exercises are effective in increasing flexibility, and thereby can allow people to more easily do activities that require greater flexibility. For this reason, flexibility activities are an appropriate part of a physical activity program, even though they have no known health benefits and it is unclear whether they reduce risk of injury. Time spent doing flexibility activities by themselves does not count toward meeting the aerobic or muscle-strengthening Guidelines.

### Warm-up and Cool-down

Warm-up and cool-down activities are an acceptable part of a person's physical activity plan. Commonly, the warm-up and cool-down involve doing an activity at a slower speed or lower intensity. A warm-up before moderate-or vigorous-intensity aerobic activity allows a gradual increase in heart rate and breathing at the start of the episode of activity. A cool-down after activity allows

a gradual decrease at the end of the episode. Time spent doing warm-up and cool-down may count toward meeting the aerobic activity Guidelines if the activity is at least moderate intensity (for example, walking briskly as a warm-up before jogging). A warm-up for muscle-strengthening activity commonly involves doing exercises with lighter weight.

### *Physical Activity in a Weight-Control Plan*

The health benefits of physical activity are generally independent of body weight. The good news for people needing to lose weight is that regular physical activity provides major health benefits, no matter how their weight changes over time.

Along with appropriate dietary intake, physical activity is an important part of maintaining healthy weight, losing weight, and keeping extra weight off once it has been lost.

Physical activity also helps reduce abdominal fat and preserve muscle during weight loss. Adults should aim for a healthy, stable body weight. The amount of physical activity necessary to achieve this weight varies greatly from person to person.

For More Information

See the *Dietary Guidelines for Americans* for additional information on weight management and how to determine a healthy weight.

The first step in achieving or maintaining a healthy weight is to meet the minimum level of physical activity in the Guidelines. For some people this will result in a stable and healthy body weight, but for many it may not.

People who are at a healthy body weight but slowly gaining weight can either gradually increase the level of physical activity (toward the equivalent of 300 minutes a week of moderate-intensity aerobic activity), or reduce caloric intake, or both, until their weight is stable. By regularly checking body weight, people can find the amount of physical activity that works for them.

Many adults will need to do more than the 150 minutes a week of moderate-intensity aerobic physical activity as part of a program to lose weight or keep it off. These adults should do more physical activity and/or further reduce their caloric intake. Some people will need to do the equivalent of 300 or more minutes of moderate-intensity physical activity a week to meet their weight-control goals. Combined with restricting caloric intake, these adults should gradually increase minutes or the intensity of aerobic physical activity per week, to the point at which the physical activity is effective in achieving a healthy weight.

Adults should strongly consider walking as one good way to get aerobic physical activity. Many studies show that walking has health benefits and a low risk of injury. It can be done year-round and in many settings.

It is important to remember that all activities—both baseline and physical activity—"count" for energy balance. Active choices, such as taking the stairs rather than the elevator or adding short episodes of walking to the day, are examples of activities that can be helpful in weight control.

For weight control, vigorous-intensity activity is far more time-efficient than moderate-intensity activity. For example, an adult who weighs 165 pounds (75 kg) will burn 560 calories from 150 minutes of brisk walking at 4 miles an hour (these calories are in addition to the calories normally burned by a body at rest). That person can burn the same number of additional calories in 50 minutes by running 5 miles at a 10 minutes-per-mile pace.

## Getting and Staying Active: Real-Life Examples

Adults can meet the *Physical Activity Guidelines* in all sorts of ways and with many types of physical activity. The choices of types and amounts of physical activity depend on personal health and fitness goals. Here are three examples.

Adults can meet the *Physical Activity Guidelines* in all sorts of ways and with many types of physical activity.

### *Jean: An Inactive Middle-Aged Woman*

Her goals: Jean sets a goal of doing 1 hour a day of moderate-intensity aerobic activity on 5 days a week (a total of 300 minutes a week). Weighing 220 pounds, Jean is obese and wants to lose about 1 pound of weight each week.

Starting out: Jean cuts back on her caloric intake and starts walking 5 minutes in the morning and 5 minutes in the evening most days of the week. She walks at a 2.5 mile-an-hour pace. Although physical activity tables show this to be light-intensity activity, for her level of fitness and fatness, it is appropriate moderate-intensity activity.

Making good progress: Two months later, Jean is comfortably walking 30 to 40 minutes at moderate intensity to and from her bus stop every day. She then adds variety to her activity by alternating among walking, riding a stationary cycle, and low-impact aerobics. She also begins muscle-strengthening activities, using elastic bands twice each week.

Reaching her goal: Eventually, Jean works up to 300 minutes a week of moderate-intensity aerobic activity, including her brisk walks to and from the bus stop. She has lost 40 pounds of weight in 1 year, with most of the weight loss occurring the previous 6 months when she mastered her diet and was able to do greater amounts of physical activity.

### *Douglas: An Active Middle-Aged Man*

His goal and current activity pattern: Douglas was a soccer player in his youth. His goal is to get back into shape by becoming a regular recreational runner. In addition to his job operating heavy equipment, he walks 30 to 40 minutes a day on 5 days each week. He also lifts weights 2 days a week.

Starting out: Douglas starts a walk/jog program with a co-worker and plans to gradually replace walking with jogging and then running. The first week he goes out on 5 days, walking for 25 minutes and jogging for 5 minutes.

Making good progress: Each week, Douglas gradually increases the time spent jogging (vigorous-intensity activity) and reduces the time spent walking (moderateintensity activity). He also continues his weight-lifting program.

Reaching his goal: Eventually, Douglas is running 30 to 45 minutes 4 days a week and lifting weights 2 days a week. He goes for a 1-hour bicycle ride on most weekends.

### *Anita: A Very Active College-Aged Adult*

Her goals and current activity pattern: Anita plays league basketball (vigorous-intensity activity) 4 days each week for 90 minutes each day. She wants to reduce her risk of injury from doing too much of one kind of activity (this is called an overuse injury).

Starting out: Anita starts out by cutting back her basketball playing to 3 days each week. She begins to bicycle to and from campus (30 minutes each way) instead of driving her car. She also joins a yoga class that meets twice each week.

Reaching her goal: Eventually, Anita is bicycling 3 days each week to and from campus in addition to playing basketball. Her yoga class helps her to build and maintain strength and flexibility.

## Achieving Target Levels of Physical Activity: The Possibilities Are Endless

These examples show how it's possible to meet the Guidelines by doing moderate-intensity or vigorous-intensity activity or a combination of both. Physical activity at this level provides substantial health benefits.

Ways to get the equivalent of 150 minutes (2 hours and 30 minutes) of moderate-intensity aerobic physical activity a week plus muscle-strengthening activities:

- Thirty minutes of brisk walking (moderate intensity) on 5 days, exercising with resistance bands (muscle strengthening) on 2 days;
- Twenty-five minutes of running (vigorous intensity) on 3 days, lifting weights on 2 days (muscle strengthening);
- Thirty minutes of brisk walking on 2 days, 60 minutes (1 hour) of social dancing (moderate intensity) on 1 evening, 30 minutes of mowing the lawn (moderate intensity) on 1 afternoon, heavy gardening (muscle strengthening) on 2 days;
- Thirty minutes of an aerobic dance class on 1 morning (vigorous intensity), 30 minutes of running on 1 day (vigorous intensity), 30 minutes of brisk walking on 1 day (moderate intensity), calisthenics (such as sit-ups, push-ups) on 3 days (muscle strengthening);
- Thirty minutes of biking to and from work on 3 days (moderate intensity), playing softball for 60 minutes on 1 day (moderate intensity), using weight machines on 2 days (muscle-strengthening on 2 days); and
- Forty-five minutes of doubles tennis on 2 days (moderate intensity), lifting weights after work on 1 day (muscle strengthening), hiking vigorously for 30 minutes and rock climbing (muscle strengthening) on 1 day.

### *Ways to be even more active*

For adults who are already doing at least 150 minutes of moderate-intensity physical activity, here are a few ways to do even more. Physical activity at this level has even greater health benefits.

- Forty-five minutes of brisk walking every day, exercising with resistance bands on 2 or 3 days;
- Forty-five minutes of running on 3 or 4 days, circuit weight training in a gym on 2 or 3 days;
- Thirty minutes of running on 2 days, 45 minutes of brisk walking on 1 day, 45 minutes of an aerobics and weights class on 1 day, 90 minutes (1 hour and 30 minutes) of social dancing on 1 evening, 30 minutes of mowing the lawn, plus some heavy garden work on 1 day;
- Ninety minutes of playing soccer on 1 day, brisk walking for 15 minutes on 3 days, lifting weights on 2 days; and

- Forty-five minutes of stationary bicycling on 2 days, 60 minutes of basketball on 2 days, calisthenics on 3 days.

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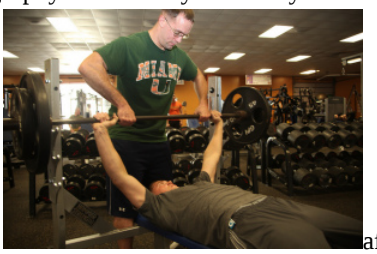
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# 16.5: Safe and Active

Although physical activity has many health benefits, injuries and other adverse events do sometimes happen. The most common



injuries affect the musculoskeletal system (the bones, joints, muscles, ligaments, and tendons). Other adverse events can also occur during activity, such as overheating and dehydration. On rare occasions, people have heart attacks during activity. The good news is that scientific evidence strongly shows that physical activity is safe for almost everyone. Moreover, the health benefits of physical activity far outweigh the risks. Still, people may hesitate to become physically active because of concern they'll get hurt. For these people, there is even more good news: They can take steps that are proven to reduce their risk of injury and adverse events. The Guidelines in this chapter provide advice to help people do physical activity safely. Most advice applies to people of all ages. Specific guidance for particular age groups and people with certain conditions is also provided.

## Explaining the Guidelines

### *Physical Activity Is Safe for Almost Everyone*

Most people are not likely to be injured when doing moderate-intensity activities in amounts that meet the *Physical Activity Guidelines.* However, injuries and other adverse events do sometimes happen. The most common problems are musculoskeletal injuries. Even so, studies show that only one such injury occurs for every 1,000 hours of walking for exercise, and fewer than four injuries occur for every 1,000 hours of running.

Both physical fitness and total amount of physical activity affect risk of musculoskeletal injuries. People who are physically fit have a lower risk of injury than people who are not. People who do more activity generally have a higher risk of injury than people who do less activity. So what should people do if they want to be active and safe? The best strategies are to:

- Be regularly physically active to increase physical fitness; and
- Follow the other guidance in this chapter (especially increasing physical activity gradually over time) to minimize the injury risk from doing medium to high amounts of activity.

Following these strategies may reduce *overall* injury risk. Active people are more likely to have an activity-related injury than inactive people. But they appear less likely to have non-activity-related injuries, such as work-related injuries or injuries that occur around the home or from motor vehicle crashes.

**Key Guidelines for Safe Physical Activity**

To do physical activity safely and reduce risk of injuries and other adverse events, people should:

- Understand the risks and yet be confident that physical activity is safe for almost everyone.
- Choose to do types of physical activity that are appropriate for their current fitness level and health goals, because some activities are safer than others.
- Increase physical activity gradually over time whenever more activity is necessary to meet guidelines or health goals. Inactive people should "start low and go slow" by gradually increasing how often and how long activities are done.
- Protect themselves by using appropriate gear and sports equipment, looking for safe environments, following rules and policies, and making sensible choices about when, where, and how to be active.
- Be under the care of a health-care provider if they have chronic conditions or symptoms. People with chronic conditions and symptoms should consult their health-care provider about the types and amounts of activity appropriate for them.

### *Choose Appropriate Types and Amounts of Activity*

People can reduce their risk of injury by choosing appropriate types of activity. As the table shows, the safest activities are moderate intensity and low impact, and don't involve purposeful collision or contact.

Walking for exercise, gardening or yard work, bicycling or exercise cycling, dancing, swimming, and golf are activities with the lowest injury rates. In the amounts commonly done by adults, walking (a moderate-intensity and low-impact activity) has a third or less of the injury risk of running (a vigorous-intensity and higher impact activity). The risk of injury for a type of physical activity can also differ according to the purpose of the activity. For example, recreational bicycling or bicycling for transportation leads to fewer injuries than training for and competing in bicycle races.

| Injury Risk Level | Activity Level | Examples |
|---|---|---|
| Lower Risk | Commuting | Walking, bicycling |
| | Lifestyle | Home repair, gardening/ yard work |
| | Recreation/Sports<br>No Contact | Walking for exercise, golf, dancing, swimming, running, tennis |
| | Recreation/Sports<br>Limited Contact | Bicycling, aerobics, skiing, volleyball, baseball, softball |
| Higher Risk | Recreation/Sports<br>Collision/Contact | Football, hockey, soccer, basketball |

*Note:* The same activity done for different purposes and with different frequency, intensity, and duration leads to different injury rates. Competitive activities tend to have higher injury rates than non-competitive activities, likely due to different degrees of intensity of participation.

People who have had a past injury are at risk of injuring that body part again. The risk of injury can be reduced by performing appropriate amounts of activity and setting appropriate personal goals. Performing a variety of different physical activities may also reduce the risk of overuse injury.

### *Increase Physical Activity Gradually Over Time*

The risk of injury to bones, muscles, and joints is directly related to the gap between a person's usual level of activity and a new level of activity.

Scientific studies indicate that the risk of injury to bones, muscles, and joints is directly related to the gap between a person's usual level of activity and a new level of activity. The size of this gap is called the amount of overload. Creating a small overload and waiting for the body to adapt and recover reduces the risk of injury. When amounts of physical activity need to be increased to meet the Guidelines or personal goals, physical activity should be increased gradually over time, no matter what the person's current level of physical activity.

Scientists have not established a standard for how to gradually increase physical activity over time. The following recommendations give general guidance for inactive people and those with low levels of physical activity on how to increase physical activity:

- Use relative intensity (intensity of the activity relative to a person's fitness) to guide the level of effort for aerobic activity.
- Generally start with relatively moderate-intensity aerobic activity. Avoid relatively vigorous-intensity activity, such as shoveling snow or running. Adults with a low level of fitness may need to start with light activity, or a mix of light- to moderate-intensity activity.
- First, increase the number of minutes per session (duration), and the number of days per week (frequency) of moderate-intensity activity. Later, if desired, increase the intensity.
- Pay attention to the relative size of the increase in physical activity each week, as this is related to injury risk. For example, a 20-minute increase each week is safer for a person who does 200 minutes a week of walking (a 10 percent increase), than for a person who does 40 minutes a week (a 50 percent increase).

The available scientific evidence suggests that adding a small and comfortable amount of light- to moderate-intensity activity, such as 5 to15 minutes of walking per session, 2 to 3 times a week, to one's usual activities has a low risk of musculoskeletal injury and no known risk of severe cardiac events. Because this range is rather wide, people should consider three factors in individualizing their rate of increase: age, level of fitness, and prior experience.

### Age

The amount of time required to adapt to a new level of activity probably depends on age. Youth and young adults probably can safely increase activity by small amounts every week or 2. Older adults appear to require more time to adapt to a new level of activity, in the range of 2 to 4 weeks.

### Level of Fitness



Less fit adults are at higher risk of injury when doing a given amount of activity, compared to fitter adults. Slower rates of increase over time may reduce injury risk. This guidance applies to overweight and obese adults, as they are commonly less physically fit.

### Prior Experience

People can use their experience to learn to increase physical activity over time in ways that minimize the risk of overuse injury. Generally, if an overuse injury occurred in the past with a certain rate of progression, a person should increase activity more slowly the next time.

## *Take Appropriate Precautions*

Taking appropriate precautions means using the right gear and equipment, choosing safe environments in which to be active, following rules and policies, and making sensible choices about how, when, and where to be active.

### Use Protective Gear and Appropriate Equipment

Using personal protective gear can reduce the frequency of injury. Personal protective gear is something worn by a person to protect a specific body part. Examples include helmets, eyewear and goggles, shin guards, elbow and knee pads, and mouth guards.

Using appropriate sports equipment can also reduce risk of injury. Sports equipment refers to sport or activity-specific tools, such as balls, bats, sticks, and shoes.

For the most benefit, protective equipment and gear should be:

- The right equipment for the activity;
- Appropriately fitted;
- Appropriately maintained; and
- Used consistently and correctly.

For More Information

See Appendix 2 for a resource chart that provides selected examples of injury prevention strategies for common physical activities.

### Be Active in Safe Environments

People can reduce their injury risks by paying attention to the places they choose to be active. To help themselves stay safe, people can look for:

- Physical separation from motor vehicles, such as sidewalks, walking paths, or bike lanes;
- Neighborhoods with traffic-calming measures that slow down traffic;
- Places to be active that are well-lighted, where other people are present, and that are well-maintained (no litter, broken windows);
- Shock-absorbing surfaces on playgrounds;
- Well-maintained playing fields and courts without holes or obstacles;
- Breakaway bases at baseball and softball fields; and
- Padded and anchored goals and goal posts at soccer and football fields.

## Follow Rules and Policies That Promote Safety

Rules, policies, legislation, and laws are potentially the most effective and wide-reaching way to reduce activity-related injuries. To get the benefit, individuals should look for and follow these rules, policies, and laws. For example, policies that promote the use of bicycle helmets reduce the risk of head injury among cyclists. Rules against diving into shallow water at swimming pools prevent head and neck injuries.

## Make Sensible Choices About How, When, and Where To Be Active

A person's choices can obviously influence the risk of adverse events. By making sensible choices, injuries and adverse events can be prevented. Consider weather conditions, such as extremes of heat and cold. For example, during very hot and humid weather, people lessen the chances of dehydration and heat stress by:

- Exercising in the cool of early morning as opposed to mid-day heat;
- Switching to indoor activities (playing basketball in the gym rather than on the playground);
- Changing the type of activity (swimming rather than playing soccer);
- Lowering the intensity of activity (walking rather than running); and
- Paying close attention to rest, shade, drinking enough fluids, and other ways to minimize effects of heat.

Exposure to air pollution is associated with several adverse health outcomes, including asthma attacks and abnormal heart rhythms. People who can modify the location or time of exercise may wish to reduce these risks by exercising away from heavy traffic and industrial sites, especially during rush hour or times when pollution is known to be high. However, current evidence indicates that the benefits of being active, even in polluted air, outweigh the risk of being inactive.

Inactive people who gradually progress over time to relatively moderate-intensity activity have no known risk of sudden cardiac events, and very low risk of bone, muscle, or joint injuries.

### *Advice From Health-Care Providers*

The protective value of a medical consultation for persons with or without chronic diseases who are interested in increasing their physical activity level is not established. People without diagnosed chronic conditions (such as diabetes, heart disease, or osteoarthritis) and who do not have symptoms (such as chest pain or pressure, dizziness, or joint pain) do not need to consult a health-care provider about physical activity.

Inactive people who gradually progress over time to relatively moderate-intensity activity have no known risk of sudden cardiac events, and very low risk of bone, muscle, or joint injuries. A person who is habitually active with moderate-intensity activity can gradually increase to vigorous intensity without needing to consult a health-care provider. People who develop new symptoms when increasing their levels of activity should consult a health-care provider.

Health-care providers can provide useful personalized advice on how to reduce risk of injuries. For people who wish to seek the advice of a health-care provider, it is particularly appropriate to do so when contemplating vigorous-intensity activity, because the risks of this activity are higher than the risks of moderate-intensity activity.

For More Information

See Chapter 4—Active Adults, for guidance and examples of how to gradually increase activity levels.

The choice of appropriate types and amounts of physical activity can be affected by chronic conditions. People with symptoms or known chronic conditions should be under the regular care of a health-care provider. In consultation with their provider, they can develop a physical activity plan that is appropriate for them. People with chronic conditions typically find that moderate-intensity activity is safe and beneficial. However, they may need to take special precautions. For example, people with diabetes need to pay special attention to blood  sugar control and proper footwear during activity.

Women who are pregnant and those who've recently had a baby should be under the regular care of a health-care provider. Moderate-intensity physical activity is generally safe for women with uncomplicated pregnancies, but women should talk with their

provider about how to adjust the amounts and types of activity while they are pregnant and right after the baby's birth.

During pregnancy, women should avoid:

- Doing activities that involve lying on their back after the first trimester of pregnancy; and
- Doing activities with high risk of falling or abdominal trauma, including contact or collision sports, such as horseback riding, soccer, basketball, and downhill skiing.

For More Information

See Chapter 7—Additional Considerations for Some Adults, for more details about physical activity during pregnancy and the postpartum period.

## Gradually Increasing Physical Activity Over Time: Real-Life Examples

Here are two examples that show how people at different ages, levels of fitness, and levels of experience can safely become more active over time.

### *Bill: A Man Who Has Been Inactive for Many Years*

Bill wants to work his way up to the equivalent of 180 to 210 minutes (3 hours to 3 hours and 30 minutes) of walking a week. On weekdays he has time for up to 45 minutes of walking, and he plans to do something physically active each weekend. He decides to start with walking because it is moderate intensity and has a low risk of injury.

- The first week, Bill starts at a low level. He walks 10 minutes a day 3 days a week. Sometimes he divides the 10 minutes a day into two sessions. He prefers to alternate rest days and active days. (Total = 30 minutes a week.)
- Between weeks 3 and 8, Bill increases duration by adding 5 minutes a day and continues walking on 3 non-consecutive days each week. The weekly increase is 15 minutes. (Week 3 total = 45 minutes. Week 8 total = 120 minutes or 2 hours.)
- In week 9, Bill adds another day of moderate-intensity activity on the weekend, and starts doing a variety of activities, including biking, hiking, and an aerobics class. Gradually increasing the minutes of activity, by week 12 he is doing 60 minutes or more of moderate-intensity activity on the weekend.

**Reaching his goal**: Over 3 months, Bill has increased to a total of 180 moderate-intensity minutes a week.

### *Kim: An Active Woman*

Kim currently does 150 minutes (2 hours and 30 minutes) a week of moderate-intensity activity. She wants to work up to at least the equivalent of 300 minutes (5 hours) of moderate-intensity activity a week. She also wants to shift some of that moderate-intensity activity to vigorous-intensity activity. Her current 150 minutes a week includes:

- Thirty minutes of mowing the grass 1 day a week;
- Thirty minutes of brisk walking 4 days a week; and
- Fifteen minutes of muscle-strengthening exercises 2 days a week.

Increasing frequency and duration:

Over a month, Kim adds walking on another weekday, and she gradually adds 15 minutes of moderate-intensity activity on each of the 5 walking days each week. This provides an additional 105 minutes (1 hour and 45 minutes) of moderate-intensity activity.

Increasing intensity:

Over the next month, Kim decides to replace some walking with jogging. Instead of walking 45 minutes, she walks for 30 minutes and jogs for 15 minutes on each weekday, providing the equivalent of 300 minutes a week of moderate-intensity physical activity from her walking and jogging.

**Reaching her goal**: After these increases, Kim is doing a total of 180 minutes of moderate-intensity activity each week (walking and mowing) and also doing 75 minutes (1 hour and 15 minutes) of vigorous-intensity jogging. One minute of vigorous-intensity activity is about the same as 2 minutes of moderate-intensity activity, so she is now doing the equivalent of 330 moderate-intensity minutes (5 hours and 30 minutes) a week. She has more than met her goal.

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# 16.6: Additional Considerations for Some Adults

 All Americans should be physically active to improve overall health and fitness and to prevent many adverse health outcomes. Most Americans should follow the Guidelines of the child and adolescent, adult, or older adult chapters, depending upon their age. However, some people have conditions that raise special issues about recommended types and amounts of physical activity. This chapter provides guidance on physical activity for healthy women who are pregnant and for people with disabilities. This chapter also affirms and illustrates how physical activity is generally appropriate for adults with chronic conditions by considering three groups of adults:

- Adults with osteoarthritis;
- Adults with type 2 diabetes; and
- Adults who are cancer survivors.

## Physical Activity for Women During Pregnancy and the Postpartum Period

Physical activity during pregnancy benefits a woman's overall health. For example, moderate-intensity physical activity by healthy women during pregnancy maintains or increases cardiorespiratory fitness.

Strong scientific evidence shows that the risks of moderate-intensity activity done by healthy women during pregnancy are very low, and do not increase risk of low birth weight, preterm delivery, or early pregnancy loss. Some evidence suggests that physical activity reduces the risk of pregnancy complications, such as preeclampsia and gestational diabetes, and reduces the length of labor, but this evidence is not conclusive.

During a normal postpartum period, regular physical activity continues to benefit a woman's overall health. Studies show that moderate-intensity physical activity during the period following the birth of a child increases a woman's cardiorespiratory fitness and improves her mood. Such activity does not appear to have adverse effects on breast milk volume, breast milk composition, or infant growth.

Physical activity also helps women achieve and maintain a healthy weight during the postpartum period, and when combined with caloric restriction, helps promote weight loss.

### *Explaining the Guidelines*

Women who are pregnant should be under the care of a health-care provider with whom they can discuss how to adjust amounts of physical activity during pregnancy and the postpartum period. Unless a woman has medical reasons to avoid physical activity during pregnancy, she can begin or continue moderate-intensity aerobic physical activity during her pregnancy and after the baby is born.

 When beginning physical activity during pregnancy, women should increase the amount gradually over time. The effects of vigorous-intensity aerobic activity during pregnancy have not been studied carefully, so there is no basis for recommending that women should begin vigorous-intensity activity during pregnancy.

Women who habitually do vigorous-intensity activity or high amounts of activity or strength training should continue to be physically active during pregnancy and after giving birth. They generally do not need to drastically reduce their activity levels,

provided that they remain healthy and discuss with their health-care provider how to adjust activity levels during this time.

During pregnancy, women should avoid doing exercises involving lying on their back after the first trimester of pregnancy. They should also avoid doing activities that increase the risk of falling or abdominal trauma, including contact or collision sports, such as horseback riding, downhill skiing, soccer, and basketball.

**Key Guidelines for Women During Pregnancy and the Postpartum Period**

- Healthy women who are not already highly active or doing vigorous-intensity activity should get at least 150 minutes (2 hours and 30 minutes) of moderate-intensity aerobic activity per week during pregnancy and the postpartum period. Preferably, this activity should be spread throughout the week.
- Pregnant women who habitually engage in vigorous-intensity aerobic activity or are highly active can continue physical activity during pregnancy and the postpartum period, provided that they remain healthy and discuss with their health-care provider how and when activity should be adjusted over time.

## Physical Activity for People With Disabilities

The benefits of physical activity for people with disabilities have been studied in diverse groups. These groups include stroke victims, people with spinal cord injury, multiple sclerosis, Parkinson's disease, muscular dystrophy, cerebral palsy, traumatic brain injury, limb amputations, mental illness, intellectual disability, and dementia.

Overall, the evidence shows that regular physical activity provides important health benefits for people with disabilities. The benefits include improved cardiovascular and muscle fitness, improved mental health, and better ability to do tasks of daily life. Sufficient evidence now exists to recommend that adults with disabilities should get regular physical activity. Physical activity in children and adolescents with disabilities is considered in Chapter 3—Active Children and Adolescents.

For More Information

See Chapter 2—Physical Activity Has Many Health Benefits, for details.

### *Explaining the Guidelines*

In consultation with their health-care providers, people with disabilities should understand how their disabilities affect their ability to do physical activity. Some may be capable of doing medium to high amounts of physical activity, and they should essentially follow the Guidelines for adults.

For More Information

See Chapter 4—Active Adults, for details on these Guidelines and how to meet them.



Some people with disabilities are not able to follow the Guidelines for adults. These people should adapt their physical activity program to match their abilities, in consultation with their health-care providers. Studies show that physical activity can be done safely when the program is matched to an individual's abilities.

### *Meeting the Guidelines*

People with disabilities are encouraged to get advice from professionals with experience in physical activity and disability because matching activity to abilities can require modifying physical activity in many different ways. Some people with disabilities also need help with their exercise program. For example, some people may need supervision when performing muscle-strengthening activities, such as lifting weights.

**Key Guidelines for Adults With Disabilities**

- Adults with disabilities, who are able to, should get at least 150 minutes per week (2 hours and 30 minutes) of moderate-intensity, or 75 minutes (1 hour and 15 minutes) per week of vigorous-intensity aerobic activity, or an equivalent combination

of moderate-and vigorous-intensity aerobic activity. Aerobic activity should be performed in episodes of at least 10 minutes, and preferably, it should be spread throughout the week.

- Adults with disabilities, who are able to, should also do muscle-strengthening activities of moderate or high intensity that involve all major muscle groups on 2 or more days per week, as these activities provide additional health benefits.
- When adults with disabilities are not able to meet the above Guidelines, they should engage in regular physical activity according to their abilities and should avoid inactivity.
- Adults with disabilities should consult their health-care providers about the amounts and types of physical activity that are appropriate for their abilities.

## Physical Activity for People With Chronic Medical Conditions

Adults with chronic conditions should engage in regular physical activity because it can help promote their quality of life and reduce the risk of developing new conditions. The type and amount of physical activity should be determined by a person's abilities and the severity of the chronic condition. Three examples are provided below to illustrate the benefits of physical activity for persons with chronic conditions.

For many chronic conditions, physical activity provides therapeutic benefits and is part of recommended treatment for the condition. However, this chapter does not discuss therapeutic exercise or rehabilitation.

### *Example 1. Physical Activity for Adults With Osteoarthritis*

Osteoarthritis is a common condition in older adults, and people can live many years with osteoarthritis. People with osteoarthritis are commonly concerned that physical activity can make their condition worse.

Osteoarthritis can be painful and cause fatigue, making it hard to begin or maintain regular physical activity. Yet people with this condition should get regular physical activity to lower their risk of getting other chronic diseases, such as heart disease or type 2 diabetes, and to help maintain a healthy body weight.

For More Information

See Chapter 2—Physical Activity Has Many Health Benefits, for details on these benefits.

Strong scientific evidence indicates that both aerobic activity and muscle-strengthening activity provide therapeutic benefits for



persons with osteoarthritis. When done safely, physical activity does not make the disease or the pain worse. Studies show that adults with osteoarthritis can expect improvements in pain, physical function, quality of life, and mental health with regular physical activity.

People with osteoarthritis should match the type and amount of physical activity to their abilities and the severity of their condition. Most people can usually do moderate-intensity activity for 150 minutes (2 hours and 30 minutes) a week or more, and may choose to be active 3 to 5 days a week for 30 to 60 minutes per episode. Some people with arthritis can safely do more than 150 minutes of moderate-intensity activity each week and may be able to tolerate equivalent amounts of vigorous-intensity activity. Health-care providers typically counsel people with osteoarthritis to do activities that are low impact, not painful, and have low risk of joint injury. Swimming, walking, and strength-training are good examples of this type of activity.

### *Example 2. Physical Activity for Adults With Type 2 Diabetes*

Physical activity in adults with type 2 diabetes shows how important it can be for people with a chronic disease to be active. Physical activity has important therapeutic effects in people with diabetes, but it is also routinely recommended to reduce risk of other diseases and help promote a healthy body weight.

For example, strong scientific evidence shows that physical activity protects against heart disease in people with diabetes. Moderate-intensity activity for about 150 minutes a week helps to substantially lower the risk of heart disease. A person who moves toward 300 minutes (5 hours) or more of moderate-intensity activity a week gets even greater benefit.

Adults with chronic conditions should work with their health-care providers to adapt physical activity so that it is appropriate for their condition. For example, people with diabetes must be careful to monitor their blood glucose and avoid injury to their feet.

### *Example 3. Physical Activity for Cancer Survivors*

With modern treatments, many people with cancer can either be cured or survive for many years, living long enough to be at risk of other chronic conditions, such as high blood pressure or type 2 diabetes. Some cancer survivors are at risk of recurrence of the original cancer. Some have experienced side effects of the cancer treatment.

Like other adults, cancer survivors should engage in regular physical activity for its preventive benefits. Physical activity in cancer survivors can reduce risk of new chronic diseases. Further, studies suggest physically active adults with breast or colon cancer are less like to die prematurely or have a recurrence of the cancer. Physical activity may also play a role in reducing adverse effects of cancer treatment.

Cancer survivors, like other adults with chronic conditions, should consult their health-care providers to match their physical activity plan to their abilities and health status.

**Key Messages for People With Chronic Medical Conditions**

- Adults with chronic conditions obtain important health benefits from regular physical activity.
- When adults with chronic conditions do activity according to their abilities, physical activity is safe.
- Adults with chronic conditions should be under the care of health-care providers. People with chronic conditions and symptoms should consult their health-care providers about the types and amounts of activity appropriate for them.

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# 16.7: Video- Cholesterol Overview



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# 16.8: Video- Stroke Overview




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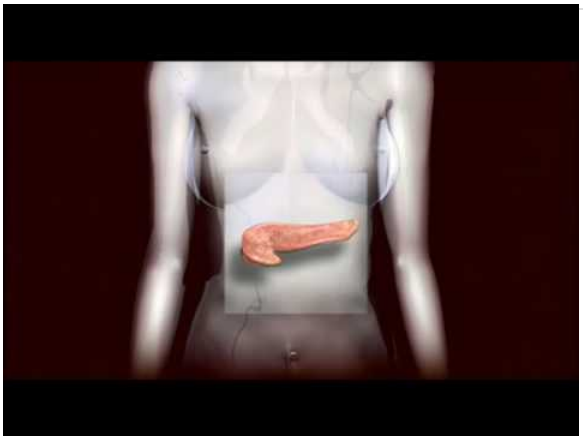
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# 16.9: Video- Diabetes Overview



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# 16.11: Assessment- President's Challenge Fitness Test Pre-Test

## DIRECTIONS

Access the site by clicking this link to the President's Challenge Fitness Test. Then, proceed according to the instructions.

- Carefully read all the important material provided on the pages of the site.
- **Step 1** – Click on the "Take the Adult Fitness Test" box. **Complete all of the fitness tests. Enter your body composition information.**
- **Step 2** – Click on the "Enter Your Data Online Here" box and enter your fitness test results in the online form to receive an evaluation. **Be honest! Make sure that the information you provide is correct and accurate. Click on the "Calculate Your Results" button to see your results. Save a copy of the results by highlighting and copying the text of the evaluation and pasting the copied text into a blank Word document. **Do not copy the whole page: copy only the date and the chart**. (Remember, you will take the tests three times during the course).

*For your own records, you can repeat this fitness test as often as you like. Look at the "Interpret & Improve" pages for each of the tests to see what you can do to improve.*

## GRADING

Your work will be assessed using the Pre-Test Rubric:

| Criteria | Absent | Present |
|---|---|---|
| Aerobic Fitness | 0 points | 1 Point<br>Must include time, heart rate, VO2 max, and score (percentile) |
| Muscular fitness | 0 points | 1 Point<br>Must include half sit-ups, push-ups,and scores (percentile) for each |
| Flexibility | 0 points | 1 Points<br>Must include sit-and-reach result and score (percentile) |
| BMI | 0 points | 1 Point |
| Waist circumference | 0 points | 1 Point |

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# CHAPTER OVERVIEW

## 17: Cardiorespiratory Endurance


17.1: Cardio Respiratory Endurance Readings
17.2: Borg Rating of Perceived Exertion (RPE) Scale
17.3: Target Heart Rate and Estimated Maximum Heart Rate
17.4: Video- Target Heart Rate
17.5: Assessment- Cardiorespiratory Endurance Plan


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# 17.1: Cardio Respiratory Endurance Readings

## Purpose

The readings will help you better understand the one of the health-related components of fitness: CR endurance, also called aerobic endurance.

## Directions

The rest of this chapter contains your reading for this section.

Additionally, information on these external sources will be useful to deepen your understanding:

- Read Summary of ACSM Guidelines

This is the news release regarding the 2011 ACSM exercise position stand paper and it summarizes the guidelines contained in the document. It is crucial that you learn the information in the bulletpoints and that you apply it to your own exercise plan you will be creating for this class. At this point you can focus on the CR exercise recommendations only.

- Read American College of Sports Medicine Guidelines

This is the complete ACSM position stand paper. It is more complex reading than most of the reading assignments up to this point; however, it contains great evidence-based information about exercise and cites all the scientific papers that support the current guidelines. I highly recommend you read from the introduction to article page 1342 (on the PDF version of the article, which can be downloaded on the side of the webpage).

- Read HR Monitoring_Encyclopedia of Lifestyle Medicine & Health (Dalleck, Lance C., and Jessica L. Mayer. “Heart Rate Training Methods and Monitoring.” *Encyclopedia of Lifestyle Medicine & Health*. Ed. James M. Rippe. Vol. 1. Thousand Oaks, CA: SAGE Reference, 2012. 553-556. *Gale Virtual Reference Library*. Retrieved from http://go.galegroup.com/ps/i.do?id=G...cf908215366226)

When reading this article pay special attention to the differences between the HR maximum and the HR reserve methods. Notice how the HR reserve method is more individualized because it takes in consideration the person’s own resting HR. Furthermore, read the section on the misconceptions and compare it with any previous knowledge you had on these topics.

- Read Bioenergetics of Exercise and Training (Su, John K. “Bioenergetics of Exercise and Training.” *Encyclopedia of Sports Medicine*. Ed. Lyle J. Micheli. Vol. 1. Thousand Oaks, CA: SAGE Reference, 2011. 159-161. *Gale Virtual Reference Library*. Retrieved from http://go.galegroup.com/ps/i.do?id=G...59c7e69c269f82)

This article explains how our bodies utilize three energy systems to produce work during exercise: creatine phosphate system, non-oxidative system, and oxidative system. Although these systems can active at the same time, different exercises and sports may rely on one system more than the others based on the intensity and duration of the activity.

- Read chapters four and five and review module key terms and sections one and two of this document: Health-Related Fitness Overview

You are not required to read the information on muscular fitness/resistance training and flexibility at this point.

This overview document was created by Mr. Travis M. Erickson, MS, CSCS*D, Lecturer for the Appalachian State University department of Health, Leisure, and Exercise Science (ericksontm@appstate.edu).

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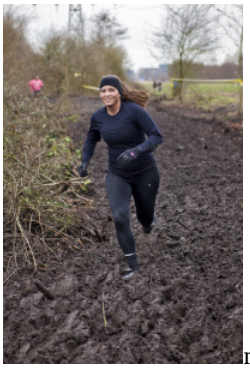
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# 17.2: Borg Rating of Perceived Exertion (RPE) Scale

## Borg scale

In sports and particularly exercise testing, the **Borg Rating of Perceived Exertion (RPE) Scale** measures perceived exertion. In



medicine this is used to document the patient's exertion during a test, and sports coaches use the scale to assess the intensity of training and competition. The original scale introduced by Gunnar Borg rated exertion on a scale of 6-20. Borg then constructed a category (C) ratio (R) scale, the Borg CR10 Scale. This is especially used in clinical diagnosis of breathlessness and dyspnea, chest pain, angina and musculo-skeletal pain. The CR-10 scale is best suited when there is an overriding sensation arising either from a specific area of the body, for example, muscle pain, ache or fatigue in the quadriceps or from pulmonary responses.

The Borg scale can be compared to other linear scales such as the Likert scale or a visual analogue scale. The sensitivity and reproducibility of the results are broadly very similar, although the Borg may outperform the Likert scale in some cases.[1]

The seemingly odd range of 6-20 is to follow the general heart rate of a healthy adult by multiplying by 10. For instance, a perceived exertion of 12 would be expected to coincide with a heart rate of roughly 120 beats per minute.

### Set points on scale

It ranges from 6 to 20,[2] where 6 means "no exertion at all" and 20 means "maximal exertion." Choose the number from below that best describes your level of exertion. This will give you a good idea of the intensity level of your activity, and you can use this information to speed up or slow down your movements to reach your desired range.

Try to appraise your feeling of exertion as honestly as possible, without thinking about what the actual physical load is. Your own feeling of effort and exertion is important, not how it compares to other people's. Look at the scales and the expressions and then give a number.

6 No exertion at all

7 Extremely light (7.5)

8

9 Very light

10

11 Light

12

13 Somewhat hard

14

15 Hard

16

17 Very hard

18

19 Extremely hard

20 Maximal exertion

9 corresponds to “very light” exercise. For a healthy person, it is like walking slowly at his or her own pace for some minutes.

13 on the scale is “somewhat hard” exercise, but it still feels OK to continue.

17, or “very hard,” is very strenuous. A healthy person can still go on, but he or she really has to push him- or herself. It feels very heavy, and the person is very tired.

19 on the scale is an extremely strenuous exercise level. For most people this is the most strenuous exercise they have ever experienced.


1. Grant, S.; Aitchison, T.; Henderson, E.; Christie, J.; Zare, S.; McMurray, J.; Dargie, H. (1999). “A Comparison of the Reproducibility and the Sensitivity to Change of Visual Analogue Scales, Borg Scales, and Likert Scales in Normal Subjects During Submaximal Exercise”. *Chest* **116** (5): 1208–1217. doi:10.1378/chest.116.5.1208. PMID 10559077.
2. CDC http://www.cdc.gov/physicalactivity/everyone/measuring/exertion.html.



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# 17.3: Target Heart Rate and Estimated Maximum Heart Rate

One way of monitoring physical activity intensity is to determine whether a person's pulse or heart rate is within the target zone during physical activity.

**For moderate-intensity physical activity**, a person's target heart rate should be 50 to 70% of his or her maximum heart rate. This maximum rate is based on the person's age. An estimate of a person's maximum age-related heart rate can be obtained by subtracting the person's age from 220. For example, for a 50-year-old person, the estimated maximum age-related heart rate would be calculated as 220 – 50 years = 170 beats per minute (bpm). The 50% and 70% levels would be:

- 50% level: 170 x 0.50 = 85 bpm, and
- 70% level: 170 x 0.70 = 119 bpm

Thus, moderate-intensity physical activity for a 50-year-old person will require that the heart rate remains between 85 and 119 bpm during physical activity.

**For vigorous-intensity physical activity**, a person's target heart rate should be 70 to 85% of his or her maximum heart rate. To calculate this range, follow the same formula as used above, except change "50 and 70%" to "70 and 85%". For example, for a 35-year-old person, the estimated maximum age-related heart rate would be calculated as 220 – 35 years = 185 beats per minute (bpm). The 70% and 85% levels would be:

- 70% level: 185 x 0.70 = 130 bpm, and
- 85% level: 185 x 0.85 = 157 bpm

Thus, vigorous-intensity physical activity for a 35-year-old person will require that the heart rate remains between 130 and 157 bpm during physical activity.



**Taking Your Heart Rate**

Generally, to determine whether you are exercising within the heart rate target zone, you must stop exercising briefly to take your pulse. You can take the pulse at the neck, the wrist, or the chest. We recommend the wrist. You can feel the radial pulse on the artery of the wrist in line with the thumb. Place the tips of the index and middle fingers over the artery and press lightly. Do not use the thumb. Take a full 60-second count of the heartbeats, or take for 30 seconds and multiply by 2. Start the count on a beat, which is counted as "zero." If this number falls between 85 and 119 bpm in the case of the 50-year-old person, he or she is active within the target range for moderate-intensity activity.

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# 17.4: Video- Target Heart Rate

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# 17.5: Assessment- Cardiorespiratory Endurance Plan

## Purpose

This assignment will help you complete your cardiorespiratory endurance plan.

## Directions

- Read how to calculate heart rate zone and practice the calculations
- Open this template: CR Endurance Plan
- Complete all the sections in the template. Do not submit the assignment in an essay format.
    - For section 1, make sure your SMART goals are related to cardiorespiratory endurance. In other words, what was your score on the walk or run test? And what do you want it to be the next time you measure it? Goals for the other assessments (ex. flexibility, BMI) do not belong here and should not be included here. Note: drinking water and other nutrition goals do not belong here either; this is strictly a CR endurance plan.
    - On section 3, item 2 (intensity), you must show **every** step in the calculations, starting with your predicted HRMax calculation.
- Save your document and submit it to the course.

## Grading

The assignment is worth 10 points maximum.

Your work will be assessed using the following CR Endurance Plan Grading Rubric:

| **Criteria** | **Absent** | **Incomplete** | **Complete** |
|---|---|---|---|
| Short and Long Term Goals | 0 Points | 1 point<br>Up to 1 point if incomplete or some goals inappropriate to the topic of this assignment (CR endurance) | 2 points<br>Complete and appropriate to the topic of this assignment (CR endurance) |
| Warm up and cool down | 0 Points | 0.5 Points<br>Up to 0.5 point if missing parts | 1 Points<br>Complete with type and time and and appropriate activities based on the readings |
| Frequency | 0 Points | 0 Points | 1 Points<br>Complete and correct based on the ACSM guidelines. If you cannot follow the ACSM guidelines due to health condition or other extenuating circumstances, please explain it in your assignment. Otherwise, I will think you selected an incorrect frequency because you did not read the guidelines. |

| | | | |
|---|---|---|---|
| Intensity | 0<br>Missing, incomplete, or with major calculation mistake. Always make sure your calculation results make sense based on the information learned. If your final target heart rate range is not safe or effective you will not be eligible for grade in this section. | 1.5 points<br>Up to 1.5 points if complete but with minor calculation mistake. A minor mistake is one that does not affect the safety or effectiveness of the final target heart rate result. | 3 Points<br>Every calculation step is complete and correct |
| Type | 0 Points | 0.5 Points<br>Up to 0.5 point if some of the listed activities are inappropriate to the topic of this assignment (CR endurance) | 1 Points<br>Complete and appropriate to the topic of this assignment (CR endurance) |
| Time/Duration | 0 Points | 0 Points | 1 Points<br>Complete and correct based on the ACSM guidelines. If you cannot follow the ACSM guidelines due to health condition or other extenuating circumstances, please explain it in your assignment. Otherwise I will think you selected an incorrect duration because you did not read the guidelines. |
| Summary | 0 Points | 0.2 Points<br>Up to 0.2 if missing parts or if the information listed in the summary does not reflect the information listed in previous sections of this assignment | 0.5 Points<br>Complete and the information listed in the summary reflects the information listed in previous sections of this assignment |
| Organization | 0 Points | 0 Points | 0.5 Points |

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# CHAPTER OVERVIEW

## 18: Flexibility


18.1: Flexibility Readings
18.2: Sample Flexibility Plan for Beginners
18.3: Help Prevent Back Pain
18.4: Reminder About Activity Tracker
18.5: Assessment- Flexibility Plan


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# 18.1: Flexibility Readings

## Purpose

The readings here will help you to learn the definition for flexibility, and the guidelines that apply to flexibility training.

## Directions

The rest of this chapter contains your reading for this section.

Additionally, information on these external sources will be useful to deepen your understanding:

- Read the Summary of ACSM Guidelines
  - This is the same summary you read last week. This time, pay special attention to the flexibility exercise recommendations.
- Read American College of Sports Medicine Guidelines
  - And here is the full length position stand again. Read pages 1344 – 1346 of the PDF version (you are not required to read the information on neuromotor training).
- Review Health-Related Fitness Overview
  - Read Sections one, two, four, and five, focusing on the flexibility/stretching portions. You are not required to read the information on muscular fitness and resistance training at this point.
- Read Stretching_Gale Encyclopedia of Fitness (Alic, Margaret. "Stretching." *The Gale Encyclopedia of Fitness*. Ed. Jacqueline L. Longe. Vol. 2. Detroit: Gale, 2012. 822-827. *Gale Virtual Reference Library*. Retrieved from http://go.galegroup.com/ps/i.do?id=G...34cd4585ea95fc)
  - This article contains great information on the best time to perform static and dynamic stretches. This is important information, especially because many people believe they should perform static stretches prior to other exercises or worse yet, stretch cold muscles. Read all the information under the blue heading "stretching."
- Read Flexibility_Encyclopedia of Lifestyle Medicine & Health (Boslaugh, Sarah. "Flexibility and Flexibility Training." *Encyclopedia of Lifestyle Medicine & Health*. Ed. James M. Rippe. Vol. 1. Thousand Oaks, CA: SAGE Reference, 2012. 477-480. *Gale Virtual Reference Library*. Retrieved from http://go.galegroup.com/ps/i.do?id=G...7eadbf2486db04)
  - Read all the information under the heading "flexibility and flexibility training."

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# 18.2: Sample Flexibility Plan for Beginners



Stretching the body's muscles provides freedom of movement to do the things you need to do and the things you like to do. Stretching can improve your flexibility, although it will not improve your endurance or strength.

## How Much, How Often

- Stretch **after** you do your regularly scheduled strength and aerobic activities. You should be stretching every day.
- If you can't do endurance or strength exercises, and stretching exercises are the only kind you are able to do, do them at least 3 times a week, for at least 20 minutes each session.
- Do each stretching exercise at least 4 times each session. Slowly stretch into the desired position, as far as possible without pain, and hold the stretch for 15–60 seconds. Relax, then repeat, trying to stretch a little farther. Always remember to breathe while stretching. Counting out loud can help ensure that you are breathing.

## Safety

- If you have had a hip or knee replacement, check with your surgeon before doing lower body exercises.
- Always warm up before doing stretching exercises. For example, do them after endurance or strength exercises or, if you are doing only stretching exercises on a particular day, do a little bit of easy walking and arm-pumping first.
- Stretching should never cause pain, especially joint pain. If it does, you are stretching too far and you need to reduce the stretch so that it doesn't hurt. Mild discomfort or a mild pulling sensation is normal. Never "bounce" into a stretch; make slow, steady movements instead. Jerking into position can cause muscles to tighten, possibly resulting in injury.
- Avoid "locking" your joints into place when you straighten them during stretches. Your arms and legs should be straight when you stretch them, but you should always have a very small amount of bend in your joints while stretching.
- Some of the exercises require you to lie on the floor. If you are afraid to lie on the floor because you think you won't be able to get back up, consider exercising with a buddy, in a chair, or in the pool. Alternatively, keep a chair nearby to use as support in getting up. All stretches can be modified.

## Getting Started

Stretching exercises are generally performed at a low intensity. You can progress in your stretching exercises; the way to know how to limit yourself is that stretching should never hurt. It may feel slightly uncomfortable, but not painful. Push yourself to stretch farther, but not so far that it hurts. Perform the following exercises, in order, as described below.

Detailed instructions for each exercise are provided at the end of this handout and are taken from *Exercise: A Guide from the National Institute on Aging.*

**STRETCH REPETITIONS, SETS, AND SESSIONS**

| Flexibility Exercise/Stretch | # of repetitions per set | # of sets per session | # of sessions per week |
|---|---|---|---|
| **Hamstrings** | 4 per side | 1 | After every aerobic or strength session |
| **Alternative Hamstrings** | 4 per side | 1 | After every aerobic or strength session |

| | | | |
|---|---|---|---|
| **Calves** | 4 per side | 1 | After every aerobic or strength session |
| **Ankles** | 4 per side | 1 | After every aerobic or strength session |
| **Triceps** | 4 per side | 1 | After every aerobic or strength session |
| **Wrists** | 4 per side | 1 | After every aerobic or strength session |
| **Quadriceps** | 4 per side | 1 | After every aerobic or strength session |
| **Double Hip Rotation** | 4 per side | 1 | After every aerobic or strength session |
| **Single Hip Rotation** | 4 per side | 1 | After every aerobic or strength session |
| **Shoulder Rotation** | 4 per side | 1 | After every aerobic or strength session |
| **Neck Rotation** | 4 per side | 1 | After every aerobic or strength session |
| **Side Leg Raise** | 4 per side | 1 | After every aerobic or strength session |

If you are not currently doing aerobic or strength activities, do flexibility and stretching at least 3 times per week for at least 20 minutes per session.

## EXERCISES

### Hamstrings

*Stretches muscles in the back of the thigh*

- Sit sideways on bench or other hard surface (such as two chairs placed side by side).
- Keep one leg stretched out on bench, straight, toes pointing up.
- Keep other leg off of bench, with foot flat on floor.
- Straighten back.
- If you feel a stretch at this point, hold the position for 15–60 seconds.
- If you don’t feel a stretch, lean forward from hips (not waist) until you feel stretching in leg on bench, keeping back and shoulders straight. Omit this step if you have had a hip replacement, unless surgeon/therapist approves.
- Hold position for 15–60 seconds.
- Repeat with other leg.
- Repeat at least 4 times on each side.

### Alternative Hamstrings Stretch

*Stretches muscles in the back of the thigh*

- Stand behind chair, holding on with both hands.
- Bend forward from the hips (not waist), keeping back and shoulders straight at all times.
- When upper body is parallel to floor, hold position for 15–60 seconds. You should feel a stretch in the backs of your thighs.
- Repeat at least 4 times.

### Calves

*Stretches lower leg muscles in two ways: with knee straight and knee bent*

- Stand with hands against wall, arms outstretched and elbows straight.
- Keeping your left knee slightly bent, toes of right foot slightly turned inward, step back 1–2 feet with right leg, heel, and foot flat on floor. You should feel a stretch in your calf muscle, but you shouldn't feel uncomfortable. If you don't feel a stretch, move your foot farther back until you do.
- Hold position for 15–60 seconds.
- Bend knee of right leg, keep heel and foot flat on floor.
- Hold position for another 15–60 seconds.
- Repeat with left leg.
- Repeat at least 4 times for each leg.

### Ankles

*Stretches front ankle muscles*

- Remove your shoes. Sit toward the front edge of a chair and lean back, using pillows to support your back.
- Stretch legs out in front of you.
- With your heels still on the floor, bend ankles to point feet toward you.
- Next, bend ankles to point feet away from you.
- If you don't feel the stretch, repeat with your feet slightly off the floor.
- Hold the position for 15–60 seconds.
- Repeat at least 4 times.

### Triceps

*Stretches muscles in back of upper arm*

- Hold one end of a towel in right hand.
- Raise and bend right arm to drape towel down back. Keep your right arm in this position, and continue holding onto the towel.
- Reach behind your lower back and grasp bottom end of towel with left hand.
- Climb left hand progressively higher up towel, which also pulls your right arm down. Continue until your hands touch, or as close to that as you can comfortably go. Hold for 15–60 seconds.
- Reverse positions.
- Repeat each position at least 4 times.

### Wrists

*Stretches wrist muscles*

- Place hands together, in praying position.
- Slowly raise elbows so arms are parallel to floor, keeping hands flat against each other.
- Hold position for 15–60 seconds.
- Repeat at least 4 times.

## FLOOR EXERCISES

### About Floor Exercises

### To get into a lying position:

- Stand next to a very sturdy chair that won't tip over (put chair against wall for support if you need to).
- Put your hands on the seat of the chair.
- Lower yourself down on one knee.
- Bring the other knee down.
- Put your left hand on the floor and lean on it as you bring your left hip to the floor.
- Your weight is now on your left hip.
- Straighten your legs out.
- Lie on your left side.
- Roll onto your back.

*Note: You don't have to use your left side. You can use your right side, if you prefer.*

### To get up from a lying position:

- Roll onto your left side.
- Use your right hand, placed on the floor at about the level of your ribs, to push your shoulders off the floor.
- Your weight is on your left hip.
- Roll forward, onto your knees, leaning on your hands for support. Lean your hands on the seat of the chair you used to lie down.
- Lift one of your knees so that one leg is bent, foot flat on the floor.
- Leaning your hands on the seat of the chair for support, rise from this position.

*Note: You don't have to use your left side. You can reverse positions, if you prefer.*

### Quadriceps

*Stretches muscles in front of thighs*

- Lie on side on the floor. Your hips should be lined up so that one is directly above the other one.
- Rest head on pillow or hand.
- Bend knee that is on top.
- Reach back and grab heel of that leg. If you can't reach your heel with your hand, loop a belt over your foot and hold belt ends.
- Gently pull that leg until front of thigh stretches.
- Hold position for 15–60 seconds.
- Reverse position and repeat.
- Repeat at least 4 times on each side. If the back of your thigh cramps during this exercise, stretch your leg and try again, more slowly.

### Shoulder Rotation

*Stretches shoulder muscles*

- Lie flat on floor, pillow under head, legs straight. If your back bothers you, place a rolled towel under your knees.
- Stretch arms straight out to side. Your shoulders and upper arms will remain flat on the floor throughout this exercise.
- Bend elbows so that your hands are pointing toward the ceiling.
- Let your arms slowly roll backwards from the elbow. Stop when you feel a stretch or slight discomfort, and stop immediately if you feel a pinching sensation or a sharp pain.
- Hold position for 15–60 seconds.
- Slowly raise your arms, still bent at the elbow, to point toward the ceiling again. Then let your arms slowly roll forward, remaining bent at the elbow, to point toward your hips. Stop when you feel a stretch or slight discomfort.
- Hold position for 15–60 seconds.
- Alternate pointing above head, then toward ceiling, then toward hips. Begin and end with pointing-above-head position.
- Repeat 4 times.

### Double Hip Rotation

*Stretches outer muscles of hips and thighs. Unless your surgeon approves, don't do this exercise if you have had a hip replacement*

- Lie on floor on your back, knees bent and feet flat on the floor.

- Keep shoulders on floor at all times.
- Keeping knees bent and together, gently lower legs to one side as far as possible without forcing them.
- Hold position for 15–60 seconds.
- Return legs to upright position.
- Repeat toward other side.
- Repeat at least 4 times on each side.

### Single Hip Rotation

*Stretches muscles of pelvis and inner thigh. Unless your surgeon approves, don't do this exercise if you have had a hip replacement*

- Lie on your back on floor, knees bent and feet flat on the floor.
- Keep shoulders on floor throughout exercise.
- Lower one knee slowly to side, keeping the other leg and your pelvis in place.
- Hold position for 15–60 seconds.
- Bring knee back up slowly.
- Repeat with other knee.
- Repeat at least 4 times on each side.

### Neck Rotation

*Stretches neck muscles*

- Lie on the floor with a phone book or other thick book under your head.
- Slowly turn head from side-to-side, holding position each time for 15–60 seconds on each side. Your head should not be tipped forward or backward, but should be in a comfortable position. You can keep your knees bent to keep your back comfortable during this exercise.
- Repeat at least 4 times.

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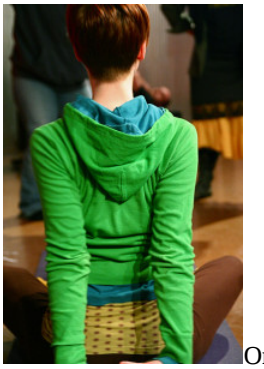
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# 18.3: Help Prevent Back Pain

## The Basics

 One of the best ways to prevent back pain is to keep your back muscles strong. Follow these steps to help protect your back and prevent back pain:

- Do back-strengthening and stretching exercises at least 2 or 3 times a week.
- Stand and sit up straight.
- Avoid heavy lifting. If you do lift something heavy, bend your knees and keep your back straight. This way, your leg muscles will do most of the work.
- Stay active and eat a balanced diet.
- If you are overweight, lose weight to help lower the strain on your back.

Learn more about back pain and how to prevent it.

### There are different kinds of back pain.

Back pain can feel like a dull, constant ache or a sudden, sharp pain. Back pain often gets better on its own. Find out when to call a doctor or nurse.

#### *What is the difference between acute and chronic back pain?*

Acute back pain is pain that lasts from a few days to a few weeks. It's often caused by an accident, a fall, or lifting something too heavy. Acute back pain usually gets better without any treatment.

Back pain that lasts for more than 3 months is called chronic back pain. It is much less common than acute back pain. Most chronic back pain can be treated without surgery.

Find out about ways to treat back pain.

### Who gets back pain?

Most people have back pain at some point in their lives. It's one of the most common reasons people visit the doctor or nurse. People are more likely to experience back pain as they get older.

Many people hurt their backs at work when they lift, push, or pull something that's too heavy. People may also be at risk for back pain if they:

- Have poor posture (don't stand and sit up straight)
- Aren't physically active
- Are overweight
- Fall or have an accident
- Have a health problem that causes back pain (like arthritis or cancer)
- Smoke

## Take Action!

Take care of your back to avoid back pain. Preventing back pain is easier than treating it.

### Strengthen your back.

There are things you can do to make your back stronger and lower your risk of back pain.

- Do back-strengthening and stretching exercises at least 2 or 3 times a week.
- Try a yoga class. It can help stretch and strengthen muscles and improve your posture.
- Stay active. Regular physical activity can help keep your back muscles strong. Aim for 2 hours and 30 minutes of moderate activity a week.

If you have a health condition, your doctor can help you choose the best activities for you. Get tips on staying active with a disability.

### Focus on good posture.

Good posture can help prevent back pain.

- Try not to slouch when standing and sitting.
- Sit up straight with your back against the back of your chair and your feet flat on the floor. Keep your knees slightly higher than your hips.
- Stand tall with your head up and shoulders back.

Find out how to have good posture while sitting at a computer.

### Lift correctly.

Lift things with your legs, not your back. Keep your back straight and bend at the knees or at the hips. Get help if the load is too heavy for you to lift alone. Get more tips on safe lifting.

### Watch your weight.

If you are overweight, watching your weight can help reduce the strain on your back.

### Get enough calcium and vitamin D.

Getting enough calcium and vitamin D can help keep your bones strong and prevent osteoporosis (“os-tee-oh-puh-ROH-sis”). If you have osteoporosis, your bones are weak and more likely to fracture (break). Spine fractures from osteoporosis are a leading cause of back pain.

### Prevent back injuries at work.

Protecting your back on the job can help prevent injuries. Back injuries are the most common type of workplace injury.

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# 18.4: Reminder About Activity Tracker

## Track your exercise program

Begin your cardiorespiratory (CR) endurance program now (based on the CR plan you created). Use the Physical Activity Tracker to record your weekly activities so that you can submit them at the end of the course. Bookmark this link if you need.

You are required to record your activities on the activity tracker website every week but you are not required to submit it for grading now. You will be required to submit a summary report from the activity tracker website later in the term. Therefore, record your weekly activities diligently or you will not be able to create a summary report.

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# 18.5: Assessment- Flexibility Plan

## Purpose

This assignment will help you complete your flexibility plan.

## Directions

- Open this template of the Flexibility Plan and answer the questions in it

For this assignment, you must start with SMART Goals. All goals should be flexibility or low back health goals, and **at least one goal must be linked to your pretest score. Do not include any pretest score other than your flexibility score.**

A good way to determine whether or not you have written a SMART goal is to ask yourself a few questions. For each goal you write, ask yourself: is it Specific? Is it Measurable? Is it Attainable? Is it Realistic? Is it Timeframe specific?

The last question (T) is easy to answer because your current SMART Goals must describe what you hope to accomplish in this course. Once you have developed your goals, move on to your FITT plan. You must include a minimum of two upper body stretches and two lower body stretches: you can add more if you like.

- Save the document with your answers and upload it to the course.

## Grading

The assignment is graded. It is worth 10 points maximum.

The Flexibility Plan Grading Rubric will be used to assess your work:

| Criteria | Absent | Incomplete | Complete |
|---|---|---|---|
| Short- and long-term goals | 0 points | 1 point<br>Up to 1 point if incomplete or some goals inappropriate to the topic of this assignment (flexibility) | 2 Points<br>Complete and appropriate to the topic of this assignment (flexibility) |
| Warm up and cool down | 0 points | 0.2 points<br>Up to 0.2 points if missing parts | 0.5 Points<br>Complete with activity and time |
| Frequency | 0 points | 0 points | 2 Points<br>Complete and correct based on the ACSM guidelines. If you cannot follow the ACSM guidelines due to health condition or other extenuating circumstances, please explain it in your assignment. Otherwise, I will think you selected an incorrect frequency because you did not read the guidelines. |
| Intensity | 0 points | 0 points | 1 Points<br>Complete and correct based on the ACSM guidelines. |

| | | | |
|---|---|---|---|
| Type | 0 points | 0.5 Points | 2 Points<br>Complete and correct based on the ACSM guidelines. |
| Time/Duration | 0 points | 0 Points | 2 Points<br>Complete and correct based on the ACSM guidelines. If you cannot follow the ACSM guidelines due to health condition or other extenuating circumstances, please explain it in your assignment. Otherwise I will think you selected an incorrect duration because you did not read the guidelines. |
| Organization | 0 points | 0 Points | 0.5 Points |

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# CHAPTER OVERVIEW

## 19: Body Composition


19.1: Unit 3 Overview and Objectives
19.2: Body Composition Reading
19.3: About BMI for Adults
19.4: Discussion- How's It Going?
19.5: Assessment- Re-Assessed Fitness Level Results


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# 19.1: Unit 3 Overview and Objectives

## Overview

Now that you have passed “Go!” and have been traveling along your journey, in this unit you will make some changes and then “Keep Going!”

## Learning Objectives

At the end of unit, you will be able to:

- Discuss how body composition influences wellness
- Identify current body composition recommendations
- Re-assess fitness level, body mass index (BMI), and waist circumference
- Evaluate the progress of your fitness program and make the necessary adjustments
- Define body composition terminology such as overweight, obese, underweight, fat-free mass, essential fat, and nonessential fat
- Determine recommended energy requirements and own current energy intake
- Explain the physiological function of essential nutrients
- Outline current nutrition guidelines for healthy adults and for individuals with special dietary needs, and how to maintain a lifetime healthy diet
- Articulate the importance of portion size and food labels on a well-balanced diet
- Compare the nutritional characteristics and affordability of various foods and how you can use this information to implement a personal nutrition plan to promote wellness
- Describe the basic anatomy and physiology of the musculoskeletal system and how it is affected by exercise
- Define muscular strength and muscular endurance and describe the benefits of each
- Apply the FITT dimensions to the development of a muscular fitness program and select safe and effective muscular strength/endurance exercises for major muscle groups to accomplish your goals

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# 19.2: Body Composition Reading

## Purpose

The readings will help you understand the topics covered in this week.

## Directions

The rest of this chapter contains your reading for this section.

Additionally, information on these external sources will be useful to deepen your understanding:

- Read Health-Related Fitness Overview
  Review the Module key terms and sections one and three. Focus on the body composition information.

  This overview document was created by Mr. Travis M. Erickson, MS, CSCS*D, Lecturer for the Appalachian State University department of Health, Leisure, and Exercise Science (ericksontm@appstate.edu).
- Read ACSM_Body composition
  You are not required to read the Q&A sections (pages 2 and 6). Read everything else. Notice how both this article and the previous one (#1) emphasize that Body Mass Index (BMI) is not an assessment of body composition. However, since it is a widely used screening tool it is important to know what the numbers mean in terms of classification (ex. BMI ≥ 30 = obese).
- Read Body Comp_Measurement_Encyclopedia of Lifestyle Medicine & Health (Hongu, Nobuko, Lee R. Vinson, and Scott Going. “Body Composition: Measurement Techniques.” *Encyclopedia of Lifestyle Medicine & Health*. Ed. James M. Rippe. Vol. 1. Thousand Oaks, CA: SAGE Reference, 2012. 138-143. *Gale Virtual Reference Library*. Retrieved from http://go.galegroup.com/ps/i.do?id=G...2894a1f451caec)
  This article will help you understand how to estimate body fat and will give you better insight into the screening tools we are using for this class: BMI and waist measurement.
- Read Body Fat Distribution

  This very short article introduces a new screening tool for obesity-related problems: waist-to-hip ratio. I recommend you calculate your own waist-to-hip ratio as explained in the article. This will help you understand if you are at an increased risk of health problems due to the distribution of your body fat.
- Read Female_Athlete_Triad (Ackerman, Kathryn E. “Female Athlete Triad.” *Encyclopedia of Sports Medicine*. Ed. Lyle J. Micheli. Vol. 2. Thousand Oaks, CA: SAGE Reference, 2011. 497-499. *Gale Virtual Reference Library*. Retrieved from http://go.galegroup.com/ps/i.do?id=G...9b33b3819e60f3)

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# 19.3: About BMI for Adults

## What is BMI?

Body Mass Index (BMI) is a number calculated from a person's weight and height. BMI is a fairly reliable indicator of body fatness for most  people. BMI does not measure body fat directly, but research has shown that BMI correlates to direct measures of body fat, such as underwater weighing and dual energy x-ray absorptiometry (DXA).[1, 2] BMI can be considered an alternative for direct measures of body fat. Additionally, BMI is an inexpensive and easy-to-perform method of screening for weight categories that may lead to health problems.

## How is BMI used?

BMI is used as a screening tool to identify possible weight problems for adults. However, BMI is not a diagnostic tool. For example, a person may have a high BMI. However, to determine if excess weight is a health risk, a healthcare provider would need to perform further assessments. These assessments might include skinfold thickness measurements, evaluations of diet, physical activity, family history, and other appropriate health screenings.

## Why does CDC use BMI to measure overweight and obesity?

Calculating BMI is one of the best methods for population assessment of overweight and obesity. Because calculation requires only height and weight, it is inexpensive and easy to use for clinicians and for the general public. The use of BMI allows people to compare their own weight status to that of the general population.

To see the formula based on either kilograms and meters or pounds and inches, visit How is BMI calculated and interpreted?

## What are some of the other ways to measure obesity? Why doesn't CDC use those to determine overweight and obesity among the general public?

Other methods to measure body fatness include skinfold thickness measurements (with calipers), underwater weighing, bioelectrical impedance, dual-energy x-ray absorptiometry (DXA), and isotope dilution. However, these methods are not always readily available, and they are either expensive or need highly trained personnel. Furthermore, many of these methods can be difficult to standardize across observers or machines, complicating comparisons across studies and time periods.

## How is BMI calculated and interpreted?

**Calculation of BMI**

BMI is calculated the same way for both adults and children. The calculation is based on the following formulas:

| Measurement Units | Formula and Calculation |
|---|---|
| Kilograms and meters (or centimeters) | Formula: weight (kg) / [height (m)]$^2$<br>With the metric system, the formula for BMI is weight in kilograms divided by height in meters squared. Since height is commonly measured in centimeters, divide height in centimeters by 100 to obtain height in meters.<br>Example: Weight = 68 kg, Height = 165 cm (1.65 m)<br>Calculation: 68 ÷ $(1.65)^2$ = 24.98 |

| | |
|---|---|
| Pounds and inches | Formula: weight (lb) / [height (in)]$^2$ x 703<br>Calculate BMI by dividing weight in pounds (lbs) by height in inches (in) squared and multiplying by a conversion factor of 703.<br>Example: Weight = 150 lbs, Height = 5’5″ (65″)<br>Calculation: [150 ÷ (65)$^2$] x 703 = 24.96 |

**Interpretation of BMI for adults**

For adults 20 years old and older, BMI is interpreted using standard weight status categories that are the same for all ages and for both men and women. For children and teens, on the other hand, the interpretation of BMI is both age- and sex-specific.

The standard weight status categories associated with BMI ranges for adults are shown in the following table.

| BMI | Weight Status |
|---|---|
| Below 18.5 | Underweight |
| 18.5 – 24.9 | Normal |
| 25.0 – 29.9 | Overweight |
| 30.0 and Above | Obese |

For example, here are the weight ranges, the corresponding BMI ranges, and the weight status categories for a sample height.

| Height | Weight Range | BMI | Weight Status |
|---|---|---|---|
| 5′ 9″ | 124 lbs or less | Below 18.5 | Underweight |
| | 125 lbs to 168 lbs | 18.5 to 24.9 | Normal |
| | 169 lbs to 202 lbs | 25.0 to 29.9 | Overweight |
| | 203 lbs or more | 30 or higher | Obese |

## How reliable is BMI as an indicator of body fatness?

The correlation between the BMI number and body fatness is fairly strong; however the correlation varies by sex, race, and age. These variations include the following examples: [3, 4]

- At the same BMI, women tend to have more body fat than men.
- At the same BMI, older people, on average, tend to have more body fat than younger adults.
- Highly trained athletes may have a high BMI because of increased muscularity rather than increased body fatness.

It is also important to remember that BMI is only one factor related to risk for disease. For assessing someone’s likelihood of developing overweight- or obesity-related diseases, the National Heart, Lung, and Blood Institute guidelines recommend looking at two other predictors:

- The individual’s waist circumference (because abdominal fat is a predictor of risk for obesity-related diseases).
- Other risk factors the individual has for diseases and conditions associated with obesity (for example, high blood pressure or physical inactivity).

For more information about the assessment of health risk for developing overweight- and obesity-related diseases, visit the following Web pages from the National Heart, Lung, and Blood Institute:

- Assessing Your Risk
- Body Mass Index Table
- Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults

## If an athlete or other person with a lot of muscle has a BMI over 25, is that person still considered to be overweight?

According to the BMI weight status categories, anyone with a BMI over 25 would be classified as overweight and anyone with a BMI over 30 would be classified as obese.

It is important to remember, however, that BMI is not a direct measure of body fatness and that BMI is calculated from an individual's weight which includes both muscle and fat. As a result, some individuals may have a high BMI but not have a high percentage of body fat. For example, highly trained athletes may have a high BMI because of increased muscularity rather than increased body fatness. Although some people with a BMI in the overweight range (from 25.0 to 29.9) may not have excess body fatness, most people with a BMI in the obese range (equal to or greater than 30) will have increased levels of body fatness.

It is also important to remember that weight is only one factor related to risk for disease. If you have questions or concerns about the appropriateness of your weight, you should discuss them with your healthcare provider.

## What are the health consequences of overweight and obesity for adults?

The BMI ranges are based on the relationship between body weight and disease and death.[5] Overweight and obese individuals are at increased risk for many diseases and health conditions, including the following: [6]

- Hypertension
- Dyslipidemia (for example, high LDL cholesterol, low HDL cholesterol, or high levels of triglycerides)
- Type 2 diabetes
- Coronary heart disease
- Stroke
- Gallbladder disease
- Osteoarthritis
- Sleep apnea and respiratory problems
- Some cancers (endometrial, breast, and colon)

For more information about these and other health problems associated with overweight and obesity, visit Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults.

## Is BMI interpreted the same way for children and teens as it is for adults?

Although the BMI number is calculated the same way for children and adults, the criteria used to interpret the meaning of the BMI number for children and teens are different from those used for adults. For children and teens, BMI age- and sex-specific percentiles are used for two reasons:

- The amount of body fat changes with age.
- The amount of body fat differs between girls and boys.

Because of these factors, the interpretation of BMI is both age- and sex-specific for children and teens. The CDC BMI-for-age growth charts take into account these differences and allow translation of a BMI number into a percentile for a child's sex and age.

For adults, on the other hand, BMI is interpreted through categories that are not dependent on sex or age.

## References

[1]Mei Z, Grummer-Strawn LM, Pietrobelli A, Goulding A, Goran MI, Dietz WH. Validity of body mass index compared with other body-composition screening indexes for the assessment of body fatness in children and adolescents. *American Journal of Clinical Nutrition* 2002;7597–985.

[2]Garrow JS and Webster J. Quetelet's index (W/H2) as a measure of fatness. *International Journal of Obesity* 1985;9:147–153.

[3]Prentice AM and Jebb SA. Beyond Body Mass Index. *Obesity Reviews*. 2001 August; 2(3): 141–7.

[4]Gallagher D, et al. How useful is BMI for comparison of body fatness across age, sex and ethnic groups? *American Journal of Epidemiology* 1996;143:228–239.

[5]World Health Organization. Physical status: The use and interpretation of anthropometry. Geneva, Switzerland: World Health Organization 1995. WHO Technical Report Series.

[6]Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults.

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# 19.4: Discussion- How's It Going?

## Purpose

You will evaluate your current fitness program and your progress, and share helpful information with your classmates.

## Directions

- Go to the Discussion Forum "How's it Going?"
- Tell us what's happening with your fitness plans. Specifically address the following questions.
  - Any positives or negatives?
  - What results, if any, are you seeing in your fitness activities?
  - How have you used the principle of progressive overload up to this point?
  - Has your resting heart rate changed? And what does it mean?
  - Have you had to make any modifications in frequency, intensity, type or time (FITT)? And Why/why not?
  - What modifications are you planning to make to your exercise program?
- Submit your original entry, then respond to two of your classmates. No attachments or activity logs, please! You can offer suggestions about something that is working for you, or let a classmate know that you will try something s/he is doing.

## Grading

The assignment is worth 10 points maximum.

Your work will be assessed using the How's It Going Grading Rubric:

| Criteria | Absent | Incomplete | Complete |
|---|---|---|---|
| Original entry | 0 points | 3.5 points<br>Up to 3.5 points if submitted late, missing answers to some questions listed in the assignment instructions, or less than 3 sentences long. | 7 Points<br>Thorough entry addressing all questions listed in the assignment instructions and submitted by the deadline. Posting should be at least 3 sentences long. |
| Response to two classmates | 0 points | 1 point<br>Up to 1 point if late or response to one classmate only. | 2 Points<br>Well-constructed responses to two classmates addressing the classmate original posting and submitted by the deadline. |
| Grammar and organization | 0 points | 0 points | 1 Points |

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# 19.5: Assessment- Re-Assessed Fitness Level Results

## Purpose

It is time to reassess your fitness level. You will re-take the fitness pre-test to determine your fitness level.

## Directions

- Go to the President's Challenge Website to take the test.
  - For the Aerobic test, you must select the same test (1 mile test or the 1.5 mile run test) you used in Unit Two
- Submit your test results in the course.

## Grading

The assignment is worth 5 points maximum.

Grading will be based on the following Reassessed Fitness Level Grading Rubric:

| Criteria | Absent | Present |
|---|---|---|
| Aerobic Fitness | 0 points | 1 point<br>Must include time, heart rate, VO2 max, and score (percentile) |
| Muscular fitness | 0 points | 1 point<br>Must include half sit-ups, push-ups,and scores (percentile) for each |
| Flexibility | 0 points | 1 point<br>Must include sit-and-reach result and score (percentile) |
| BMI | 0 points | 1 point |
| Waist circumference | 0 points | 1 point |

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# CHAPTER OVERVIEW

## 20: Nutrition


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20.2: Nutrition For Everyone
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20.4: Dietary Fat
20.5: Carbohydrates
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20.11: Dietary Guidelines- Young and Middle Adulthood
20.12: Dietary Guidelines- Foods and Food Components to Reduce
20.13: Dietary Guidelines- Foods and Nutrients to Increase
20.14: Dietary Guidelines- Building Healthy Eating Patterns
20.15: Dietary Guidelines- Using the Food Label
20.16: Discussion- Grocery Shopping
20.17: Assessment- Food Tracker



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# 20.1: Nutrition and Diet

## Learning Objectives

By the end of this section, you will be able to:

- Explain how different foods can affect metabolism
- Describe a healthy diet, as recommended by the U.S. Department of Agriculture (USDA)
- List reasons why vitamins and minerals are critical to a healthy diet

The carbohydrates, lipids, and proteins in the foods you eat are used for energy to power molecular, cellular, and organ system activities. Importantly, the energy is stored primarily as fats. The quantity and quality of food that is ingested, digested, and absorbed affects the amount of fat that is stored as excess calories. Diet—both what you eat and how much you eat—has a dramatic impact on your health. Eating too much or too little food can lead to serious medical issues, including cardiovascular disease, cancer, anorexia, and diabetes, among others. Combine an unhealthy diet with unhealthy environmental conditions, such as smoking, and the potential medical complications increase significantly.

## Food and Metabolism

The amount of energy that is needed or ingested per day is measured in calories. A calorie is the amount of heat it takes to raise 1 g of water by 1 °C. On average, a person needs 1500 to 2000 calories per day to sustain (or carry out) daily activities. The total number of calories needed by one person is dependent on their body mass, age, height, gender, activity level, and the amount of exercise per day. If exercise is regular part of one's day, more calories are required. As a rule, people underestimate the number of calories ingested and overestimate the amount they burn through exercise. This can lead to ingestion of too many calories per day. The accumulation of an extra 3500 calories adds one pound of weight. If an excess of 200 calories per day is ingested, one extra pound of body weight will be gained every 18 days. At that rate, an extra 20 pounds can be gained over the course of a year. Of course, this increase in calories could be offset by increased exercise. Running or jogging one mile burns almost 100 calories.

The type of food ingested also affects the body's metabolic rate. Processing of carbohydrates requires less energy than processing of proteins. In fact, the breakdown of carbohydrates requires the least amount of energy, whereas the processing of proteins demands the most energy. In general, the amount of calories ingested and the amount of calories burned determines the overall weight. To lose weight, the number of calories burned per day must exceed the number ingested. Calories are in almost everything you ingest, so when considering calorie intake, beverages must also be considered.

To help provide guidelines regarding the types and quantities of food that should be eaten every day, the USDA has updated their food guidelines from MyPyramid to MyPlate. They have put the recommended elements of a healthy meal into the context of a place setting of food. MyPlate categorizes food into the standard six food groups: fruits, vegetables, grains, protein foods, dairy, and oils. The accompanying website gives clear recommendations regarding quantity and type of each food that you should consume each day, as well as identifying which foods belong in each category. The accompanying graphic (Figure 24.24) gives a clear visual with general recommendations for a healthy and balanced meal. The guidelines recommend to "Make half your plate fruits and vegetables." The other half is grains and protein, with a slightly higher quantity of grains than protein. Dairy products are represented by a drink, but the quantity can be applied to other dairy products as well.

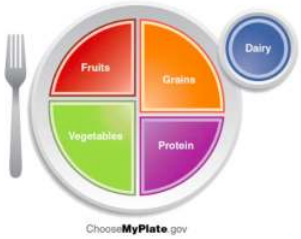



Figure 24.24 MyPlate The U.S. Department of Agriculture developed food guidelines called MyPlate to help demonstrate how to maintain a healthy lifestyle.

ChooseMyPlate.gov provides extensive online resources for planning a healthy diet and lifestyle, including offering weight management tips and recommendations for physical activity. It also includes the SuperTracker, a web-based application to help you analyze your own diet and physical activity.

### Everyday Connection

**Metabolism and Obesity**

Obesity in the United States is epidemic. The rate of obesity has been steadily rising since the 1980s. In the 1990s, most states reported that less than 10 percent of their populations was obese, and the state with the highest rate reported that only 15 percent of their population was considered obese. By 2010, the U.S. Centers for Disease Control and Prevention reported that nearly 36 percent of adults over 20 years old were obese and an additional 33 percent were overweight, leaving only about 30 percent of the population at a healthy weight. These studies find the highest levels of obesity are concentrated in the southern states. They also find the level of childhood obesity is rising.

Obesity is defined by the body mass index (BMI), which is a measure of an individual's weight-to-height ratio. The normal, or healthy, BMI range is between 18 and 24.9 kg/m2. Overweight is defined as a BMI of 25 to 29.9 kg/m2, and obesity is considered to be a BMI greater than 30 kg/m2. Obesity can arise from a number of factors, including overeating, poor diet, sedentary lifestyle, limited sleep, genetic factors, and even diseases or drugs. Severe obesity (morbid obesity) or long-term obesity can result in serious medical conditions, including coronary heart disease; type 2 diabetes; endometrial, breast, or colon cancer; hypertension (high blood pressure); dyslipidemia (high cholesterol or elevated triglycerides); stroke; liver disease; gall bladder disease; sleep apnea or respiratory diseases; osteoarthritis; and infertility. Research has shown that losing weight can help reduce or reverse the complications associated with these conditions.

## Vitamins

Vitamins are organic compounds found in foods and are a necessary part of the biochemical reactions in the body. They are involved in a number of processes, including mineral and bone metabolism, and cell and tissue growth, and they act as cofactors for energy metabolism. The B vitamins play the largest role of any vitamins in metabolism (Table 24.3 and Table 24.4).

You get most of your vitamins through your diet, although some can be formed from the precursors absorbed during digestion. For example, the body synthesizes vitamin A from the β-carotene in orange vegetables like carrots and sweet potatoes. Vitamins are either fat-soluble or water-soluble. Fat-soluble vitamins A, D, E, and K, are absorbed through the intestinal tract with lipids in chylomicrons. Vitamin D is also synthesized in the skin through exposure to sunlight. Because they are carried in lipids, fat-soluble vitamins can accumulate in the lipids stored in the body. If excess vitamins are retained in the lipid stores in the body, hypervitaminosis can result.

Water-soluble vitamins, including the eight B vitamins and vitamin C, are absorbed with water in the gastrointestinal tract. These vitamins move easily through bodily fluids, which are water based, so they are not stored in the body. Excess water- soluble vitamins are excreted in the urine. Therefore, hypervitaminosis of water-soluble vitamins rarely occurs, except with an excess of vitamin supplements.

Table 24.3.

| Fat-soluble Vitamins | | | | |
|---|---|---|---|---|
| Vitamin and alternative name | Sources | Recommended daily allowance | Function | Problems associated with deficiency |
| A<br>retinal or β-carotene | Yellow and orange fruits and vegetables, dark green leafy vegetables, eggs, milk, liver | 700–900 $\mu$g | Eye and bone development, immune function | Night blindness, epithelial changes, immune system deficiency |
| D<br>cholecalciferol | Dairy products, egg yolks; also synthesized in the skin from exposure to sunlight | 5–15 $\mu$g | Aids in calcium absorption, promoting bone growth | Rickets, bone pain, muscle weakness, increased risk of death from cardiovascular disease, cognitive impairment, asthma in children, cancer |

| Fat-soluble Vitamins | | | | |
|---|---|---|---|---|
| Vitamin and alternative name | Sources | Recommended daily allowance | Function | Problems associated with deficiency |
| E<br>tocopherols | Seeds, nuts, vegetable oils, avocados, wheat germ | 15 mg | Antioxidant | Anemia |
| K<br>phylloquinone | Dark green leafy vegetables, broccoli, Brussels sprouts, cabbage | 90–120 $\mu$g | Blood clotting, bone health | Hemorrhagic disease of newborn in infants; uncommon in adults |

Table 24.4.

| Water-soluble Vitamins | | | | |
|---|---|---|---|---|
| Vitamin and alternative name | Sources | Recommended daily allowance | Function | Problems associated with deficiency |
| $B_1$<br>thiamine | Whole grains, enriched bread and cereals, milk, meat | 1.1–1.2 mg | Carbohydrate metabolism | Beriberi, Wernicke-Korsikoff syndrome |
| $B_2$<br>riboflavin | Brewer's yeast, almonds, milk, organ meats, legumes, enriched breads and cereals, broccoli, asparagus | 1.1–1.3 mg | Synthesis of FAD for metabolism, production of red blood cells | Fatigue, slowed growth, digestive problems, light sensitivity, epithelial problems like cracks in the corners of the mouth |
| $B_3$<br>niacin | Meat, fish, poultry, enriched breads and cereals, peanuts | 14–16 mg | Synthesis of NAD, nerve function, cholesterol production | Cracked, scaly skin; dementia; diarrhea; also known as pellagra |
| $B_5$<br>pantothenic acid | Meat, poultry, potatoes, oats, enriched breads and cereals, tomatoes | 5 mg | Synthesis of coenzyme A in fatty acid metabolism | Rare: symptoms may include fatigue, insomnia, depression, irritability |
| $B_6$<br>pyridoxine | Potatoes, bananas, beans, seeds, nuts, meat, poultry, fish, eggs, dark green leafy vegetables, soy, organ meats | 1.3–1.5 mg | Sodium and potassium balance, red blood cell synthesis, protein metabolism | Confusion, irritability, depression, mouth and tongue sores |
| $B_7$<br>biotin | Liver, fruits, meats | 30 $\mu$g | Cell growth, metabolism of fatty acids, production of blood cells | Rare in developed countries; symptoms include dermatitis, hair loss, loss of muscular coordination |
| $B_9$<br>folic acid | Liver, legumes, dark green leafy vegetables, enriched breads and cereals, citrus fruits | 400 $\mu$g | DNA/protein synthesis | Poor growth, gingivitis, appetite loss, shortness of breath, gastrointestinal problems, mental deficits |

| Water-soluble Vitamins | | | | |
|---|---|---|---|---|
| Vitamin and alternative name | Sources | Recommended daily allowance | Function | Problems associated with deficiency |
| $B_{12}$ cyanocobalamin | Fish, meat, poultry, dairy products, eggs | 2.4 $\mu$g | Fatty acid oxidation, nerve cell function, red blood cell production | Pernicious anemia, leading to nerve cell damage |
| C ascorbic acid | Citrus fruits, red berries, peppers, tomatoes, broccoli, dark green leafy vegetables | 75–90 mg | Necessary to produce collagen for formation of connective tissue and teeth, and for wound healing | Dry hair, gingivitis, bleeding gums, dry and scaly skin, slow wound healing, easy bruising, compromised immunity; can lead to scurvy |

## Minerals

Minerals in food are inorganic compounds that work with other nutrients to ensure the body functions properly. Minerals cannot be made in the body; they come from the diet. The amount of minerals in the body is small—only 4 percent of the total body mass—and most of that consists of the minerals that the body requires in moderate quantities: potassium, sodium, calcium, phosphorus, magnesium, and chloride.

The most common minerals in the body are calcium and phosphorous, both of which are stored in the skeleton and necessary for the hardening of bones. Most minerals are ionized, and their ionic forms are used in physiological processes throughout the body. Sodium and chloride ions are electrolytes in the blood and extracellular tissues, and iron ions are critical to the formation of hemoglobin. There are additional trace minerals that are still important to the body's functions, but their required quantities are much lower.

Like vitamins, minerals can be consumed in toxic quantities (although it is rare). A healthy diet includes most of the minerals your body requires, so supplements and processed foods can add potentially toxic levels of minerals. Table 24.5 and Table 24.6 provide a summary of minerals and their function in the body.

Table 24.5.

| Major Minerals | | | | |
|---|---|---|---|---|
| Mineral | Sources | Recommended daily allowance | Function | Problems associated with deficiency |
| Potassium | Meats, some fish, fruits, vegetables, legumes, dairy products | 4700 mg | Nerve and muscle function; acts as an electrolyte | Hypokalemia: weakness, fatigue, muscle cramping, gastrointestinal problems, cardiac problems |
| Sodium | Table salt, milk, beets, celery, processed foods | 2300 mg | Blood pressure, blood volume, muscle and nerve function | Rare |
| Calcium | Dairy products, dark green leafy vegetables, blackstrap molasses, nuts, brewer's yeast, some fish | 1000 mg | Bone structure and health; nerve and muscle functions, especially cardiac function | Slow growth, weak and brittle bones |

| Major Minerals | | | | |
|---|---|---|---|---|
| Mineral | Sources | Recommended daily allowance | Function | Problems associated with deficiency |
| Phosphorous | Meat, milk | 700 mg | Bone formation, metabolism, ATP production | Rare |
| Magnesium | Whole grains, nuts, leafy green vegetables | 310–420 mg | Enzyme activation, production of energy, regulation of other nutrients | Agitation, anxiety, sleep problems, nausea and vomiting, abnormal heart rhythms, low blood pressure, muscular problems |
| Chloride | Most foods, salt, vegetables, especially seaweed, tomatoes, lettuce, celery, olives | 2300 mg | Balance of body fluids, digestion | Loss of appetite, muscle cramps |

Table 24.6.

| Trace Minerals | | | | |
|---|---|---|---|---|
| Mineral | Sources | Recommended daily allowance | Function | Problems associated with deficiency |
| Iron | Meat, poultry, fish, shellfish, legumes, nuts, seeds, whole grains, dark leafy green vegetables | 8–18 mg | Transport of oxygen in blood, production of ATP | Anemia, weakness, fatigue |
| Zinc | Meat, fish, poultry, cheese, shellfish | 8–11 mg | Immunity, reproduction, growth, blood clotting, insulin and thyroid function | Loss of appetite, poor growth, weight loss, skin problems, hair loss, vision problems, lack of taste or smell |
| Copper | Seafood, organ meats, nuts, legumes, chocolate, enriched breads and cereals, some fruits and vegetables | 900 $\mu$g | Red blood cell production, nerve and immune system function, collagen formation, acts as an antioxidant | Anemia, low body temperature, bone fractures, low white blood cell concentration, irregular heartbeat, thyroid problems |
| Iodine | Fish, shellfish, garlic, lima beans, sesame seeds, soybeans, dark leafy green vegetables | 150 $\mu$g | Thyroid function | Hypothyroidism: fatigue, weight gain, dry skin, temperature sensitivity |
| Sulfur | Eggs, meat, poultry, fish, legumes | None | Component of amino acids | Protein deficiency |
| Fluoride | Fluoridated water | 3–4 mg | Maintenance of bone and tooth structure | Increased cavities, weak bones and teeth |

| Trace Minerals | | | | |
|---|---|---|---|---|
| Mineral | Sources | Recommended daily allowance | Function | Problems associated with deficiency |
| Manganese | Nuts, seeds, whole grains, legumes | 1.8–2.3 mg | Formation of connective tissue and bones, blood clotting, sex hormone development, metabolism, brain and nerve function | Infertility, bone malformation, weakness, seizures |
| Cobalt | Fish, nuts, leafy green vegetables, whole grains | None | Component of $B_{12}$ | None |
| Selenium | Brewer's yeast, wheat germ, liver, butter, fish, shellfish, whole grains | 55 $\mu$g | Antioxidant, thyroid function, immune system function | Muscle pain |
| Chromium | Whole grains, lean meats, cheese, black pepper, thyme, brewer's yeast | 25–35 $\mu$g | Insulin function | High blood sugar, triglyceride, and cholesterol levels |
| Molybdenum | Legumes, whole grains, nuts | 45 $\mu$g | Cofactor for enzymes | Rare |

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# 20.2: Nutrition For Everyone

## Nutrition Basics

Do you ever feel like you can't keep up with the changes in technology? Sometimes it seems that way with dietary advice, as if things are always changing. While it's true that the fields of diet and nutrition are areas of evolving research, there are some basic concepts you can keep in mind. By knowing these basics, you will be better equipped to sort through nutrition research and dietary advice.

### Food Groups

Are you interested in healthy eating and having a balanced diet? If so, you'll want to learn more about food groups.

This section helps explain the food groups based on the Dietary Guidelines for Americans, 2010 and provides information about food plans. There are five groups consisting of vegetables, fruits, grains, dairy and a protein group which includes meat, poultry, fish and nuts. MyPlate illustrates the five food groups that are the building blocks for a healthy diet using a familiar image—a place setting for a meal —and display how much of each food group you need to eat for a healthy diet.

### What are the basic food groups?

| Food Groups | Examples | |
|---|---|---|
| **Vegetables** | The vegetables you eat may be fresh, frozen, canned or dried and may be eaten whole, cut-up, or mashed. You should eat a variety of dark green, red and orange vegetables, as well as beans and peas (which are also considered part of the protein group). Examples include broccoli, carrots, collard greens, split peas, green beans, black-eyed peas, kale, lima beans, potatoes, spinach, squash, sweet potatoes, tomatoes and kidney beans. Any vegetable or 100% vegetable juice counts in this group. |  |
| **Fruits** | The fruits you eat may be fresh, canned, frozen or dried and may be eaten whole, cut-up, or pureed. Examples include apples, apricots, bananas, dates, grapes, oranges, grapefruit, mangoes, melons, peaches, pineapples, raisins, strawberries, tangerines, and 100% fruit juice. |  |
| **Grains** | There are two types of grains – whole grains and refined grains. At least half of the grains you eat should be whole grains, such as whole-wheat bread, whole-grain cereals and crackers, oatmeal, bulgur, and brown rice. Refined grains include white bread, white rice, enriched pasta, flour tortillas, and most noodles. |  |

| | | |
|---|---|---|
| **Dairy** | Most of your choices should be fat-free or low-fat milk and milk products, but all milks and calcium-containing milk products count in this category. Examples include milk, cheeses, and yogurt as well as lactose-free and lactose-reduced products and soy beverages. Foods that are made from milk but have little or no calcium are not included, such as butter, cream, sour cream, and cream cheese. |  |
| **Protein Foods** | Choose a variety of lean meats and poultry, seafood, beans and peas, eggs, processed soy products, unsalted nuts, and seeds. Make sure to eat at least 8 ounces of seafood each week. |  |

*Oils are NOT a food group, but they provide essential nutrients such as vitamin E.

**How much of each food group should I eat?**
The amount of food you need to eat from each group depends on your age, sex, and level of physical activity. For information about the food groups and the recommended daily amounts visit ChooseMyPlate.gov Daily Food Plans. For easy advice on creating a healthy balanced plate visit –10 Tips to a great plate [PDF- 805Kb].

## Food Plans

A healthy eating plan will show you how much you need from each food group to stay within your calorie needs and promote good health. A healthy eating plan can also help you learn—

- How many calories you need each day and how to balance your calorie needs.
- How much of each food group you should consume.
- How to make healthy choices in each food group.

For more information about food plans visit: Food Plans at MyPlate.gov

Vegetarian Plans can meet all the recommendations for nutrients. The key is to consume a variety of foods and the right amount of foods to meet your calorie needs. Visit MyPlate.gov for Vegetarian Tips.

Make sure you know the myths about nutrition! Check out common myths and tricks, tips for cooking and fitness, and information on vegan and vegetarian diets reading the ACSM Nutrition Newsletter.

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# 20.3: Water- Meeting Your Daily Fluid Needs

Ever notice how lifeless a house plant looks when you forget to water it? Just a little water and it seems to perk back up. Water is just as essential for our bodies because it is in every cell, tissue, and organ in your body. That's why getting enough water every day is important for your health.

Healthy people meet their fluid needs by drinking when thirsty and drinking fluids with meals. But, if you're outside in hot weather for most of the day or doing vigorous physical activity, you'll need to make an effort to drink more fluids.

## Where do I get the water I need?

Most of your water needs are met through the water and beverages you drink.
You can get some fluid through the foods you eat. For example, broth soups and other foods that are 85% to 95% water such as celery, tomatoes, oranges, and melons.

## What does water do in my body?

Water helps your body with the following:

- Keeps its temperature normal.
- Lubricates and cushions your joints.
- Protects your spinal cord and other sensitive tissues.
- Gets rid of wastes through urination, perspiration, and bowel movements.

## Why do I need to drink enough water each day?



You need water to replace what your body loses through normal everyday functions. Of course, you lose water when you go to the bathroom or sweat, but you even lose small amounts of water when you exhale. You need to replace this lost water to prevent dehydration.

Your body also needs more water when you are—

- In hot climates.
- More physically active.
- Running a fever.
- Having diarrhea or vomiting.

To help you stay hydrated during prolonged physical activity or when it is hot outside:

1. Drink fluid while doing the activity.
2. Drink several glasses of water or other fluid after the physical activity is completed.

Also, when you are participating in vigorous physical activity, it's important to drink before you even feel thirsty. Thirst is a signal that your body is on the way to dehydration. For more information, visit Fit Facts, Healthy Hydration from the American Council on Fitness .*(PDF-1.4Mb)

Some people may have fluid restrictions because of a health problem, such as kidney disease. If your healthcare provider has told you to restrict your fluid intake, be sure to follow that advice.

## Tips for Increasing Your Fluid Intake by Drinking More Water



Under normal conditions, most people can drink enough fluids to meet their water needs. If you are outside in hot weather for most of the day or doing vigorous activity, you may need to increase your fluid intake.

If you think you're not getting enough water each day, the following tips may help:

- Carry a water bottle for easy access when you are at work or running errands.
- Freeze some freezer-safe water bottles. Take one with you for ice-cold water all day long.

- Choose water instead of sugar-sweetened beverages. This tip can also help with weight management. Substituting water for one 20-ounce sugar-sweetened soda will save you about 240 calories.
- Choose water instead of other beverages when eating out. Generally, you will save money and reduce calories.
- Give your water a little pizzazz by adding a wedge of lime or lemon. This may improve the taste, and you just might drink more water than you usually do.

### Do sugar-sweetened beverages count?

Although beverages that are sweetened with sugars do provide water, they usually have more calories than unsweetened beverages. To help with weight control, you should consume beverages and foods that don't have added sugars.

Examples of beverages with added sugars:

- Fruit drinks.
- Some sports drinks.
- Soft drinks and sodas (non-diet).

Visit Rethink Your Drink for more information about the calories in beverages and how you can make better drink choices to reduce your calorie intake.

### Sources

U.S. National Library of Medicine & NIH. MedlinePlus Medical Encyclopedia: *Water in Diet*. http://www.nlm.nih.gov/medlineplus/ency/article/002471.htm

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# 20.4: Dietary Fat

What counts as fat? Are some fats better than other fats? While fats are essential for normal body function, some fats are better for you than others. *Trans* fats, saturated fats and cholesterol are less healthy than polyunsaturated and monounsaturated fats.

## How much *total* dietary fat do I need?

The *Dietary Guidelines for Americans 2010* recommend that Americans:

- Consume less than 10% of calories from saturated fats.
- Replace solid fats with oils when possible.
- Limit foods that contain synthetic sources of *trans* fatty acids (such as hydrogenated oils), and keep total *trans* fatty acid consumption as low as possible.
- Eat fewer than 300 mg of dietary cholesterol per day.
- Reduce intake of calories from solid fats.

| Age Group | Total Fat Limits |
|---|---|
| Children ages 2 to 3 | 30% to 40% of total calories |
| Children and adolescents ages 4 to 18 | 25% to 35% of total calories |
| Adults, ages 19 and older | 20% to 35% of total calories |

| Quick Q& A |
|---|
| If some fats are healthier than others, can I eat as much of these fats as I want? |
| No, it's best to keep your total fat intake between 20 and 35% of your total calories each day.<br>**Know your limits on fats.** You can meet this recommendation by following a healthy eating plan that meets your needs. ChooseMyPlate.gov has personalized plans that will provide your daily allowance of oils and solid fats, based on your age, gender, height, weight, and physical activity level. |

## Trans Fat

Download Trans Fat: The Facts [PDF–2.1Mb]

The *Dietary Guidelines for Americans 2010* and the Institute of Medicine recommend that individuals keep trans fatty acid consumption as low as possible.[1, 2] There are two main sources of dietary trans fatty acids (trans fat). Naturally occurring trans fat is found in small amounts in the fatty parts of meat and dairy products. Artificial trans fat comes from foods that contain partially hydrogenated oil and is formed when hydrogen is added to liquid oil turning it into solid fat. Often food manufacturers use artificial trans fat in food products because it is inexpensive and it increases the food's shelf life, stability, and texture.

**Dietary Guidelines for Americans (DGA)[1]**
The DGA recommend that individuals keep trans fatty acid consumption as low as possible, especially by limiting foods that contain synthetic [artificial] sources of trans fats, such as partially hydrogenated oils, and by limiting other solid fats.

Consuming trans fat increases low-density lipoprotein (LDL, or "bad") cholesterol. This risk factor contributes to the leading cause of death in the U.S. – coronary heart disease (CHD).[1] Trans fat may also have other adverse health effects like decreasing high-density lipoprotein (HDL, or "good") cholesterol. Further reducing trans fat consumption by avoiding artificial trans fat could prevent 10,000-20,000 heart attacks and 3,000-7,000 coronary heart disease deaths each year in the U.S.[3]

Trans fat intake has significantly decreased in the US as a result of efforts to increase awareness of its health effects, Nutrition Facts label changes, industry efforts to voluntarily reformulate foods, and some state and local governments' restriction of its use in restaurants and other food service outlets. However, on average Americans still consume 1.3 grams (0.6% of energy) of artificial trans fat each day.[4] Major contributors to artificial trans fat intake include fried items, savory snacks (like microwave popcorn), frozen pizzas, cake, cookies, pie, margarines and spreads, ready-to-use frosting, and coffee creamers. The amount of trans fat can vary among similar food categories.

**The amount of trans fat can vary within food categories** [4]

| Food category | Range of trans fat per serving (g) |
|---|---|
| Margarine and spreads | 0.0-3.0 g |
| Cookies | 0.0-3.5 g |
| Frozen pies | 0.0-4.5 g |
| Frozen pizza | 0.0-5.0 g |
| Savory Snacks | 0.0-7.0 g |

Trans fat are also found in restaurant and cafeteria foods that contain or are prepared with partially hydrogenated oil. Currently, only about 1 in 5 Americans (20 percent) lives where there are policies that limit the use or sale of foods that contain more than 0.5 grams of artificial trans fat per serving.[5]

## What Can Be Done To Reduce Artificial Trans Fat

**Everyone can:**

- Read the Nutrition Facts label and ingredient list to compare foods.




  - Choose products with 0 grams trans fat.
  - Check the Ingredient List to see if there is any partially hydrogenated oil in the product.
  - Because products containing less than 0.5 grams of trans fat per serving can be labeled as having 0 grams trans fat, checking the Ingredient List is important to avoid all artificial trans fat.
- When choosing foods low in trans fat, make sure they are also low in saturated fat and cholesterol: look for foods with 5% of the Daily Value or less. Foods with 20% or more of the Daily Value of these two components are high.
- Use monounsaturated fat (canola and olive oil) and polyunsaturated fat (soybean, corn, and sunflower oil) in recipes that call for fat.
- A good way to avoid trans fat is to eat a balanced diet rich in fruits, vegetables, whole grains, lean sources of protein, and low-fat or fat-free dairy products.
- Ask your grocer to stock products free of “partially hydrogenated oil” and “shortening”.
- Talk with your favorite restaurant establishment about current use of partially hydrogenated oils or changing to a menu that is 100% free of “partially hydrogenated oil” and “shortening”.
- Choose restaurants that do not use partially hydrogenated oil to prepare food.

**Restaurants and Cafeterias can:**

- Change their frying and cooking oils to ones that do not contain any partially hydrogenated oil.
- Ask suppliers to provide products that do not contain partially hydrogenated oil and are low in saturated fat.
- Promote partially hydrogenated oil-free, and low saturated fat, items on the menu.

**Food Producers and Processors can:**

- Continue to reformulate products to remove partially hydrogenated oil by increasing the use of mono- and polyunsaturated fats as replacements.
- Find innovative ways to remove partially hydrogenated oil, without increasing saturated fat, from baked goods, frosting, and other products that currently contain significant amounts of trans fat.

**State and Local Governments can:**

- Increase public awareness about the use of partially hydrogenated oil in foods and cardiovascular risks of consuming trans fat.
- Adopt procurement guidelines regarding the sale and/or use of foods containing artificial trans fat (partially hydrogenated oil).

### Resources

Dietary Guidelines for Americans 2010

The Departments of Agriculture (USDA) and Health and Human Services (HHS), jointly publish the Dietary Guidelines for Americans, which provides advice about how good dietary habits for people aged 2 years and older can promote health and reduce risk for major chronic diseases.

Trans Fat: What you need to know

The U.S. Food and Drug Administration published a general fact sheet about trans fat.

### References

[1] U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2010. 7th Edition, Washington, DC: U.S. Government Printing Office, December 2010.

[2] Institute of Medicine. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. National Academies Press, Washington, DC, 2005.

[3] Dietz WH, Scanlon, KS. 2012. Eliminating the Use of Partially Hydrogenated Oil in Food Production and Preparation. JAMA. 2012;308(2):143-144.

[4] Doell D, Folmer D, Lee H, Honigfort M, Carberry S. 2012. Updated estimate of trans fat intake in the U.S. population. Food Additives & Contaminants: Part A: Chemistry, Analysis, Control, Exposure & Risk Assessment. Available online at: http://www.tandfonline.com/doi/abs/10.1080/19440049.2012.664570.

[5] Center for Science in the Public Interest. Trans fat bans in restaurants: http://www.cspinet.org/transfat/. Accessed March 18, 2012.

## Saturated Fat

You may have heard that saturated fats are the “solid” fats in your diet. For the most part, this is true. For example, if you open a container of meat stew, you will probably find some fat floating on top. This fat is saturated fat.

### The Recommendation

Diets high in saturated fat have been linked to chronic disease, specifically, coronary heart disease. The Dietary Guidelines for Americans 2005 recommend consuming less than 10% of daily calories as saturated fat.

But other saturated fats can be more difficult to see in your diet. In general, saturated fat can be found in the following foods:

- High-fat cheeses
- High-fat cuts of meat
- Whole-fat milk and cream
- Butter
- Ice cream and ice cream products
- Palm and coconut oils

It’s important to note that lower-fat versions of these foods usually will contain saturated fats, but typically in smaller quantities than the regular versions.

As you look at this list above, notice two things. First, animal fats are a primary source of saturated fat. Secondly, certain plant oils are another source of saturated fats: palm oils, coconut oils, and cocoa butter. You may think you don’t use palm or coconut oils, but they are often added to commercially-prepared foods, such as cookies, cakes, doughnuts, and pies. Solid vegetable shortening often contains palm oils and some whipped dessert toppings contain coconut oil.

#### How do I control my saturated fat intake?

In general, saturated fat can be found in the following foods:

- High-fat cheeses

- High-fat cuts of meat
- Whole-fat milk and cream
- Butter
- Ice cream and ice cream products
- Palm and coconut oils

So how can you cut back on your intake of saturated fats? Try these tips:

1. Choose leaner cuts of meat that do not have a marbled appearance (where the fat appears embedded in the meat). Leaner cuts include round cuts and sirloin cuts. Trim all visible fat off meats before eating.
2. Remove the skin from chicken, turkey, and other poultry before cooking.
3. When re-heating soups or stews, skim the solid fats from the top before heating.
4. Drink low-fat (1%) or fat-free (skim) milk rather than whole or 2% milk.
5. Buy low-fat or non-fat versions of your favorite cheeses and other milk or dairy products.
6. When you want a sweet treat, reach for a low-fat or fat-free version of your favorite ice cream or frozen dessert. These versions usually contain less saturated fat.
7. Use low-fat spreads instead of butter. Most margarine spreads contain less saturated fat than butter. Look for a spread that is low in saturated fat and doesn't contain trans fats.
8. Choose baked goods, breads, and desserts that are low in saturated fat. You can find this information on the Nutrition Facts label.
9. Pay attention at snack time. Some convenience snacks such as sandwich crackers contain saturated fat. Choose instead to have non-fat or low-fat yogurt and a piece of fruit.

To learn more about the Nutrition Facts label, visit How to Understand and Use the Nutrition Facts Label (FDA).

Quick Q&A

What should I choose— butter or margarine? Should I choose a stick, tub, or liquid?

 With such a variety of products available, it can be a difficult decision. Here are some general rules of thumb to help you compare products:
Look at the Nutrition Facts label to compare both the *trans* fat and the saturated fat content. Choose the one that has the fewest grams of *trans* fat and the fewest grams of saturated fat and dietary cholesterol.
If possible, find one that says zero grams of trans fat.
When looking at the Daily Value for saturated fat and cholesterol remember that 5 percent is low and 20 percent is high.
If you are also trying to reduce calories, you may want to look for a version that says "light." These products contain fewer calories and can help you stay within your calorie goals.
If you find two products that seem comparable, try them both and choose the one that tastes better!

## Dietary Cholesterol

Cholesterol is a fatty substance that's found in animal-based foods such as meats, poultry, egg yolks, and whole milks. Do you remember the other type of fat that is found in animal-based products? That's right — saturated fat.

### The Recommendation

The *Dietary Guidelines for Americans 2010* recommend that individuals consume less than 300 milligrams (mg) of cholesterol each day.

So, when you follow the tips to reduce your saturated fat intake, in most cases, you will be reducing your dietary cholesterol intake at the same time. For example, if you switch to low-fat and fat-free dairy products, you will reduce your intake of both saturated fat and cholesterol.

| Quick Q&A |
| --- |
| I've heard that some people have high blood cholesterol because of the foods they eat but that other people have high cholesterol because of genetics. What's the difference? |
| Not only do you get cholesterol from the foods you eat (your diet) your body also makes cholesterol to use in normal body functions. The cholesterol made by your body is partly influenced by your genes and these genes are shared by your family members.<br>Even though genetics play a role, families often also share the same eating and lifestyle habits. Some health problems that seem to run in families may be worsened by these unhealthful habits. If you have a genetic tendency to produce more cholesterol, you may still obtain additional benefits from reducing the cholesterol in your diet. |

## Cholesterol in Your Blood

You may be reading this section about cholesterol because you have been diagnosed with high blood cholesterol, or you may have been told that your "good" cholesterol is too low, or that your "bad" cholesterol is too high. What does all this mean?

Here are some quick definitions that may help you. You may also want to check out the links below for more detailed information.

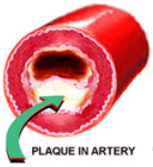
**Total Cholesterol.** This is the total measured cholesterol in your blood. This number includes all other types of cholesterol such as HDL and LDL, as defined below. High blood cholesterol can increase your risk of heart disease.

**It is important to know your numbers.** You can't tell if the cholesterol in your blood is high by how you feel. You'll need a blood test from your healthcare provider to know. If you don't know what your blood cholesterol level is, talk to your health care provider.

**HDL.** HDL stands for high-density lipoprotein cholesterol. The HDL cholesterol is often called "good" cholesterol because it helps carry cholesterol away from your body's organs and to your liver where it can be removed. To help you remember, that HDL is the "good" cholesterol, recall that the "H" stands for high and higher HDL cholesterol is good.

**LDL.** LDL stands low-density lipoprotein cholesterol. The LDL cholesterol is sometimes called "bad" cholesterol because it's the type of cholesterol that is linked with a higher chance of heart disease. Remember that L stands for "low" and you want to keep LDL lower in your blood.

**What Is High Blood Cholesterol?**




Too much cholesterol in the blood, or high blood cholesterol, can be serious. People with high blood cholesterol have a greater chance of getting heart disease. Cholesterol can build up on the walls of your arteries (blood vessels that carry blood from the heart to other parts of the body). This buildup of cholesterol is called plaque. Over time, plaque can cause narrowing of the arteries.

If you've already been diagnosed with high blood cholesterol or want more information about how to prevent it, visit these links from the National Heart, Lung, and Blood Institute for more information.

**High Blood Cholesterol**
National Institute of Health (NIH), National Heart, Lung and Blood Institute (NHLBI)
This site explains what high blood cholesterol is, its signs and symptoms, and how it is diagnosed and treated.

**High Blood Cholesterol: What You Need to Know** (PDF-195k)
NHLBI, National Cholesterol Education Program
This document explains what your cholesterol numbers mean, how to calculate your heart disease risk, and how to treat high levels of cholesterol using the Therapeutic Lifestyle Changes (TLC) diet.

Please note that these Web sites are intended for adults who have been diagnosed with high cholesterol. For information about cholesterol and children, please visit the American Heart Association's Cholesterol and Atherosclerosis in Children.*

## Polyunsaturated Fats and Monounsaturated Fats

Most of the fat that you eat should come from unsaturated sources: polyunsaturated fats and monounsaturated fats. In general, nuts, vegetable oils, and fish are sources of unsaturated fats. The table below provides examples of specific types of unsaturated fats.

| Monounsaturated Fat Sources | Omega-6 Polyunsaturated Fat Sources | Omega-3 Polyunsaturated Fat Sources |
|---|---|---|
| Nuts | | |
| Vegetable oils | | Soybean oil |
| Canola oil | Soybean oil | Canola oil |
| Olive oil | Corn oil | Walnuts |
| High oleic safflower oil | Safflower oil | Flaxseed |
| Sunflower oil | | Fish: trout, herring, and salmon |
| Avocado | | |

Polyunsaturated fats can also be broken down into two types:

- Omega-6 polyunsaturated fats — these fats provide an essential fatty acid that our bodies need, but can't make.
- Omega-3 polyunsaturated fats — these fats also provide an essential fatty acid that our bodies need. In addition, omega-3 fatty acids, particularly from fish sources, may have potential health benefits.

### How do I control my polyunsaturated fat and monounsaturated fat intake?

In general, nuts, vegetable oils, and fish are sources of unsaturated fats. The table below provides examples of specific types of unsaturated fats.

| Monounsaturated Fat Sources | Omega-6 Polyunsaturated Fat Sources | Omega-3 Polyunsaturated Fat Sources |
|---|---|---|
| Nuts | | |
| Vegetable oils | | Soybean oil |
| Canola oil | Soybean oil | Canola oil |
| Olive oil | Corn oil | Walnuts |
| High oleic safflower oil | Safflower oil | Flaxseed |
| Sunflower oil | | Fish: trout, herring, and salmon |
| Avocado | | |

Below are tips for including appropriate amounts of unsaturated fats in your diet:

- Replace solid fats used in cooking with liquid oils. Visit Choose MyPlate – Daily Food Plans to learn more about your daily recommendations.
- Remember any type of fat is high in calories. To avoid additional calories, substitute polyunsaturated and monounsaturated fats for saturated fats and trans fats rather than adding these fats to your diet.
- Have an ounce of dry-roasted nuts as a snack. Nuts and seeds count as part of your meat and beans allowance on the MyPyramid plan.

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# 20.5: Carbohydrates

Not sure what to think about carbohydrates these days? You've come to the right section. Here are the facts to separate the hype from the truth about carbohydrates.

## What are carbohydrates?

Your body uses carbohydrates (carbs) to make glucose which is the fuel that gives you energy and helps keep everything going.

Your body can use glucose immediately or store it in your liver and muscles for when it is needed.

You can find carbohydrates in the following:

- Fruits
- Vegetables
- Breads, cereals, and other grains
- Milk and milk productssugar-sweetened
- Foods containing added sugars (e.g., cakes, cookies, and beverages).

Healthier foods higher in carbohydrates include ones that provide dietary fiber and whole grains as well as those without added sugars.

What about foods higher in carbohydrates such as sodas and candies that also contain added sugars? Those are the ones that add extra calories but not many nutrients to your diet.

| Quick Q& A |
| --- |
| I've heard there are "good" carbs and "bad" carbs? Can you provide me more information? |
| Some diet books use "bad" carbs to talk about foods with refined carbohydrates (i.e., meaning they're made from white flour and added sugars).<br>Examples include white bread, cakes, and cookies.<br>"Good" carbs is used to describe foods that have more fiber and complex carbohydrates. Complex carbohydrates are carbohydrates that take longer to break down into glucose; such as vegetables, fruits, whole grains and beans.<br>These terms aren't used in the *Dietary Guidelines for Americans 2010*. Instead, the guidelines recommend choosing fiber-rich carbohydrate choices from the vegetable, fruit, and grain groups and avoid added sugars.<br>It is also recommended that at least half of your daily grain choices are whole grains. |

## What are the types of carbohydrates?

There are two main types of carbohydrates:

- Complex carbohydrates
- Simple carbohydrates

### Complex Carbohydrates

Starch and dietary fiber are the two types of complex carbohydrates.

Starch must be broken down through digestion before your body can use it as a glucose source.

Quite a few foods contain starch and dietary fiber such as breads, cereals, and vegetables:

- Starch is in certain vegetables (i.e., potatoes, dry beans, peas, and corn).
- Starch is also found in breads, cereals, and grains.
- Dietary fiber is in vegetables, fruits, and whole grain foods.

### Dietary Fiber

You may have seen dietary fiber on the label listed as soluble fiber or insoluble fiber.

Soluble fiber is found in the following:

- Oatmeal
- Oat bran
- Nuts and seeds
- Most fruits (e.g., strawberries, blueberries, pears, and apples)
- Dry beans and peas

Insoluble fiber found in the following:

- Whole wheat bread
- Barley
- Brown rice
- Couscous
- Bulgur or whole grain cereals
- Wheat bran
- Seeds
- Most vegetables
- Fruits

Which type is best? Both! Each has important health benefits so eat a variety of these foods to get enough of both. You're also more likely to get other nutrients that you might miss if you just chose 1 or 2 high-fiber foods.

### How much dietary fiber do I need each day?

Most Americans greatly under consume dietary fiber. Breads, rolls, buns and pizza crust made with refined flour are not among the best sources of dietary fiber, but currently contribute to a large portion our diets. To meet the recommendations for fiber, most people need to increase the consumption of beans peas other vegetable, fruits and whole grains, and other foods with naturally occurring fiber.

It's recommended that you get 14 grams of dietary fiber for every 1,000 calories that you consume each day.[1] To find out how many calories you need each day, visit: Food Plans at MyPlate.gov and enter your age, sex, height, weight, and your activity level in the Daily Food plan.

Or as a general rule you may refer to the chart below to find out the recommended amount of fiber you need based on age and gender groups. [1,2]

| nutrient (units) | source of goala | child 1–3 | female 4–8 | Male 4–8 | female 9–13 | Male 9–13 | female 14–18 | Male 14–18 |
|---|---|---|---|---|---|---|---|---|
| Total fiber (grams) | IOMd | 14 | 17 | 20 | 22 | 25 | 25 | 31 |

| nutrient (units) | source of goala | female 19–30 | Male 19–30 | female 31–50 | Male 31–50 | female 51+ | Male 51+ |
|---|---|---|---|---|---|---|---|
| Total fiber (grams) | IOMd | 28 | 34 | 25 | 31 | 22 | 28 |

At first, you may find it challenging to eat all of your daily fiber grams. Just take it slowly and try to choose higher-fiber foods more often. Over time, you'll gradually be eating more fiber!

Try these tips to jumpstart your intake of dietary fiber:

- Choose whole fruits more often than fruit juice. Fresh, frozen, or canned—it doesn't matter— they all count!
- Try to eat two vegetables with your evening meal.
- Keep a bowl of veggies already washed and prepared your refrigerator—try carrots, cucumbers, or celery for a quick snack.
- Make a meal around dried beans or peas (also called legumes) instead of meat.
- Choose whole grain foods more often. Take a look at the "whole grains buzz words list" below to help you decide. A good guide is to make at least ½ of your grain choices be whole grains.

- Start your day with a whole grain breakfast cereal low in added sugar. Top your cereal with fruit for even more fiber. While bananas may come to your mind first, you can add even more variety by also trying sliced peaches or berries. You can often find these fruits year-round in the frozen foods section of your grocery store.

### Whole Grains

Whole grains are a good source of fiber and nutrients. Whole grains refer to grains that have all of the parts of the grain seed (sometimes called the kernel). These parts of the kernel are called the bran, the germ, and the endosperm.

If the whole grain has been cracked, crushed, or flaked (as in cracked whole grain bread or flake cereal), then the whole grain must still have about the same proportions of bran, germ, and endosperm to be called a whole grain.[3]

When whole grains are processed, some of the dietary fiber and other important nutrients are removed. A processed grain is called a “refined” grain.

Some refined grain products have key nutrients, such as folic acid and iron, which were removed during the initial processing and added back. These are called enriched grains. White rice and white bread are enriched grain products.

Some enriched grain foods have extra nutrients added. These are called fortified grains.

### Whole Grain “Buzz Words”

*The Dietary Guidelines for Americans* recommend that you try to make at least half of your daily grain choices as whole grains.

You can find out if the food you are eating is made of whole grains by looking at the ingredients list of the food label. The whole grain should be the first ingredient listed. The following are some examples of how whole grains could be listed:

- brown rice
- buckwheat
- bulgur (cracked wheat)
- millet
- wild rice
- popcorn*
- quinoa
- triticale
- whole-grain barley
- whole-grain corn
- whole oats/oatmeal
- whole rye
- whole wheat

*Popcorn is a whole grain that can have added fat and salt. Try air-popping your popcorn to avoid these extras. If you’re buying microwave popcorn, look for a lower-fat variety. You may also want to try the snack size bag to help with portion control.

### Grains Galore!

Here are some explanations of less-familiar grains:[5]
**Bulgur.** A staple of Middle Eastern dishes. Bulgur wheat consists of kernels that have been steamed, dried, and crushed. It has a tender and chewy texture.

**Millet.** A staple grain in parts of Africa and Asia. Millet comes in several varieties and has a bland flavor that is a background to other seasonings.

**Quinoa.** A grain that has been traditionally used in South American cuisine. Its texture has been compared to that of couscous.

**Triticale.** A grain that is a hybrid of wheat and rye. It comes in several varieties including whole berry, flakes, and flour.

### Simple Carbohydrates

Simple carbohydrates include sugars found naturally in foods such as fruits, vegetables milk, and milk products. Simple carbohydrates also include sugars added during food processing and refining.[6] What’s the difference? In general, foods with added sugars have fewer nutrients than foods with naturally-occurring sugars.

**How can I avoid added sugars?**

One way to avoid these sugars is to read the ingredient lists on food labels.

Look for these ingredients as added sugars:[7]

- If you see any of these in the ingredient list, you know the food has added sugars. The closer to the top of the list, the more of that sugar is in the food.

  You can learn more about sugars on the food label by visiting How to Understand and Use the Nutrition Facts Label.

  Other tips for avoiding added sugars include—
  - Choose water instead of sugar-sweetened sodas.
  - Choose 4 fluid ounces (1/2 cup) of 100% fruit juice rather than a fruit drink.
  - Have a piece of fruit for dessert and skip desserts with added sugar.
  - Choose breakfast cereals that contain no or less added sugars.

  If you want to learn more about avoiding added sugar in what you drink, check out Re-think your Drink.

  You probably already know sugars and starches can play a role in causing cavities. But it's worth mentioning again, particularly as far as kids are concerned. Be sure to also brush, floss, and drink fluoridated water to help prevent cavities.

### For More Information on Carbohydrates

It's important to *choose carbohydrates wisely*. Foods containing carbohydrates are part of a healthful diet. For more information about carbohydrates visit:

- HHS Health Facts: Choose Carbohydrates Wisely (PDF-96k)

### Sources

[1]Dietary Guidelines for Americans, 2010 (pg 41).
[2]Dietary Guidelines for Americans, 2010, (pg 76).
[3]Dietary Guidelines for Americans, 2010 (pg 36).
[4]DHHS, A Healthier You, (pg 43).
[5]Barron's Food Lover's Companion. Copyright © 2001 by Barron's Educational Series, Inc.
[6]U.S. National Library of Medicine & NIH. MedlinePlus Medical Encyclopedia: Carbohydrates.
[7]DHHS, A Healthier You, (pg 55).

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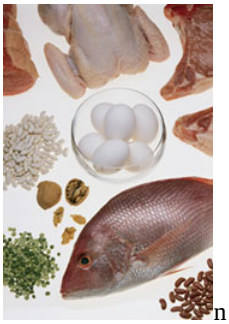
# 20.6: Protein

What do you think about when you hear the word *protein*? Maybe it's an ad for some protein shake that promises massive muscles? Or is it the last high-protein diet craze you read about? With all this talk about protein, you might think Americans were at risk for not eating enough. In fact, most of us eat more protein than we need. Protein is in many foods that we eat on a regular basis.

This section will help you learn more about protein. You'll find information about what foods have protein and what happens when we eat more protein than we need.

## What is Protein?

Proteins are part of every cell, tissue, and organ in our bodies. These body proteins are constantly being broken dow



n and replaced. The protein in the foods we eat is digested into amino acids that are later used to replace these proteins in our bodies.

Protein is found in the following foods:

1. meats, poultry, and fish
2. legumes (dry beans and peas)
3. tofu
4. eggs
5. nuts and seeds
6. milk and milk products
7. grains, some vegetables, and some fruits (provide only small amounts of protein relative to other sources)

As we mentioned, most adults in the United States get more than enough protein to meet their needs. It's rare for someone who is healthy and eating a varied diet to not get enough protein.

## What are the types of protein?

Proteins are made up of amino acids. Think of amino acids as the building blocks. There are 20 different amino acids that join together to make all types of protein. Some of these amino acids can't be made by our bodies, so these are known as *essential* amino acids. It's *essential* that our diet provide these.

In the diet, protein sources are labeled according to how many of the essential amino acids they provide:

- A *complete* protein source is one that provides all of the essential amino acids. You may also hear these sources called *high quality proteins*. Animal-based foods; for example, meat, poultry, fish, milk, eggs, and cheese are considered complete protein sources.



- An *incomplete* protein source is one that is low in one or more of the essential amino acids. *Complementary* proteins are two or more incomplete protein sources that together provide adequate amounts of all the essential amino acids.




For example, rice contains low amounts of certain essential amino acids; however, these same essential amino acids are found in greater amounts in dry beans. Similarly, dry beans contain lower amounts of other essential amino acids that can be found in larger

amounts in rice. Together, these two foods can provide adequate amounts of all the essential amino acids the body needs.

| Quick Q& A |
| --- |
| Is it true that complementary proteins must be eaten together to count as a complete protein source? |
| In the past, it was thought that these complementary proteins needed to be eaten at the same meal for your body to use them together. Now studies show that your body can combine complementary proteins that are eaten within the same day.[1] |

## How much protein do I need?

Maybe you've wondered how much protein you need each day. In general, it's recommended that 10–35% of your daily calories come from protein. Below are the Recommended Dietary Allowances (RDA) for different age groups.[2]

| Recommended Dietary Allowance for Protein | |
| --- | --- |
| | Grams of protein needed each day |
| Children ages 1 – 3 | 13 |
| Children ages 4 – 8 | 19 |
| Children ages 9 – 13 | 34 |
| Girls ages 14 – 18 | 46 |
| Boys ages 14 – 18 | 52 |
| Women ages 19 – 70+ | 46 |
| Men ages 19 – 70+ | 56 |

Here are examples of amounts of protein in food:

- 1 cup of milk has 8 grams of protein
- A 3-ounce piece of meat has about 21 grams of protein
- 1 cup of dry beans has about 16 grams of protein
- An 8-ounce container of yogurt has about 11 grams of protein

Added together, just these four sources would meet the protein needs of an adult male (56 grams). This doesn't count all the other foods that add smaller amounts of protein to his diet.

Rather than just focusing on your protein needs, choose an overall healthy eating plan that provides the protein you need as well as other nutrients.

To help you get the amounts of protein you need:

- Compare the amount of meat, poultry, fish, eggs, legumes, nuts, and seeds you are eating per day to what is recommended. As an example, if you refer to MyPlate Daily Food Plan, a 48-year-old female who is active less than 30 minutes a day only needs about 5 ounces each day from the protein group. Some pre-cut slices of meat and poultry, such as a pork chop or chicken breast, can be four to five ounces each. You can see how it would be easy to eat too much.
- Save your money and don't buy the protein supplements. If you're healthy, you probably get all the protein you need from your diet.

To help you make lower-fat protein choices —

- Choose meats that are leaner cuts and trim away any fat you can see. For chicken and turkey, remove the skin to reduce fat.
- Substitute pinto or black beans for meat in chili and tacos.
- Choose low-fat or fat-free milk and yogurt.
- Choose low-fat or fat-free cheese.
- Choose egg whites or pasteurized egg white products.

**What if I am a vegetarian?**

Because some vegetarians avoid eating all (or most) animal foods, they must rely on plant-based sources of protein to meet their protein needs. With some planning, a vegetarian diet can easily meet the recommended protein needs of adults and children.

Choosemyplate.gov provides meal planning tips for vegetarians.

### Is there any harm in getting more protein than I need?

Most people eat more protein than they need without harmful effects. However, protein contributes to calorie intake, so if you eat more protein than you need, your overall calorie intake could be greater than your calorie needs and contribute to weight gain.

Besides that, animal sources of protein can be sources of saturated fat which has been linked to elevated low-density lipoprotein (LDL) cholesterol, a risk factor for heart disease.

In addition, for people with certain kidney diseases, a lower-protein diet may be recommended to help prevent an impairment in kidney function.

Source: NIH Medical Encyclopedia

## Sources

[1]Position of the American Dietetic Association and Dietitians of Canada: Vegetarian diets. *JADA*, 2003; 103(6) 748 – 765.

[2]Source for Acceptable Macronutrient Distribution Range (AMDR) reference and RDAs: Institute of Medicine (IOM) Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. This report may be accessed via www.nap.edu*

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# 20.7: Vitamins and Minerals

A, $B_6$, $B_{12}$, C, D, Calcium, Zinc & more

Vitamins are organic substances (made by plants or animals), minerals are inorganic elements that come from the earth; soil and water and are absorbed by plants. Animals and humans absorb minerals from the plants they eat. Vitamins and minerals are nutrients that your body needs to grow and develop normally.

Vitamins and minerals have a unique role to play in maintaining your health. For example Vitamin D helps your body absorb the amount of calcium (a mineral) it needs to form strong bones. A deficiency in vitamin D can result in a disease called rickets (softening of the bones caused by the bodies inability to absorb the mineral calcium.) The body cannot produce calcium; therefore, it must be absorbed through our food. Other minerals like chromium, copper, iodine, iron, selenium, and zinc are called trace minerals because you only need very small amounts of them each day. The best way to get enough vitamins is to eat a balanced diet with a variety of foods. You can usually get all your vitamins from the foods you eat.

**NIH, Vitamin and Mineral Supplement Fact Sheets**

These fact sheets provide information about the role of vitamins and minerals in health and disease:

- Many products are marketed as dietary supplements. It is important to remember that supplements include vitamins and minerals, as well as herbs, botanicals and other substances. For more information about dietary supplements see:
  - Dietary Supplements
  - Frequently Asked Questions

## Related Information

### CDC, Calcium and Bone Health

Bones play many roles in the body. They provide structure, protect organs, anchor muscles, and store calcium. Adequate calcium consumption and weight bearing physical activity build strong bones, optimizes bone mass, and may reduce the risk of osteoporosis later in life.

### CDC, Folic Acid

Folic acid is a B vitamin. It is used in our bodies to make new cells. If a woman has enough folic acid in her body before she is pregnant, it can help prevent major birth defects of her baby's brain and spine.

### CDC, Iron and Iron Deficiency

Iron is a mineral needed by our bodies. Iron is a part of all cells and does many things in our bodies. For example, iron (as part of the protein hemoglobin) carries oxygen from our lungs throughout our bodies. Having too little hemoglobin is called anemia. Although anemia has a number of causes, iron deficiency anemia is the most common type of anemia.

### Salt

Most of the sodium we consume is in the form of salt, and the vast majority of sodium we consume is in processed and restaurant foods. Too much sodium is bad for your health. It can increase your blood pressure and your risk for a heart attack and stroke.

### Sodium and Potassium

Nearly all Americans eat too much salt (sodium). Most of the salt comes from eating processed and restaurant foods (>70%). On average, the more salt a person eats, the higher his or her blood pressure.

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# 20.8: Dietary Guidelines- Glossary

## GLOSSARY

**added sugars**—Sugars, syrups, and other caloric sweeteners that are added to foods during processing, preparation, or consumed separately. Added sugars do not include naturally occurring sugars such as those in fruit or milk. Names for added sugars include: brown sugar, corn sweetener, corn syrup, dextrose, fructose, fruit juice concentrates, glucose, high-fructose corn syrup, honey, invert sugar, lactose, maltose, malt syrup, molasses, raw sugar, turbinado sugar, trehalose, and sucrose.

**Body mass index (BMi)**—A measure of weight in kilograms (kg) relative to height in meters (m) squared. BMI is considered a reasonably reliable indicator of total body fat, which is related to the risk of disease and death. BMI status categories include underweight, healthy weight, overweight, and obese. Overweight and obese describe ranges of weight that are greater than what is considered healthy for a given height, while underweight describes a weight that is lower than what is considered healthy. Because children and adolescents are growing, their BMI is plotted on growth charts for sex and age. The percentile indicates the relative position of the child's BMI among children of the same sex and age.

**calorie**—Unit of (heat) energy available from the metabolism of food that is required to sustain the body's various functions, including metabolic processes and physical activity. Carbohydrate, fat, protein, and alcohol provide all of the energy supplied by foods and beverages.

**calorie balance**—The balance between calories consumed through eating and drinking and those expended through physical activity and metabolic processes.

**calorie density**—Amount of calories provided per unit of food weight. Also known as "energy density." Foods high in water and/or dietary fiber typically have fewer calories per gram and are lower in calorie density, while foods higher in fat are generally higher in calorie density. Calorie density is most useful when considering the eating pattern in its entirety. A healthy eating pattern with low calorie density can include consumption of a small amount of some calorie-dense foods (such as olive oil and nuts). An eating pattern low in calorie density is characterized by a relatively high intake of vegetables, fruit, and dietary fiber and a relatively low intake of total fat, saturated fat, and added sugars. (See "Nutrient dense.")

**carbohydrates**—One of the macronutrients. They include sugars, starches, and fibers:

- **sugars**—A simple carbohydrate composed of one unit (a monosaccharide, such as glucose or fructose) or two joined units (a disaccharide, such as lactose or sucrose). Sugars include those occurring naturally in foods, those added to foods during processing and preparation, and those consumed separately.
- **starches**—Many glucose units linked together into long chains. Examples of foods containing starch include grains (e.g., brown rice, oats, wheat, barley, corn), beans and peas (e.g., kidney beans, garbanzo beans, lentils, split peas), and tubers (e.g., potatoes, carrots). Refined starches are added to foods during food processing or cooking as thickeners and stabilizers. Corn starch is an example of a refined starch.
- **fiber**—Nondigestible carbohydrates and lignin that are intrinsic and intact in plants. Fiber consists of dietary fiber (the fiber naturally occurring in foods) and functional fiber, which are isolated, nondigestible carbohydrates that have beneficial physiological effects in humans.

**cardiovascular disease**—Diseases of the heart and diseases of the blood vessel system (arteries, capillaries, veins) within a person's entire body.

**cholesterol**—A natural sterol present in all animal tissues. Free cholesterol is a component of cell membranes and serves as a precursor for steroid hormones (estrogen, testosterone, aldosterone), and for bile acids. Humans are able to synthesize sufficient cholesterol to meet biologic requirements, and there is no evidence for a dietary requirement for cholesterol.

- **dietary cholesterol**—Cholesterol found in foods of animal origin, including meat, seafood, poultry, eggs, and dairy products. Biologically, a liver is required to produce cholesterol, thus plant foods, such as grains, vegetables and fruits, and oils contain no dietary cholesterol.
- **serum cholesterol**—Cholesterol that travels in the blood as part of distinct particles containing both lipids and proteins (lipoproteins). Three major classes of lipoproteins are found in the serum of a fasting individual: low-density lipo-protein (LDL), high-density lipoprotein (HDL), and very-low-density lipoprotein (VLDL). Another lipoprotein class, intermediate-density lipoprotein (IDL), resides between VLDL and LDL; in clinical practice, IDL is included in the LDL measurement. Elevated lipid levels in the blood is known as hyperlipidemia.

**cross-contamination**—The spread of bacteria, viruses, or other harmful agents from one surface to another.

**cup equivalent**—The amount of a food product that is considered equal to 1 cup from the vegetable, fruit, or milk food group. A cup equivalent for some foods may be less than a measured cup because the food has been concentrated (such as raisins or tomato paste), more than a cup for some foods that are airy in their raw form and do not compress well into a cup (such as salad greens), or measured in a different form (such as cheese).

**diabetes**—A disorder of metabolism—the way the body uses digested food for growth and energy. In diabetes, the pancreas either produces little or no insulin (a hormone that helps glucose, the body's main source of fuel, get into cells), or the cells do not respond appropriately to the insulin that is produced. The three main types of diabetes are type 1, type 2, and gestational diabetes. About 90 to 95 percent of people with diabetes have type 2. This form of diabetes is most often associated with older age, obesity, family history of diabetes, previous history of gestational diabetes, physical inactivity, and certain ethnicities. About 80 percent of people with type 2 diabetes are overweight. Prediabetes, also called impaired fasting glucose or impaired glucose tolerance, is a state in which blood glucose levels are higher than normal but not high enough to be called diabetes.

**dietary reference intakes (dris)**—A set of nutrient-based reference values that expand upon and replace the former Recommended Dietary Allowances (RDAs) in the United States and the Recommended Nutrient Intakes (RNIs) in Canada. They include:

- **acceptable Macronutrient distribution range (aMdr)**—Range of intake for a particular energy source that is associated with reduced risk of chronic disease while providing intakes of essential nutrients. An intake outside of the AMDR carries the potential of increased risk of chronic diseases and/or insufficient intakes of essential nutrients.
- **adequate intake (ai)**—A recommended average daily nutrient intake level based on observed or experimentally determined approximations or estimates of mean nutrient intake by a group (or groups) of apparently healthy people. This is used when the Recommended Dietary Allowance cannot be determined.
- **estimated average requirement (ear)**—The average daily nutrient intake level estimated to meet the requirement of half the healthy individuals in a particular life stage and gender group.
- **recommended dietary allowance (rda)**—The average dietary intake level that is sufficient to meet the nutrient requirement of nearly all (97 to 98%) healthy individuals in a particular life stage and gender group.
- **tolerable upper intake level (ul)**—The highest average daily nutrient intake level likely to pose no risk of adverse health effects for nearly all individuals in a particular life stage and gender group. As intake increases above the UL, the potential risk of adverse health effects increases.

**eating pattern**—The combination of foods and beverages that constitute an individual's complete dietary intake over time. This may be a description of a customary way of eating or a description of a combination of foods recommended for consumption. Specific examples include USDA Food Patterns, Dietary Approaches to Stop Hypertension (DASH) Eating Plan, and Mediterranean, vegetarian, and vegan patterns.

**enrichment**—The addition of specific nutrients (iron, thiamin, riboflavin, and niacin) to refined-grain products in order to replace losses of the nutrients that occur during processing.

**essential nutrient**—A vitamin, mineral, fatty acid, or amino acid required for normal body functioning that either cannot be synthesized by the body at all, or cannot be synthesized in amounts adequate for good health, and thus must be obtained from a dietary source. Other food components, such as dietary fiber, while not essential, also are considered to be nutrients.

**fast food**—Foods designed for ready availability, use, or consumption and sold at eating establishments for quick availability or take-out. Fast food restaurants also are known as quick-service restaurants.

**fats**—One of the macronutrients. (See "Solid Fats" and "Oils" and Figure 3-3 in Chapter 3.)

- **Monounsaturated fatty acids**—Monounsaturated fatty acids (MUFAs) have one double bond. Plant sources that are rich in MUFAs include nuts and vegetable oils that are liquid at room temperature (e.g., canola oil, olive oil, and high oleic safflower and sunflower oils).
- **Polyunsaturated fatty acid**s—Polyunsaturated fatty acids (PUFAs) have two or more double bonds and may be of two types, based on the position of the first double bond.
    - **omega-6 Pufas**—Linoleic acid, one of the n-6 fatty acids, is required but cannot be synthesized by humans and, therefore, is considered essential in the diet. Primary sources are liquid vegetable oils, including soybean oil, corn oil, and safflower oil. Also called n-6 fatty acids.

- **omega-3 Pufas**—Alphalinolenic acid is an n-3 fatty acid that is required because it is not synthesized by humans and, therefore, is considered essential in the diet. It is obtained from plant sources, including soybean oil, canola oil, walnuts, and flaxseed. Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are long chain n-3 fatty acids that are contained in fish and shellfish. Also called n-3 fatty acids.

- **saturated fatty acids**—Saturated fatty acids have no double bonds. Examples include the fatty acids found in animal products, such as meat, milk and milk products, hydrogenated shortening, and coconut or palm oils. In general, foods with relatively high amounts of saturated fatty acids are solid at room temperature
- **trans fatty acids**—Unsaturated fatty acids that contain one or more isolated double bonds in a trans configuration produced by chemical hydrogenation. Sources of trans fatty acids include hydrogenated/partially hydrogenated vegetable oils that are used to make shortening and commercially prepared baked goods, snack foods, fried foods, and margarine. Trans fatty acids also are present in foods that come from ruminant animals (e.g., cattle and sheep). Such foods include dairy products, beef, and lamb.

**fightBac!®**—A national public education campaign to promote food safety to consumers and educate them on how to handle and prepare food safely. In this campaign, pathogens are represented by a cartoonlike bacteria character named “BAC.”

**food security**—Access by all people at all times to enough food for an active, healthy life. Food security includes, at a minimum: (a) the ready availability of nutritionally adequate and safe foods; and (b) an assured ability to acquire acceptable foods in socially acceptable ways (e.g., without resorting to emergency food supplies, scavenging, stealing, or other coping strategies).

**food insecurity**—The limited or uncertain availability of nutritionally adequate and safe foods or uncertain ability to acquire acceptable foods in socially acceptable ways. Hunger is defined as the uneasy or painful sensation caused by a lack of food, or the recurrent and involuntary lack of access to food.

**foodborne disease**—Disease caused by consuming foods or beverages contaminated with disease- causing bacteria or viruses. Many different disease-causing microbes, or pathogens, can contaminate foods, so there are many different foodborne infections. In addition, poisonous chemicals, or other harmful substances, can cause foodborne diseases if they are present in food. The most commonly recognized foodborne infections are those caused by the bacteria Campylobacter, Salmonella, and E. coli O157:H7, and by a group of viruses called calicivirus, also known as the Norwalk and Norwalk-like viruses.

**fortification**—The addition of one or more essential nutrients to a food, whether or not it is normally contained in the food. Fortification may be used for the purpose of preventing or correcting a deficiency in the population or specific population groups; to restore naturally occurring nutrients lost during processing, storage, or handling; or to increase the nutrient level above that found in comparable food and to serve as a meaningful source of the specific nutrient.

**hypertension**—A condition, also known as high blood pressure, in which blood pressure remains elevated over time. Hypertension makes the heart work too hard, and the high force of the blood flow can harm arteries and organs, such as the heart, kidneys, brain, and eyes. Uncontrolled hypertension can lead to heart attacks, heart failure, kidney disease, stroke, and blindness. Prehypertension is defined as blood pressure that is higher than normal but not high enough to be defined as hypertension.

**Macronutrient**—A dietary component that provides energy. Macronutrients include protein, fats, carbohydrates, and alcohol.

**nutrient dense**—Nutrient-dense foods and beverages provide vitamins, minerals, and other substances that may have positive health effects, with relatively few calories. The term “nutrient dense” indicates the nutrients and other beneficial substances in a food have not been “diluted” by the addition of calories from added solid fats, added sugars, or added refined starches, or by the solid
fats naturally present in the food. Nutrient-dense foods and beverages are lean or low in solid fats,
and minimize or exclude added solid fats, sugars, starches, and sodium. Ideally, they also are in forms that retain naturally occurring components, such as dietary fiber. All vegetables, fruits, whole grains, seafood, eggs, beans and peas, unsalted nuts and seeds, fat-free and low-fat milk and milk products, and lean meats and poultry—when prepared without solid fats or added sugars —are nutrient-dense foods. (See “Calorie density.”)

**oils**—Fats that are liquid at room temperature. Oils come from many different plants and from seafood. Some common oils include canola, corn, olive, peanut, safflower, soybean, and sunflower oils. A number of foods are naturally high in oils, such as nuts, olives, some fish, and avocados. Foods that are mainly oil include mayonnaise, certain salad dressings, and soft (tub or squeeze) margarine with no trans fats. Most oils are high in monounsaturated or polyunsaturated fats, and low in saturated fats. A few plant oils, including coconut oil and palm kernel oil, are high in saturated fats and for nutritional purposes should be considered solid fats. Hydrogenated oils that contain trans fats also should be considered solid fats for nutritional purposes.

**ounce-equivalent (oz-eq)**—The amount of a food product that is considered equal to 1 ounce from the grain group or the protein foods group. An oz-eq for some foods may be less than a measured ounce if the food is concentrated or low in water content (nuts, peanut butter, dried meats, or flour), more than an ounce if the food contains a large amount of water (tofu, cooked beans, cooked rice, or cooked pasta).

**Portion size**—The amount of a food served or consumed in one eating occasion. A portion is not a standardized amount, and the amount considered to be a portion is subjective and varies. (See "Serving size.")

**Protein**—One of the macronutrients. Protein is the major functional and structural component of every cell in the body. Proteins are composed of amino acids, nine of which cannot be synthesized to meet the body's needs and therefore must be obtained from the diet. The quality of a source of dietary protein depends on its ability to provide the nitrogen and amino acid requirements that are necessary for the body's growth, maintenance, and repair.

**refined grains**—Grains and grain products missing the bran, germ, and/or endosperm; any grain product that is not a whole grain. Many refined grains are low in fiber and enriched with thiamin, riboflavin, niacin, and iron, and fortified with folic acid as required by U.S. regulations.

**seafood**—Marine animals that live in the sea and in freshwater lakes and rivers. Seafood includes fish, such as salmon, tuna, trout, and tilapia, and shellfish, such as shrimp, crab, and oysters.

**serving size**—A standardized amount of a food, such as a cup or an ounce, used in providing information about a food within a food group, such as in dietary guidance. Serving size on the Nutrition Facts label is determined based on the Reference Amounts Customarily Consumed (RACC) for foods that have similar dietary usage, product characteristics, and customarily consumed amounts for consumers to make "like product" comparisons. (See "Portion size.")

**solid fats**—Fats that are usually not liquid at room temperature. Solid fats are found in most animal foods but also can be made from vegetable oils through hydrogenation. Some common solid fats include: butter, beef fat (tallow, suet), chicken fat, pork fat (lard), stick margarine, coconut oil, palm oil, and shortening. Foods high in solid fats include: full-fat (regular) cheese, cream, whole milk, ice cream, well-marbled cuts of meats, regular ground beef, bacon, sausages, poultry skin, and many baked goods (such as cookies, crackers, donuts, pastries, and croissants). Solid fats contain more saturated fatty acids and/or trans fatty acids, and less monounsaturated or polyunsaturated fatty acids than do most oils, which are liquid at room temperature. (See "Fats" and Figure 3-3 in Chapter 3.)

**sugar-sweetened beverage**s—Liquids that are sweetened with various forms of sugars that add calories. These beverages include, but are not limited to, soda, fruit ades and fruit drinks, and sports and energy drinks.

**whole grains**—Grains and grain products made from the entire grain seed, usually called the kernel, which consists of the bran, germ, and endosperm. If the kernel has been cracked, crushed, or flaked, it must retain nearly the same relative proportions of bran, germ, and endosperm as the original grain in order to be called whole grain. Many, but not all, whole grains are also a source of dietary fiber.

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# 20.9: Dietary Guidelines- Introduction

In 1980, the U.S. Department of Agriculture (USDA) and the U.S. Department of Health and Human Services (HHS) released the first edition of Nutrition and Your Health: Dietary Guidelines for Americans. These Dietary Guidelines were different from previous dietary guidance in that they reflected emerging scientific evidence about diet and health and expanded the traditional focus on nutrient adequacy to also address the impact of diet on chronic disease.



Subsequent editions of the Dietary Guidelines for Americans have been remarkably consistent in their recommendations about the components of a health-promoting diet, but they also have changed in some significant ways to reflect an evolving body of evidence about nutrition, the food and physical activity environment, and health. The ultimate goal of the Dietary Guidelines for Americans is to improve the health of our Nation's current and future generations by facilitating and promoting healthy eating and physical activity choices so that these behaviors become the norm among all individuals.

The recommendations contained in the Dietary Guidelines for Americans traditionally have been intended for healthy Americans ages 2 years and older. However, Dietary Guidelines for Americans, 2010 is being released at a time of rising concern about the health of the American population. Its recommendations accommodate the reality that a large percentage of Americans are overweight or obese and/or at risk of various chronic diseases. Therefore, the Dietary Guidelines for Americans, 2010 is intended for Americans ages 2 years and older, including those who are at increased risk of chronic disease.

Poor diet and physical inactivity are the most important factors contributing to an epidemic of overweight and obesity in this country. The most recent data indicate that 72 percent of men and 64 percent of women are overweight or obese, with about one-third of adults being obese.9 Even in the absence of overweight, poor diet and physical inactivity are associated with major causes of morbidity and mortality. These include cardiovascular disease, hypertension, type 2 diabetes, osteoporosis, and some types of cancer. Some racial and ethnic population groups are disproportionately affected by the high rates of overweight, obesity, and associated chronic diseases. These diet and health associations make a focus on improved nutrition and physical activity choices ever more urgent. These associations also provide important opportunities to reduce health disparities through dietary and physical activity changes.

Dietary Guidelines for Americans also recognizes that in recent years nearly 15 percent of American households have been unable to acquire adequate food to meet their needs because of insufficient money or other resources for food.10 This dietary guidance can help them maximize the nutritional content of their meals within their resource constraints. Many other Americans consume less than optimal intake of certain nutrients, even though they have adequate resources for a healthy diet. This dietary guidance and nutrition information can help them choose a healthy, nutritionally adequate diet.

Children are a particularly important focus of the Dietary Guidelines for Americans because of the growing body of evidence documenting the vital role that optimal nutrition plays throughout the lifespan. Today, too many children are consuming diets with too many calories and not enough nutrients and are not getting enough physical activity. Approximately 32 percent of children and adolescents ages 2 to 19 years are overweight or obese, with 17 percent of children being obese.11 In addition, risk factors for adult chronic diseases are increasingly found in younger ages. Eating patterns established in childhood often track into later life, making early intervention on adopting healthy nutrition and physical activity behaviors a priority.

## Developing the Dietary Guidelines for Americans, 2010

Because of their focus on health promotion and disease risk reduction, the Dietary Guidelines form the basis for nutrition policy in Federal food, education, and information programs. By law (Public Law 101-445, Title III, 7 U.S.C. 5301 et seq.), the Dietary Guidelines for Americans is reviewed, updated if necessary, and published every 5 years. The process to create each edition of the Dietary Guidelines for Americans is a joint effort of the USDA and HHS and has evolved to include three stages.

 In the first stage, an external scientific Dietary Guidelines Advisory Committee (DGAC) is appointed to conduct an analysis of new scientific information on diet and health and to prepare a report summarizing its findings. The Committee's analysis is the primary resource for the two Departments in developing the Dietary Guidelines for Americans. The 2010 DGAC used a systematic evidence-based review methodology involving a web-based electronic system to facilitate its review of the scientific literature and address approximately 130 scientific questions. The methodological rigor of each study included in the analysis was assessed, and the body of evidence supporting each question was summarized, synthesized, and graded by the Committee (this work is publicly available at http://www.nutritionevidencelibrary.gov). The DGAC used data analyses, food pattern modeling analyses,12 and reviews of other evidence-based reports to address an additional 50 questions.

The DGAC report presents a thorough review of key nutrition, physical activity, and health issues, including those related to energy balance and weight management; nutrient adequacy; fatty acids and cholesterol; protein; carbohydrates; sodium, potassium, and water; alcohol; and food safety and technology. Following its completion in June 2010, the DGAC report was made available to the public and Federal agencies for comment. For more information about the process and the Committee's review, see the Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2010 at http://www.dietaryguidelines.gov.

During the second stage, the Departments develop the policy document, Dietary Guidelines for Americans. The audiences for this document include policymakers, nutrition educators, nutritionists, and healthcare providers. Similar to previous editions, the 2010 edition of Dietary Guidelines for Americans is based on the Advisory Committee's report and a consideration of public and Federal agency comments. The Dietary Guidelines science-based recommendations are used for program and policy development. In the third and final stage, the two Departments develop messages and materials communicating the Dietary Guidelines to the general public.

## the heavy toll of diet-related chronic diseases

### cardiovascular disease

- 81.1 million Americans—37 percent of the population—have cardiovascular disease.13 Major risk factors include high levels of blood cholesterol and other lipids, type 2 diabetes, hypertension (high blood pressure), metabolic syndrome, overweight and obesity, physical inactivity, and tobacco use.
- 16 percent of the U.S. adult population has high total blood cholesterol.14 hypertension
- 74.5 million Americans—34 percent of U.S. adults—have hypertension.15
- Hypertension is a major risk factor for heart disease, stroke, congestive heart failure, and kidney disease.
- Dietary factors that increase blood pressure include excessive sodium and insufficient potassium intake, overweight and obesity, and excess alcohol consumption.
- 36 percent of American adults have prehypertension—blood pressure numbers that are higher than normal, but not yet in the hypertension range.16

**diabetes**

- Nearly 24 million people—almost 11 percent of the population—ages 20 years and older have diabetes.17 The vast majority of cases are type 2 diabetes, which is heavily influenced by diet and physical activity.
- About 78 million Americans—35 percent of the U.S. adult population ages 20 years or older—have pre-diabetes.18 Pre-diabetes (also called impaired glucose tolerance or impaired fasting glucose) means that blood glucose levels are higher than normal, but not high enough to be called diabetes.

**cancer**

- Almost one in two men and women—approximately 41 percent of the population—will be diagnosed with cancer during their lifetime.19
- Dietary factors are associated with risk of some types of cancer, including breast (post-menopausal), endometrial, colon, kidney, mouth, pharynx, larynx, and esophagus.

**osteoporosis**

- One out of every two women and one in four men ages 50 years and older will have an osteoporosis-related fracture in their lifetime.20
- About 85 to 90 percent of adult bone mass is acquired by the age of 18 in girls and the age of 20 in boys.21 Adequate nutrition and regular participation in physical activity are important factors in achieving and maintaining optimal bone mass.

## A RoadMap to the Dietary Guidelines For Americans, 2010

Dietary Guidelines for Americans, 2010 consists of six chapters. This first chapter introduces the document and provides information on background and purpose. The next five chapters correspond to major themes that emerged from the 2010 DGAC's review of the evidence, and Chapters 2 through 5 provide recommendations with supporting evidence and explanations. These recommendations are based on a preponderance of the scientific evidence for nutritional factors that are important for promoting health and lowering risk of diet-related chronic disease. Quantitative recommendations always refer to individual intake or amount rather than population average intake, unless otherwise noted.

Although divided into chapters that focus on particular aspects of eating patterns, Dietary Guidelines for Americans provides integrated recommendations for health. To get the full benefit, individuals should carry out these recommendations in their entirety as part of an overall healthy eating pattern:

- chapter 2: Balancing calories to Manage
  weight explains the concept of calorie balance, describes some of the environmental factors that have contributed to the current epidemic of overweight and obesity, and discusses diet and physical activity principles that can be used to help Americans achieve calorie balance.
- chapter 3: foods and food components to reduce focuses on several dietary components that Americans generally consume in excess compared to recommendations. These include sodium, solid fats (major sources of saturated fats and trans fats), cholesterol, added sugars, refined grains, and for some Americans, alcohol. The chapter explains that reducing foods and beverages that contain relatively high amounts of these dietary components and replacing them with foods and beverages that provide substantial amounts of nutrients and relatively few calories would improve the health of Americans.
- chapter 4: foods and nutrients to increase focuses on the nutritious foods that are recommended for nutrient adequacy, disease prevention, and overall good health. These include vegetables; fruits; whole grains; fat-free or low-fat milk and milk products;22 protein foods, including seafood, lean meat and poultry, eggs, beans and peas, soy products, and unsalted nuts and seeds; and oils. Additionally, nutrients of public health concern, including potassium, dietary fiber, calcium, and vitamin D, are discussed.
- chapter 5: Building healthy eating Patterns shows how the recommendations and principles described in earlier chapters can be combined into a healthy overall eating pattern. The USDA Food Patterns and DASH Eating Plan are healthy eating patterns that provide flexible templates allowing all Americans to stay within their calorie limits, meet their nutrient needs, and reduce chronic disease risk.
- chapter 6: helping americans Make healthy choices discusses two critically important facts. The first is that the current food and physical activity environment is influential in the nutrition and activity choices that people make—for better and for worse. The second is that all elements of society, including individuals and families, communities, business and industry, and various levels of government, have a positive and productive role to play in the movement to make America healthy. The chapter suggests a number of ways that these players can work together to improve the Nation's nutrition and physical activity.

In addition to these chapters, Dietary Guidelines for Americans, 2010 provides resources that can be used in developing policies, programs, and educational materials. These include Guidance for Specific Population Groups (Appendix 1), Key Consumer Behaviors and Potential 

Strategies for Professionals to Use in Implementing the 2010 Dietary Guidelines (Appendix 2), Food Safety Principles and Guidance for Consumers (Appendix 3), and Using the Food Label to Track

Calories, Nutrients, and Ingredients (Appendix 4). These resources complement existing Federal websites that provide nutrition information and guidance, such as www.healthfinder.gov, www.nutrition.gov, www.mypyramid.gov, and www.dietaryguidelines.gov.

Finally, the document has additional appendices containing nutritional goals for age-gender groups based on the Dietary Reference Intakes and the Dietary Guidelines recommendations (Appendix 5), estimated calorie needs per day by age, gender, and physical activity level (Appendix 6), the USDA Food Patterns and DASH Eating Plan (Appendices 7–10), tables that support individual chapters (Appendices 11–15), and a glossary of terms (Appendix 16).

### sources of information

For more information about the articles and reports used to inform the development of the Dietary Guidelines for Americans, readers are directed to the Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2010 and the related Nutrition Evidence Library website (http://www.nutritionevidencelibrary.gov). Unless otherwise noted, usual nutrient, food group, and selected dietary component intakes by Americans are drawn from analyses conducted by the National Cancer Institute (NCI),23 a component of HHS's National Institutes of Health, and by USDA's Agricultural Research Service (ARS),24 using standard methodologies and data from the National Health and Nutrition Examination Survey (NHANES). Additional references are provided throughout this document, where appropriate.

### Key Terms to Know

Several terms are used throughout Dietary Guidelines for Americans, 2010 and are essential to understanding the principles and recommendations discussed:

- **calorie balance**. The balance between calories consumed in foods and beverages and calories expended through physical activity and metabolic processes.
- **eating pattern**. The combination of foods and beverages that constitute an individual's complete dietary intake over time.
- **nutrient dense**. Nutrient-dense foods and beverages provide vitamins, minerals, and other substances that may have positive health effects with relatively few calories. The term "nutrient dense" indicates that the nutrients and other beneficial substances in a food have not been "diluted" by the addition of calories from added solid fats, added sugars, or added refined starches, or by the solid fats naturally present in the food. Nutrient-dense foods and beverages are lean or low in solid fats, and minimize or exclude added solid fats, sugars, starches, and sodium. Ideally, they also are in forms that retain naturally occurring components, such as dietary fiber. All vegetables, fruits, whole grains, seafood, eggs, beans and peas, unsalted nuts and seeds, fat-free and low-fat milk and milk products, and lean meats and poultry—when prepared without adding solid fats or sugars—are nutrient-dense foods. For most Americans, meeting nutrient needs within their calorie needs is an important goal for health. Eating recommended amounts from each food group in nutrient-dense forms is the best approach to achieving this goal and building a healthy eating pattern.

## Importance of the Dietary Guidelines for Health Promotion and Disease Prevention

A growing body of scientific evidence demonstrates that the dietary and physical activity recommendations described in the Dietary Guidelines for Americans may help people attain and maintain a healthy weight, reduce the risk of chronic disease, and promote overall health. These recommendations accommodate the varied food preferences, cultural traditions, and customs of the many and diverse groups who live in the United States.

A basic premise of the Dietary Guidelines is that nutrient needs should be met primarily through consuming foods. Foods provide an array of nutrients and other components that are thought to have beneficial effects on health. Americans should aim to consume a diet that achieves the Institute of Medicine's most recent Dietary Reference Intakes (DRIs), which consider the individual's life stage, gender, and activity level. In some cases, fortified foods and dietary supplements may be useful in providing one or more nutrients that otherwise may be consumed in less than recommended amounts. Another important premise of the Dietary Guidelines is that foods should be prepared and handled in a way that reduces risk of foodborne illness. All of these issues are discussed in detail in the remainder of this document and its appendices.

### Uses of the Dietary Guidelines for Americans, 2010

As with previous editions, Dietary Guidelines for Americans, 2010 forms the basis for nutrition policy in Federal food, nutrition, education, and information programs. This policy document has several specific uses.

## Development of Educational Materials and Communications

The information in this edition of Dietary Guidelines for Americans is used in developing nutrition education and communication messages and materials. For example, Federal dietary guidance publications are required by law to be consistent with the Dietary Guidelines.

When appropriate, specific statements in Dietary Guidelines for Americans, 2010 indicate the strength of the evidence (e.g., strong, moderate, or limited) related to the topic as summarized by the 2010 Dietary Guidelines Advisory Committee. The strength of evidence is provided so that users are informed about how much evidence is available and how consistent the evidence is for a particular statement or recommendation. This information is useful for educators when developing programs and tools. Statements supported by strong or moderate evidence can and should be emphasized in educational materials over those with limited evidence.

When considering the evidence that supports a recommendation, it is important to recognize the difference between association and causation. Two factors may be associated; however, this association does not mean that one factor necessarily causes the other. Often, several different factors may contribute to an outcome. In some cases, scientific conclusions are based on relationships or associations because studies examining cause and effect are not available. When developing education materials, the relationship of associated factors should be carefully worded so that causation is not suggested.

**Describing the Strength of the Evidence**

Throughout this document, the Dietary Guidelines note the strength of evidence supporting its recommendations:

- strong evidence reflects consistent, convincing findings derived from studies with robust methodology relevant to the population
  of interest.
- Moderate evidence reflects somewhat less evidence or less consistent evidence. The body of evidence may include studies of weaker design and/or some inconsistency in results. The studies may be susceptible to some bias, but not enough to invalidate the results, or the body of evidence may not be as generalizable to the population of interest.
- limited evidence reflects either a small number of studies, studies of weak design, and/or inconsistent results.

For more information about evaluating the strength of evidence, go to http://www.nutritionevidencelibrary.gov

## Development of Nutrition-Related Programs

The Dietary Guidelines aid policymakers in designing and implementing nutrition-related programs. For example, the Federal Government uses the Dietary Guidelines in developing nutrition assistance programs such as the National Child Nutrition Programs and the Elderly Nutrition Program. The Dietary Guidelines also provide the foundation for the Healthy People national health promotion and disease prevention objectives related to nutrition, which set measurable targets for achievement over a decade.

## Development of Authoritative Statements

The Dietary Guidelines for Americans, 2010 has the potential to offer authoritative statements as a basis for health and nutrient content claims, as provided for in the Food and Drug Administration Modernization Act (FDAMA). Potential authoritative statements should be phrased in a manner that enables consumers to understand the claim in the context of the total daily diet. FDAMA upholds the “significant scientific agreement” standard for authorized health claims. By law, this standard is based on the totality of publicly available scientific evidence. Therefore, for FDAMA purposes, statements based on, for example, evidence that is moderate, limited, inconsistent, emerging, or growing, are not authoritative statements.

## References

9. Flegal KM, Carroll MD, Ogden CL, Curtin LR. Prevalence and trends in obesity among U.S. adults, 1999-2008. JAMA. 2010;303(3):235-241.

10. Nord M, Coleman-Jensen A, Andrews M, Carlson S. Household food security in the United States, 2009. Washington (DC): U.S. Department of Agriculture, Economic Research Service. 2010 Nov. Economic Research Report No. ERR-108. Available from http://www.ers.usda.gov/publications/err108.

11. Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. Prevalence of high body mass index in U.S. children and adolescents, 2007-2008. JAMA. 2010;303(3):242-249.

12. Food pattern modeling analyses are conducted to determine the hypothetical impact on nutrients in and adequacy of food patterns when specific modifications to the patterns are made.

13. American Heart Association. Heart Disease and Stroke Statistics, 2010 Update At-A-Glance. http://www.americanheart.org/downloadable/ heart/1265665152970DS-3241%20HeartStrokeUpdate_2010.pdf.

14. Centers for Disease Control and Prevention. Cholesterol Facts. http://www.cdc.gov/cholesterol/facts.htm.

15. American Heart Association. Heart Disease and Stroke Statistics, 2010 Update. Table 6-1. http://circ.ahajournals.org/cgi/reprint/ CIRCULATIONAHA.109.192667.

16. Egan BM, Zhao Y, Axon RN. U.S. trends in prevalence, awareness, treatment, and control of hypertension, 1988–2008. JAMA. 2010;303(20):2043-2050.

17.Centers for Disease Control and Prevention. National Diabetes Fact Sheet, 2007. http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2007.pdf.

18. Centers for Disease Control and Prevention. National Diabetes Fact Sheet, 2007. http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2007.pdf. Estimates projected to U.S. population in 2009.

19. National Cancer Institute. Surveillance Epidemiology and End Results (SEER) Stat Fact Sheets: All Sites. http://seer.cancer.gov/statfacts/html/all.html.

20. National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS). NIH Osteoporosis and Related Bone Diseases National Resource Center. http://www.niams.nih.gov/Health_Info.../default.asp#h.

21. National Osteoporosis Foundation. Fast Facts. http://www.nof.org/node.40.

22. Milk and milk products also can be referred to as dairy products.

23. National Cancer Institute (NCI). Usual dietary intakes: food intakes, U.S. population, 2001–2004. Risk Factor Monitoring and Methods. http://riskfactor. cancer.gov/diet/usualintakes/pop/#results. Updated January 15, 2009. Accessed April 10, 2010.

24. Agricultural Research Service (ARS). Nutrient intakes from food: mean amounts consumed per individual, one day, 2005–2006. Food Surveys Research Group, ARS, U.S. Department of Agriculture. www.ars.usda.gov/ba/bhnrc/fsrg. 2008. Accessed April 10, 2010.

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# 20.10: Dietary Guidelines- Balancing Calories to Manage Weight



Achieving and sustaining appropriate body weight across the lifespan is vital to maintaining good health and quality of life. Many behavioral, environmental, and genetic factors have been shown to affect a person's body weight. Calorie balance over time is the key to weight management. Calorie balance refers to the relationship between calories consumed from foods and beverages and calories expended in normal body functions (i.e., metabolic processes) and through physical activity. People cannot control the calories expended in metabolic processes, but they can control what they eat and drink, as well as how many calories they use in physical activity.

Calories consumed must equal calories expended for a person to maintain the same body weight. Consuming more calories than expended will result in weight gain. Conversely, consuming fewer calories than expended will result in weight loss. This can be achieved over time by eating fewer calories, being more physically active, or, best of all, a combination of the two.

Maintaining a healthy body weight and preventing excess weight gain throughout the lifespan are highly preferable to losing weight after weight gain. Once a person becomes obese, reducing body weight back to a healthy range requires significant effort over a span of time, even years. People who are most successful at losing weight and keeping it off do so through continued attention to calorie balance.

The current high rates of overweight and obesity among virtually all subgroups of the population in the United States demonstrate that many Americans are in calorie imbalance—that is, they consume more calories than they expend. To curb the obesity epidemic and improve their health, Americans need to make significant efforts to decrease the total number of calories they consume from foods and beverages and increase calorie expenditure through physical activity. Achieving these goals will require Americans to select a healthy eating pattern that includes nutrient-dense foods and beverages they enjoy, meets nutrient requirements, and stays within calorie needs. In addition, Americans can choose from a variety of strategies to increase physical activity.

**Key Recommendations**

- Prevent and/or reduce overweight and obesity through improved eating and physical activity behaviors.
- Control total calorie intake to manage body weight. For people who are overweight or obese, this will mean consuming fewer calories from foods and beverages.
- Increase physical activity and reduce time spent in sedentary behaviors.
- Maintain appropriate calorie balance during each stage of life—childhood, adolescence, adulthood, pregnancy and breastfeeding, and older age.

## An Epidemic of Overweight and Obesity

The prevalence of overweight and obesity in the United States is dramatically higher now than it was a few decades ago. This is true for all age groups, including children, adolescents, and adults. One of the largest changes has been an increase in the number of Americans in the obese category. As shown in Table 2-1, the prevalence of obesity has doubled and in some cases tripled between the 1970s and 2008.

The high prevalence of overweight and obesity across the population is of concern because individuals who are overweight or obese have an increased risk of many health problems. Type 2 diabetes, heart disease, and certain types of cancer are among the conditions most often associated with obesity. Ultimately, obesity can increase the risk of premature death.




These increased health risks are not limited to adults. Weight-associated diseases and conditions that were once diagnosed primarily in adults are now observed in children and adolescents with excess body fat. For example, cardiovascular disease risk factors, such as high blood cholesterol and hypertension, and type 2 diabetes are now increasing in children and adolescents. The adverse effects also tend to persist through the lifespan, as children and adolescents who are overweight and obese are at substantially increased risk of being overweight and obese as adults and developing weight-related chronic diseases later in life. Primary prevention of obesity, especially in childhood, is an important strategy for combating and reversing the obesity epidemic.

All Americans—children, adolescents, adults, and older adults—are encouraged to strive to achieve and maintain a healthy body weight. Adults who are obese should make changes in their eating and physical activity behaviors to prevent additional weight gain and promote weight loss. Adults who are overweight should not gain additional weight, and most, particularly those with cardiovascular disease risk factors, should make changes to their eating and physical activity behaviors to lose weight. Children and adolescents are encouraged to maintain calorie balance to support normal growth and development without promoting excess weight gain. Children and adolescents who are overweight or obese should change their eating and physical activity behaviors so that their BMI-for-age percentile does not increase over time. Further, a health care provider should be consulted to determine appropriate weight management for the child or adolescent. Families, schools, and communities play important roles in supporting changes in eating and physical activity behaviors for children and adolescents.

Maintaining a healthy weight also is important for certain subgroups of the population, including women who are capable of becoming pregnant, pregnant women, and older adults.

- Women are encouraged to achieve and maintain a healthy weight before becoming pregnant. This may reduce a woman's risk of complications during pregnancy, increase the chances of a healthy infant birth weight, and improve the long-term health of both mother and infant.
- Pregnant women are encouraged to gain weight within the 2009 Institute of Medicine (IOM) gestational weight gain guidelines.26 Maternal weight gain during pregnancy outside the recommended range is associated with increased risks for maternal and child health.
- Adults ages 65 years and older who are overweight are encouraged to not gain additional weight. Among older adults who are obese, particularly those with cardiovascular disease risk factors, intentional weight loss can be beneficial and result in improved quality of life and reduced risk of chronic diseases and associated disabilities.

Table 2-1. Obesity in America…Then and Now

| obesity then | obesity now |
|---|---|
| In the early 1970s, the prevalence of obesity was 5% for children ages 2 to 5 years, 4% for children ages 6 to 11 years, and 6% for adolescents ages 12 to 19 years. | In 2007–2008, the prevalence of obesity reached 10% for children ages 2 to 5 years, 20% for children ages 6 to 11 years, and 18% for adolescents ages 12 to 19 years. |
| In the late 1970s, 15% of adults were obese. | In 2008, 34% of adults were obese. |
| In the early 1990s, zero States had an adult obesity prevalence rate of more than 25%. | In 2008, 32 States had an adult obesity prevalence rate of more than 25%. |

Sources:
Flegal KM, Carroll MD, Ogden CL, Curtin LR. Prevalence and trends in obesity among U.S. adults, 1999–2008. JAMA. 2010;303(3):235-241.
Ogden CL, Flegal KM, Carroll MD, Johnson CL. Prevalence and trends in overweight among U.S. children and adolescents, 1999–2000. JAMA. 2002;288(4):1728-1732.
Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. Prevalence of high body mass index in U.S. children and adolescents, 2007–2008. JAMA. 2010;303(3):242-249.
Centers for Disease Control and Prevention. U.S. Obesity Trends. Available at: http://www.cdc.gov/obesity/data/trends.html. Accessed August 12, 2010. [Note: State prevalence data based on self-report.]

## Contributing to the Epidemic: An Obesogenic Environment

The overall environment in which many Americans now live, work, learn, and play has contributed to the obesity epidemic. Ultimately, individuals choose the type and amount of food they eat and how physically active they are. However, choices are often limited by what is available in a person's environment, including stores, restaurants, schools, and worksites. Environment affects both sides of the calorie balance equation—it can promote over-consumption of calories and discourage physical activity and calorie expenditure.

The food supply has changed dramatically over the past 40 years. Foods available for consumption increased in all major food categories from 1970 to 2008. Average daily calories available per person in the marketplace increased approximately 600 calories,27 with the greatest increases in the availability of added fats and oils, grains, milk and milk products,28 and caloric sweeteners. Many portion sizes offered for sale also have increased. Research has shown that when larger portion sizes are served, people tend to consume more calories. In addition, strong evidence shows that portion size is associated with body weight, such that being served and consuming smaller portions is associated with weight loss.

Studies examining the relationship between the food environment and BMI have found that communities with a larger number of fast food or quick-service restaurants tend to have higher BMIs. Since the 1970s, the number of fast food restaurants has more than doubled. Further, the proportion of daily calorie intake from foods eaten away from home has increased,29 and evidence shows that children, adolescents, and adults who eat out, particularly at fast food restaurants, are at increased risk of weight gain, overweight, and obesity. The strongest association between fast food consumption and obesity is when one or more fast food meals are consumed per week. As a result of the changing food environment, individuals need to deliberately make food choices, both at home and away from home, that are nutrient dense, low in calories, and appropriate in portion size.

On the other side of the calorie balance equation, many Americans spend most of their waking hours engaged in sedentary behaviors, making it difficult for them to expend enough calories to maintain calorie balance. Many home, school, work, and community environments do not facilitate a physically active lifestyle. For example, the lack of sidewalks or parks and concerns for safety when outdoors can reduce the ability of individuals to be physically active.



Also, over the past several decades, transportation and technological advances have meant that people now expend fewer calories to perform tasks of everyday life. Consequently, many people today need to make a special effort to be physically active during leisure time to meet physical activity needs. Unfortunately, levels of leisure-time physical activity are low. Approximately one-third of American adults report that they participate in leisure-time physical activity on a regular basis, one-third participate in some leisure-time physical activity, and one-third are considered inactive.30 Participation in physical activity also declines with age. For example, in national surveys using physical activity monitors, 42 percent of children ages 6 to 11 years participate in 60 minutes of physical activity each day, whereas only 8 percent of adolescents achieve this goal.31 Less than 5 percent of adults participate in 30 minutes of physical activity each day, with slightly more meeting the recommended weekly goal of at least 150 minutes.

## Current Dietary Intake

The current dietary intake of Americans has contributed to the obesity epidemic. Many children and adults have a usual calorie intake that exceeds their daily needs, and they are not physically active enough to compensate for these intakes. The combination sets them on a track to gain weight. On the basis of national survey data, the average calorie intake among women and men older than age 19 years are estimated to be 1,785 and 2,640 calories per day, respectively. While these estimates do not appear to be excessive, the numbers are difficult to interpret because survey respondents, especially individuals who are overweight or obese, often underreport dietary intake. Well-controlled studies suggest that the actual number of calories consumed may be higher than these estimates.

**Table 2-2. Top 25 Sources of Calories Among Americans Ages 2 Years and Older, NHANES 2005–2006a**

| rank | overall, ages 2+ yrs (Mean kcal/d; total daily calories = 2,157) | children and adolescents, ages 2–18 yrs (Mean kcal/d; total daily calories = 2,027) | adults and older adults, ages 19+ yrs (Mean kcal/d; total daily calories = 2,199) |
|---|---|---|---|
| 1 | Grain-based dessertsb (138 kcal) | Grain-based desserts (138 kcal) | Grain-based desserts (138 kcal) |
| 2 | Yeast breadsc (129 kcal) | Pizza (136 kcal) | Yeast breads (134 kcal) |
| 3 | Chicken and chicken mixed dishesd (121 kcal) | Soda/energy/sports drinks (118 kcal) | Chicken and chicken mixed dishes (123 kcal) |
| 4 | Soda/energy/sports drinkse (114 kcal) | Yeast breads (114 kcal) | Soda/energy/sports drinks (112 kcal) |
| 5 | Pizza (98 kcal) | Chicken and chicken mixed dishes (113 kcal) | Alcoholic beverages (106 kcal) |
| 6 | Alcoholic beverages (82 kcal) | Pasta and pasta dishes (91 kcal) | Pizza (86 kcal) |
| 7 | Pasta and pasta dishesf (81 kcal) | Reduced fat milk (86 kcal) | Tortillas, burritos, tacos (85 kcal) |
| 8 | Tortillas, burritos, tacosg (80 kcal) | Dairy desserts (76 kcal) | Pasta and pasta dishes (78 kcal) |
| 9 | Beef and beef mixed dishesh (64 kcal) | Potato/corn/other chips (70 kcal) | Beef and beef mixed dishes (71 kcal) |
| 10 | Dairy dessertsi (62 kcal) | Ready-to-eat cereals (65 kcal) | Dairy desserts (58 kcal) |

| | | | |
|---|---|---|---|
| 11 | Potato/corn/other chips (56 kcal) | Tortillas, burritos, tacos (63 kcal) | Burgers (53 kcal) |
| 12 | Burgers (53 kcal) | Whole milk (60 kcal) | Regular cheese (51 kcal) |
| 13 | Reduced fat milk (51 kcal) | Candy (56 kcal) | Potato/corn/other chips (51 kcal) |
| 14 | Regular cheese (49 kcal) | Fruit drinks (55 kcal) | Sausage, franks, bacon, and ribs (49 kcal) |
| 15 | Ready-to-eat cereals (49 kcal) | Burgers (55 kcal) | Nuts/seeds and nut/seed mixed dishes (47 kcal) |
| 16 | Sausage, franks, bacon, and ribs (49 kcal) | Fried white potatoes (52 kcal) | Fried white potatoes (46 kcal) |
| 17 | Fried white potatoes (48 kcal) | Sausage, franks, bacon, and ribs (47 kcal) | Ready-to-eat cereals (44 kcal) |
| 18 | Candy (47 kcal) | Regular cheese (43 kcal) | Candy (44 kcal) |
| 19 | Nuts/seeds and nut/seed mixed dishesj (42 kcal) | Beef and beef mixed dishes (43 kcal) | Eggs and egg mixed dishes (42 kcal) |
| 20 | Eggs and egg mixed dishesk (39 kcal) | 100% fruit juice, not orange/grapefruit (35 kcal) | Rice and rice mixed dishes (41 kcal) |
| 21 | Rice and rice mixed dishesl (36 kcal) | Eggs and egg mixed dishes (30 kcal) | Reduced fat milk (39 kcal) |
| 22 | Fruit drinksm (36 kcal) | Pancakes, waffles, and French toast (29 kcal) | Quickbreads (36 kcal) |
| 23 | Whole milk (33 kcal) | Crackers (28 kcal) | Other fish and fish mixed disheso (30 kcal) |
| 24 | Quickbreadsn (32 kcal) | Nuts/seeds and nut/seed mixed dishes (27 kcal) | Fruit drinks (29 kcal) |
| 25 | Cold cuts (27 kcal) | Cold cuts (24 kcal) | Salad dressing (29 kcal) |

a. Data are drawn from analyses of usual dietary intakes conducted by the National Cancer Institute. Foods and beverages consumed were divided into 97 categories and ranked according to calorie contribution to the diet. Table shows each food category and its mean calorie contribution for each age group. Additional information on calorie contribution by age, gender, and race/ethnicity is available at http://riskfactor.cancer.gov/diet/foodsources/.
b. Includes cake, cookies, pie, cobbler, sweet rolls, pastries, and donuts.
c. Includes white bread or rolls, mixed-grain bread, flavored bread, whole-wheat bread, and bagels.
d. Includes fried or baked chicken parts and chicken strips/patties, chicken stir-fries, chicken casseroles, chicken sandwiches, chicken salads, stewed chicken, and other chicken mixed dishes.
e. Sodas, energy drinks, sports drinks, and sweetened bottled water including vitamin water.
f. Includes macaroni and cheese, spaghetti, other pasta with or without sauces, filled pasta (e.g., lasagna and ravioli), and noodles.
g. Also includes nachos, quesadillas, and other Mexican mixed dishes. h. Includes steak, meatloaf, beef with noodles, and beef stew.
i. Includes ice cream, frozen yogurt, sherbet, milk shakes, and pudding. j. Includes peanut butter, peanuts, and mixed nuts.
k. Includes scrambled eggs, omelets, fried eggs, egg breakfast sandwiches/ biscuits, boiled and poached eggs, egg salad, deviled eggs, quiche, and egg substitutes.
l. Includes white rice, Spanish rice, and fried rice.
m. Includes fruit-flavored drinks, fruit juice drinks, and fruit punch. n. Includes muffins, biscuits, and cornbread.
o. Fish other than tuna or shrimp.
Source: National Cancer Institute. Food sources of energy among U.S. population, 2005-2006. Risk Factor Monitoring and Methods. Control and Population Sciences. National Cancer Institute; 2010. http://riskfactor. cancer.gov/diet/foodsources/. Updated May 21, 2010. Accessed May 21, 2010.

Table 2-2 provides the top sources of calories among Americans ages 2 years and older.32 The table reveals some expected differences in intake between younger (ages 2 to 18 years) and adult (ages 19 years and older) Americans. For example, alcoholic beverages are a major calorie source for adults, while fluid milk provides a greater contribution to calorie intake for children and adolescents. Further, while not shown in the table,33 there is additional variability in calorie sources among children, adolescents, and adults of different ages. For example, sugar-sweetened beverages34 and pizza are greater calorie contributors for those ages 9 to 18 years than for younger children. Also, dairy desserts35 and ready-to-eat cereals provide a greater contribution to calorie intake for those ages 71 years and older than they do among younger adults.

Although some of the top calorie sources by category are important sources of essential nutrients, others provide calories with few essential nutrients. Many of the foods and beverages most often consumed within these top categories are in forms high in solid fats and/or added sugars, thereby contributing excess calories to the diet. For example, many grain-based desserts36 are high in added sugars and solid fats, while many chicken dishes37 are both breaded and fried, which adds a substantial number of calories to the chicken.

## Calorie Balance: Food and Beverage Intake

Controlling calorie intake from foods and beverages is fundamental to achieving and attaining calorie balance. Understanding calorie needs, knowing food sources of calories, and recognizing associations between foods and beverages and higher or lower body weight are all important concepts when building an eating pattern that promotes calorie balance and weight management. Many Americans are unaware of how many calories they need each day or the calorie content of foods and beverages.

### understanding calorie needs

The total number of calories a person needs each day varies depending on a number of factors, including the person's age, gender, height, weight, and level of physical activity. In addition, a desire to lose, maintain, or gain weight affects how many calories should be consumed. Table 2-3 provides estimated total calorie needs for weight maintenance based on age, gender, and physical activity level. A more detailed table is provided in Appendix 6. Estimates range from 1,600 to 2,400 calories per day for adult women and 2,000 to 3,000 calories per day for adult men, depending on age and physical activity level. Within each age and gender category, the low end of the range is for sedentary individuals; the high end of the range is for active individuals. Due to reductions in basal metabolic rate that occurs with aging, calorie needs generally decrease for adults as they age. Estimated needs for young children range from 1,000 to 2,000 calories per day, and the range for older children and adolescents varies substantially

from 1,400 to 3,200 calories per day, with boys generally having higher calorie needs than girls. These are only estimates, and estimation of individual calorie needs can be aided with online tools such as those available at MyPyramid.gov.

Knowing one's daily calorie needs may be a useful reference point for determining whether the calories that a person eats and drinks are appropriate in relation to the number of calories needed each day. The best way for people to assess whether they are eating the appropriate number of calories is to monitor body weight and adjust calorie intake and participation in physical activity based on changes in weight over time. A calorie deficit of 500 calories or more per day is a common initial goal for weight loss for adults. However, maintaining a smaller deficit can have a meaningful influence on body weight over time. The effect of a calorie deficit on weight does not depend on how the deficit is produced—by reducing calorie intake, increasing expenditure, or both. Yet, in research studies, a greater proportion of the calorie deficit is often due to decreasing calorie intake with a relatively smaller fraction due to increased physical activity.

### carbohydrate, protein, fat, and alcohol

Carbohydrate, protein, and fat are the main sources of calories in the diet. Most foods and beverages contain combinations of these macronutrients in varying amounts. Alcohol also is a source of calories.

Carbohydrates provide 4 calories per gram and are the primary source of calories for most Americans. Carbohydrates are classified as simple, including sugars, or complex, including starches and fibers. Some sugars are found naturally in foods (such as lactose in milk and fructose in fruit), whereas others are added to foods (such as table sugar added to coffee and high fructose corn syrup in sugar-sweetened beverages). Similarly, fiber can be naturally occurring in foods (such as in beans and whole grains) or added to foods. Most carbohydrate is consumed in the form of starches, which are found in foods such as grains, potatoes, and other starchy vegetables. A common source of starch in the American diet is refined grains. Starches also may be added to foods to thicken or stabilize them. Added sugars and added starches generally provide calories but few essential nutrients. Although most people consume an adequate amount of total carbohydrates, many people consume too much added sugar and refined grain and not enough fiber.



Protein also provides 4 calories per gram. In addition to calories, protein provides amino acids that assist in building and preserving body muscle and tissues. Protein is found in a wide variety of animal and plant foods. Animal-based protein foods include seafood, meat, poultry, eggs, and milk and milk products. Plant sources of protein include beans and peas, nuts, seeds, and soy products. Inadequate protein intake in the United States is rare.

Fats provide more calories per gram than any other calorie source—9 calories per gram. Types of fat include saturated, trans, monounsaturated, and polyunsaturated fatty acids. Some fat is found naturally in foods, and fat is often added to foods during preparation. Similar to protein, inadequate intake of total fat is not a common concern in the United States. Most Americans consume too much saturated and trans fatty acids and not enough unsaturated fatty acids.

Alcohol contributes 7 calories per gram, and the number of calories in an alcoholic beverage varies widely depending on the type of beverage consumed. Alcoholic beverages are a source of calories but provide few nutrients. Alcohol is a top calorie contributor in the diets of many American adults.

**Table 2-3. Estimated Calorie Needs Per Day By Age, Gender, and Physical Activity Level***

Estimated amounts of calories needed to maintain calorie balance for various gender and age groups at three different levels of physical activity. The estimates are rounded to the nearest 200 calories. An individual's calorie needs may be higher or lower than these average estimates.

| | | **Physical activity level*** | | |
|---|---|---|---|---|
| gender | age (years) | sedentary | Moderately active | active |

| | | | | |
|---|---|---|---|---|
| child (female and male) | 2–3 | 1,000–1,200c | 1,000–1,400c | 1,000–1,400c |
| female | 4–8 | 1,200–1,400 | 1,400–1,600 | 1,400–1,800 |
| | 9–13 | 1,400–1,600 | 1,600–2,000 | 1,800–2,200 |
| | 14–18 | 1,800 | 2,000 | 2,400 |
| | 19–30 | 1,800–2,000 | 2,000–2,200 | 2,400 |
| | 31–50 | 1,800 | 2,000 | 2,200 |
| | 51+ | 1,600 | 1,800 | 2,000–2,200 |
| male | 4–8 | 1,200–1,400 | 1,400–1,600 | 1,600–2,000 |
| | 9–13 | 1,600–2,000 | 1,800–2,200 | 2,000–2,600 |
| | 14–18 | 2,000–2,400 | 2,400–2,800 | 2,800–3,200 |
| | 19–30 | 2,400–2,600 | 2,600–2,800 | 3,000 |
| | 31–50 | 2,200–2,400 | 2,400–2,600 | 2,800–3,000 |
| | 51+ | 2,000–2,200 | 2,200–2,400 | 2,400–2,800 |

a. Based on Estimated Energy Requirements (EER) equations, using reference heights (average) and reference weights (healthy) for each age/gender group. For children and adolescents, reference height and weight vary. For adults, the reference man is 5 feet 10 inches tall and weighs 154 pounds. The reference woman is 5 feet 4 inches tall and weighs 126 pounds. EER equations are from the Institute of Medicine. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington (DC): The National Academies Press; 2002.

b. Sedentary means a lifestyle that includes only the light physical activity associated with typical day-to-day life. Moderately active means a lifestyle that includes physical activity equivalent to walking about 1.5 to 3 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life. Active means a lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life.

c. The calorie ranges shown are to accommodate needs of different ages within the group. For children and adolescents, more calories are needed at older ages. For adults, fewer calories are needed at older ages.

d. Estimates for females do not include women who are pregnant or breastfeeding.

## Does macronutrient proportion make a difference for body weight?

The Institute of Medicine has established ranges for the percentage of calories in the diet that should come from carbohydrate, protein, and fat. These Acceptable Macronutrient Distribution Ranges (AMDR) take into account both chronic disease risk reduction and intake of essential nutrients (Table 2-4).

To manage body weight, Americans should consume a diet that has an appropriate total number of calories and that is within the AMDR. Strong evidence shows that there is no optimal proportion of macronutrients that can facilitate weight loss or assist with maintaining weight loss. Although diets with a wide range of macronutrient proportions have been documented to promote weight loss and prevent weight regain after loss, evidence shows that the critical issue is not the relative proportion of macronutrients in the diet, but whether or not the eating pattern is reduced in calories and the individual is able to maintain a reduced-calorie intake over time. The total number of calories consumed is the essential dietary factor relevant to body weight. In adults, moderate evidence suggests that diets that are less than 45 percent of total calories as carbohydrate or more than 35 percent of total calories as protein are generally no more effective than other calorie-controlled diets for long-term weight loss and weight maintenance. Therefore, individuals who wish to lose weight or maintain weight loss can select eating patterns that maintain appropriate calorie intake and have macronutrient proportions that are within the AMDR ranges recommended in the Dietary Reference Intakes.

## Individual Foods and Beverages and Body Weight

For calorie balance, the focus should be on total calorie intake, but intake of some foods and beverages that are widely over- or underconsumed has been associated with effects on body weight. In studies that have held total calorie intake constant, there is little evidence that any individual food groups or beverages have a unique impact on body weight. Although total calorie intake is ultimately what affects calorie balance, some foods and beverages can be easily overconsumed, which results in a higher total calorie intake. As individuals vary a great deal in their dietary intake, the best advice is to monitor dietary intake and replace foods higher in calories with nutrient-dense foods and beverages relatively low in calories. The following guidance may help individuals control their total calorie intake and manage body weight:

- increase intake of whole grains, vegetables, and fruits: Moderate evidence shows that adults who eat more whole grains, particularly those higher in dietary fiber, have a lower body weight compared to adults who eat fewer whole grains. Moderate evidence in adults and limited evidence in children and adolescents suggests that increased intake of vegetables and/or fruits may protect against weight gain.
- reduce intake of sugar-sweetened beverages: This can be accomplished by drinking fewer sugar-sweetened beverages and/or consuming smaller portions. Strong evidence shows that children and adolescents who consume more sugar-sweetened beverages have higher body weight compared to those who drink less, and moderate evidence also supports this relationship in adults. Sugar-sweetened beverages provide excess calories and few essential nutrients to the diet and should only be consumed when nutrient needs have been met and without exceeding daily calorie limits.
- Monitor intake of 100% fruit juice for children and adolescents, especially those who are over- weight or obese: For most children and adolescents, intake of 100% fruit juice is not associated with body weight. However, limited evidence suggests that increased intake of 100% juice has been associated with higher body weight in children and adolescents who are overweight or obese.
- Monitor calorie intake from alcoholic beverages for adults: Moderate evidence suggests that moderate drinking of alcoholic beverages38 is not associated with weight gain. However, heavier than moderate consumption of alcohol over time is associated with weight gain. Because alcohol is often consumed in mixtures with other beverages, the calorie content of accompanying mixers should be considered when calculating the calorie content of alcoholic beverages. Reducing alcohol intake is a strategy that can be used by adults to consume fewer calories.

Strong evidence in adults and moderate evidence in children and adolescents demonstrates that consumption of milk and milk products does not play a special role in weight management. Evidence also suggests that there is no independent relationship between the intake of meat and poultry or beans and peas, including soy, with body weight. Although not independently related to body weight, these foods are important sources of nutrients in healthy eating patterns.

**Table 2-4. Recommended Macronutrient Proportions by Age**

| | carbohydrate | Protein | fat |
|---|---|---|---|
| Young children (1–3 years) | 45–65% | 5–20% | 30–40% |

| | | | |
|---|---|---|---|
| Older children and adolescents (4–18 years) | 45–65% | 10–30% | 25–35% |
| Adults (19 years and older) | 45–65% | 10–35% | 20–35% |

Source: Institute of Medicine. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington (DC): The National Academies Press; 2002.

### Placing individual food choices into an overall eating pattern

Because people consume a variety of foods and beverages throughout the day as meals and snacks, a growing body of research has begun to describe overall eating patterns that help promote calorie balance and weight management. One aspect of these patterns that has been researched is the concept of calorie density, or the amount of calories provided per unit of food weight. Foods high in water and/or dietary fiber typically have fewer calories per gram and are lower in calorie density, while foods higher in fat are generally higher in calorie density. A dietary pattern low in calorie density is characterized by a relatively high intake of vegetables, fruit, and dietary  fiber and a relatively low intake of total fat, saturated fat, and added sugars. Strong evidence shows that eating patterns that are low in calorie density improve weight loss and weight maintenance, and also may be associated with a lower risk of type 2 diabetes in adults. The USDA Food Patterns and the DASH Eating Plan, described in Chapter 5, are examples of eating patterns that are low in calorie density.

Although total calories consumed is important for calorie balance and weight management, it is important to consider the nutrients and other healthful properties of food and beverages, as well as their calories, when selecting an eating pattern for optimal health. When choosing carbohydrates, Americans should emphasize naturally occurring carbohydrates, such as those found in whole grains, beans and peas, vegetables, and fruits, especially those high in dietary fiber, while limiting refined grains and intake of foods with added sugars. Glycemic index and glycemic load have been developed as measures of the effects of carbohydrate-containing foods and beverages on blood sugar levels. Strong evidence shows that glycemic index and/or glycemic load are not associated with body weight; thus, it is not necessary to consider these measures when selecting carbohydrate foods and beverages for weight management. For protein, plant-based sources and/or animal-based sources can be incorporated into a healthy eating pattern. However, some protein products, particularly some animal-based sources, are high in saturated fat, so non-fat, low-fat, or lean choices should be selected. Fat intake should emphasize monounsaturated and polyunsaturated fats, such as those found in seafood, nuts, seeds, and oils.

Americans should move toward more healthful eating patterns. Overall, as long as foods and beverages consumed meet nutrient needs and calorie intake is appropriate, individuals can select an eating pattern that they enjoy and can maintain over time. Individuals should consider the calories from all foods and beverages they consume, regardless of when and where they eat or drink.

## Calorie Balance: Physical Activity

Physical activity is the other side of the calorie balance equation and should be considered when addressing weight management. In 2008, the U.S. Department of Health and Human Services released a comprehensive set of physical activity recommendations for Americans ages 6 years and older. Weight management along with health outcomes, including premature (early) death, diseases (such as coronary heart disease, type 2 diabetes, and osteoporosis), and risk factors for disease (such as high blood pressure and high blood cholesterol) were among the outcomes considered in developing the 2008 Physical Activity Guidelines for Americans.39 Getting adequate amounts of physical activity conveys many health benefits independent of body weight.

Strong evidence supports that regular participation in physical activity also helps people maintain a healthy weight and prevent excess weight gain. Further, physical activity, particularly when combined with reduced calorie intake, may aid weight loss and

maintenance of weight loss. Decreasing time spent in sedentary behaviors also is important as well. Strong evidence shows that more screen time, particularly television viewing, is associated with overweight and obesity in children, adolescents, and adults. Substituting active pursuits for sedentary time can help people manage their weight and provides other health benefits.

The 2008 Physical Activity Guidelines for Americans provides guidance to help Americans improve their health, including weight management, through appropriate physical activity (see Table 2-5). The amount of physical activity necessary to successfully maintain a healthy body weight depends on calorie intake and varies considerably among adults, including older adults. To achieve and maintain a healthy body weight, adults should do the equivalent40 of 150 minutes of moderate-intensity aerobic activity each week. If necessary, adults should increase their weekly minutes of aerobic physical activity gradually over time and decrease calorie intake to a point where they can achieve calorie balance and a healthy weight. Some adults will need a higher level of physical activity than others to achieve and maintain a healthy body weight. Some may need more than the equivalent of 300 minutes per week of moderate-intensity activity.

For children and adolescents ages 6 years and older, 60 minutes or more of physical activity per day is recommended. Although the Physical Activity Guidelines do not include a specific quantitative recommendation for children ages 2 to 5 years, young children should play actively several times each day. Children and adolescents are often active in short bursts of time rather than for sustained periods of time, and these short bursts can add up to meet physical activity needs. Physical activities for children and adolescents of all ages should be developmentally appropriate and enjoyable, and should offer variety.

## Principles For Promoting Calorie Balance and Weight Management

To address the current calorie imbalance in the United States, individuals are encouraged to become more conscious of what they eat and what they do. This means increasing awareness of what, when, why, and how much they eat, deliberately making better choices regarding what and how much they consume, and seeking ways to be more physically active. Several behaviors and practices have been shown to help people manage their food and beverage intake and calorie expenditure and ultimately manage body weight. The behaviors with the strongest evidence related to body weight include:

- focus on the total number of calories consumed. Maintaining a healthy eating pattern at an appropriate calorie level within the AMDR is advisable for weight management. Consuming an eating pattern low in calorie density may help to reduce calorie intake and improve body weight outcomes and overall health.
- Monitor food intake. Monitoring intake has been shown to help individuals become more aware of what and how much they eat and drink. The Nutrition Facts label found on food packaging provides calorie information for each serving of food or beverage and can assist consumers in monitoring their intake. Also, monitoring body weight and physical activity can help prevent weight gain and improve outcomes when actively losing weight or maintaining body weight following weight loss.
- when eating out, choose smaller portions or lower-calorie options. When possible, order a small-sized option, share a meal, or take home part of the meal. Review the calorie content of foods and beverages offered and choose lower-calorie options. Calorie information may be available on menus, in a pamphlet, on food wrappers, or online. Or, instead of eating out, cook and eat more meals at home.
- Prepare, serve, and consume smaller portions of foods and beverages, especially those high in calories. Individuals eat and drink more when provided larger portions. Serving and consuming smaller portions is associated with weight loss and weight maintenance over time.
- eat a nutrient-dense breakfast. Not eating breakfast has been associated with excess body weight, especially among children and adolescents. Consuming breakfast also has been associated with weight loss and weight loss maintenance, as well as improved nutrient intake.
- limit screen time. In children, adolescents, and adults, screen time, especially television viewing, is directly associated with increased overweight and obesity. Children and adolescents are encouraged to spend no more than 1 to 2 hours each day watching television, playing electronic games, or using the computer (other than for homework). Also, avoid eating while watching television, which can result in overeating.

Research has investigated additional principles that may promote calorie balance and weight management. However, the evidence for these behaviors is not as strong. Some evidence indicates that beverages are less filling than solid foods, such that the calories from beverages may not be offset by reduced intake of solid foods, which can lead to higher total calorie intake. In contrast, soup, particularly broth or water-based soups, may lead to decreased calorie intake and body weight over time. Further, replacing added sugars with non-caloric sweeteners may reduce calorie intake in the short-term, yet questions remain about their effectiveness as a weight management strategy. Other behaviors have been studied, such as snacking and frequency of eating, but there is currently not enough evidence to support a specific recommendation for these behaviors to help manage body weight.

**Table 2-5. 2008 Physical Activity Guidelines**

| age group | guidelines | | |
|---|---|---|---|
| 6 to 17 years | Children and adolescents should do 60 minutes (1 hour) or more of physical activity daily.<br>• 18 to 64 years | • 65 years and older | • a. Moderate-intensity physical activity: Aerobic activity that increases a person's heart rate and breathing to some extent. On a scale relative to a person's capacity, moderate-intensity activity is usually a 5 or 6 on a 0 to 10 scale. Brisk walking, dancing, swimming, or bicycling on a level terrain are examples.<br>b. Vigorous-intensity physical activity: Aerobic activity that greatly increases a person's heart rate and breathing. On a scale relative to a person's capacity, vigorous-intensity activity is usually a 7 or 8 on a 0 to 10 scale. Jogging, singles tennis, swimming continuous laps, or bicycling uphill<br>are examples.<br>c. Muscle-strengthening activity: Physical activity, including exercise, that increases skeletal muscle strength, power, endurance, and mass. It includes strength training, resistance training, and muscular strength and endurance exercises.<br>d. Bone-strengthening activity: Physical activity that produces an impact or tension force on bones, which promotes bone growth and strength. Running, jumping rope, and lifting weights are examples. |

## Improving Public Health Through Diet and Physical Activity

This chapter has focused on the two main elements in calorie balance—calories consumed and calories expended. These elements are critical for achieving and maintaining an appropriate body weight throughout the lifespan, and they also have broader implications for the health of Americans.

Although obesity is related to many chronic health conditions, it is not the only lifestyle-related public health problem confronting the Nation. Eating patterns that are high in calories, but low in nutrients can leave a person overweight but malnourished. Nutritionally unbalanced diets can negatively affect a person's health regardless of weight status. Such diets are related to many of the most common and costly health problems in the United States, particularly heart disease and its risk factors and type 2 diabetes. Similarly, a sedentary lifestyle increases risk of these diseases. Improved eating patterns and increased physical activity have numerous health benefits beyond maintaining a healthy weight.

Improved nutrition, appropriate eating behaviors, and increased physical activity have tremendous potential to decrease the prevalence of overweight and obesity, enhance the public's health, reduce morbidity and premature mortality, and reduce health care costs.

## References:


26. Institute of Medicine (IOM) and National Research Council (NRC). Weight gain during pregnancy: reexamining the guidelines. Washington (DC): The National Academies Press; 2009.

27. Adjusted for spoilage and other waste. ERS Food Availability (Per Capita) Data System. http://www.ers.usda.gov/Data/FoodConsumption/. Accessed August 12, 2010.

28. Milk and milk products also can be referred to as dairy products.

29. Stewart H, Blisard N, Jolliffe D. Let's eat out: Americans weigh taste, convenience, and nutrition. U.S. Department of Agriculture, Economic Research Service; 2006. Economic Information Bulletin No. 19. http://www.ers.usda.gov/publications/eib19/eib19.pdf.

30. Pleis JR, Lucas JW, Ward BW. Summary health statistics for U.S. adults: National Health Interview Survey, 2008. Vital Health Stat. 2009;10(242):1-157.

31. Troiano RP, Berrigan D, Dodd KW, Mâsse LC, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. Med Sci Sports Exerc. 2008;40(1):181–188.

32. Data are drawn from analyses of usual dietary intakes conducted by the National Cancer Institute. Source: National Cancer Institute. Food sources of energy among U.S. population, 2005-2006. Risk Factor Monitoring and Methods. Cancer Control and Population Sciences. 2010. http://riskfactor.cancer. gov/diet/foodsources/. Updated May 21, 2010. Accessed May 21, 2010.

33. Additional information on the top calorie contributors for various age groups, as well as by gender and race/ethnicity, are available at http://riskfactor. cancer.gov/diet/foodsources/.

34. Sodas, energy drinks, sports drinks, and sweetened bottled water including vitamin water.

35. Includes ice cream, frozen yogurt, sherbet, milk shakes, and pudding.

36. Includes cake, cookies, pie, cobbler, sweet rolls, pastries, and donuts.

37. Includes fried or baked chicken parts and chicken strips/patties, chicken stir-fries, chicken casseroles, chicken sandwiches, chicken salads, stewed chicken, and other chicken mixed dishes.

38. Moderate alcohol consumption is the consumption of up to one drink per day for women and up to two drinks per day for men.

39. U.S. Department of Health and Human Services. 2008 Physical Activity Guidelines for Americans. Washington (DC): U.S. Department of Health and Human Services; 2008. Office of Disease Prevention and Health Promotion Publication No. U0036. http://www.health.gov/paguidelines. Accessed August 12, 2010.

40. One minute of vigorous-intensity physical activity counts as two minutes of moderate-intensity physical activity toward meeting the recommendations


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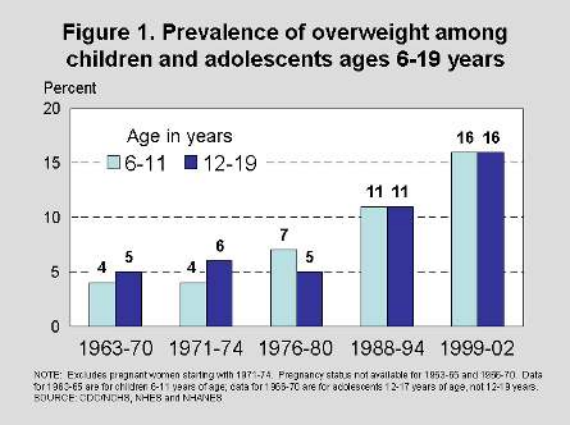
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# 20.11: Dietary Guidelines- Young and Middle Adulthood

Avoiding obesity aids in preventative nutrition immensely. Figure 1 from the CDC's report on American teens shows that just over ten years ago the obesity rate for adolescents 6-19 years of age was 16%. That number today is larger, over 20%. As more and more youth ages into adulthood already overweight and unhealthy, nutrition guidelines for adults become increasingly important.




The USDA separates their dietary recommendations between men and women in adulthood. The fact is, men and women have similar yet diverging needs as they age. When you're young, you tend to not need to examine your eating habits nearly as rigorously as when you are older. Men and women share equally in this progression. To prevent conditions like cancer or diabetes later in life, critical thinking applied to your diet during young adulthood is crucial.

Below are the USDA dietary guidelines provided for adult men and women.

## Guidelines for Women

- Use a smaller plate at meals to help control the amount of food and calories you eat. Take time to enjoy smaller amounts of food.
- Choose foods like fat-free and low-fat milk, cheese, yogurt, and fortified soymilk to help strengthen bones. Be sure your morning coffee includes fat-free or low-fat milk.
- Add fruit to meals as part of main or side dishes. Choose red, orange, or dark-green vegetables like tomatoes, sweet potatoes, and broccoli, along with other vegetables for meals.
- Sip water or other drinks with few or no calories to help maintain a healthy weight. Keep a water bottle in your bag or at your desk to satisfy your thirst throughout the day.
- Eat whole grains more often. Choose whole grains like brown rice and whole-grain pastas and breads more often. Foods with a high-fiber content can help give you a feeling of fullness and also provide key nutrients.
- Cut calories by cutting out foods high in solid fats and added sugar. Limit fatty meats like ribs, bacon, and hot dogs. Choose cakes, cookies, candies, and ice cream as just occasional treats.
- Try out healthier recipes that use less solid fat, salt, and sugar. Eat at home more often so you can control what you are eating. If you eat out, check and compare nutrition information. Choose healthier options such as baked chicken instead of fried chicken.
- Set a goal to fit in at least 2½ hours of moderate physical activity in your week. Being active 10 minutes at a time also adds to your weekly total. Ask your friends or family to keep you company as you bike, jog, walk, or dance. Don't forget to do some muscle strengthening activities twice a week.

## Guidelines for Men

- There's no magic food or way to eat. There are some foods men need to eat such as vegetables; fruits; whole grains; protein foods like beans, eggs, or lean meats; and dairy like 1% milk. You'll get nutrients you need for good health—including magnesium, potassium, calcium, vitamin D, fiber, and protein.
- Keep healthy foods in your kitchen that need little preparation. Keep your fridge filled with carrots, apples, oranges, low-fat yogurt, and eggs. Stock up on fresh, canned, or frozen vegetables and fruits, lean meats, canned beans, and tuna or salmon. Find healthier heat-andeat options to replace heating up a frozen pizza.
- Make sure half your grains are whole grains. Whole grains can help give a feeling of fullness and key nutrients. Choose whole-wheat breads, pasta, and crackers; brown rice; and oatmeal instead of white bread, rice, or other refined-grain products.

- Cut calories by skipping foods high in solid fats and added sugar. Limit fatty meats like ribs, bacon, and hot dogs. Cakes, cookies, candies, and ice cream should be just occasional treats. Use smaller plates to adjust the amount of food you eat.
- Water is your friend. Water is a better choice than many routine drink choices. Beverages can add about 400 calories a day to men's diets. So limit high-calorie beverages, including those with alcohol. Skip soda, fruit drinks, energy drinks, sports drinks, and other sugary drinks.
- Start cooking more often. Try steaming vegetables, roasting a chicken, and making a tasty veggie sauce for spaghetti from scratch. Eating your own home-cooked meals allows you to control what and how much you eat.
- Use both Nutrition Facts and ingredient labels to discover what nutrients foods and beverages contain. Cut back on foods that have sugar or fat as the first ingredient.
- Be active whenever you can. Have friends or family join you when you go for a long walk, bike, or jog. Vary activities to stay motivated. Set a goal of 2½ hours or more of moderate physical activity a week. Include strengthening your arms, legs, and core muscles at least 2 days a week. Being active just 10 minutes at a time makes a difference.



Healthy eating in middle age does not have to mean eliminating all tasty foods.

As the guidelines state, there is not a magic solution to an unhealthy lifestyle. Only you can choose to make good choices in the way you eat. Later in life the choices you make become increasingly important as a method of eliminating the negative health effects of a bad diet. A good rule of thumb to follow is to significantly cut down on saturated fat combined with sugar as you get older. It may seem hard, and habits built in youth are hard to break, but think about all the healthy foods you know are delicious!

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# 20.12: Dietary Guidelines- Foods and Food Components to Reduce

The Dietary Guidelines for Americans provides science-based advice to promote health and reduce the risk of major chronic diseases through diet and physical activity. Currently, very few Americans consume diets that meet Dietary Guideline recommendations. This chapter focuses on certain foods and food components that are consumed in excessive amounts and may increase the risk of certain chronic diseases. These include sodium, solid fats (major sources of saturated and trans fatty acids), added sugars, and refined grains. These food components are consumed in excess by children, adolescents, adults, and older adults. In addition, the diets of most men exceed the recommendation for cholesterol. Some people also consume too much alcohol.

This excessive intake replaces nutrient-dense forms of foods in the diet, making it difficult for people to achieve recommended nutrient intake and control calorie intake. Many Americans are overweight or obese, and are at higher risk of chronic diseases, such as cardiovascular disease, diabetes, and certain types of cancer. Even in the absence of overweight or obesity, consuming too much sodium, solid fats, saturated and trans fatty acids, cholesterol, added sugars, and alcohol increases the risk of some of the most common chronic diseases in the United States. Discussing solid fats in addition to saturated and trans fatty acids is important because, apart from the effects of saturated and trans fatty acids on cardiovascular disease risk, solid fats are abundant in the diets of Americans and contribute significantly to excess calorie intake. The recommendations in this chapter are based on evidence that eating less of these foods and food components can help Americans meet their nutritional needs within appropriate calorie levels, as well as help reduce chronic disease risk.

### Key Recommendations

- Reduce daily sodium intake to less than 2,300 milligrams (mg) and further reduce intake to 1,500 mg among persons who are 51 and older and those of any age who are African American or have hypertension, diabetes, or chronic kidney disease. The 1,500 mg recommendation applies to about half of the U.S. population, including children, and the majority of adults.
- Consume less than 10 percent of calories from saturated fatty acids by replacing them with monounsaturated and polyunsaturated fatty acids.
- Consume less than 300 mg per day of dietary cholesterol.
- Keep trans fatty acid consumption as low as possible, especially by limiting foods that contain synthetic sources of trans fats, such as partially hydrogenated oils, and by limiting other solid fats.
- Reduce the intake of calories from solid fats and added sugars.
- Limit the consumption of foods that contain refined grains, especially refined grain foods that contain solid fats, added sugars, and sodium.
- If alcohol is consumed, it should be consumed in moderation—up to one drink per day for women and two drinks per day for men—and only by adults of legal drinking age.

## Supporting the Recommendations

The following sections expand on the recommendations and review the evidence supporting the health risks associated with greater intake of foods that are high in sodium, solid fats, added sugars, and refined grains, and excessive alcohol consumption. An important underlying principle is the need to control calorie intake to manage body weight and limit the intake of food components that increase the risk of certain chronic diseases. This goal can be achieved by consuming fewer foods that are high in sodium, solid fats, added sugars, and refined grains and, for those who drink, consuming alcohol in moderation.

**How is an alcoholic drink defined?** One drink is defined as 12 fluid ounces of regular beer (5% alcohol), 5 fluid ounces of wine (12% alcohol), or 1.5 fluid ounces of 80 proof (40% alcohol) distilled spirits. One drink contains 0.6 fluid ounces of alcohol.

### sodium

Sodium is an essential nutrient and is needed by the body in relatively small quantities, provided that substantial sweating does not occur. On average, the higher an individual's sodium intake, the higher the individual's blood pressure. A strong body of evidence in adults documents that as sodium intake decreases, so does blood pressure. Moderate evidence in children also has documented that as sodium intake decreases, so does blood pressure. Keeping blood pressure in the normal range reduces an individual's risk of cardiovascular disease, congestive heart failure, and kidney disease. Therefore, adults and children should limit their intake of sodium.

Virtually all Americans consume more sodium than they need. The estimated average intake of sodium for all Americans ages 2 years and older is approximately 3,400 mg per day (Figure 3-1).

Sodium is primarily consumed as salt (sodium chloride). As a food ingredient, salt has multiple uses, such as in curing meat, baking, masking off- flavors, retaining moisture, and enhancing flavor (including the flavor of other ingredients). Salt added at the table and in cooking provides only a small proportion of the total sodium that Americans consume. Most sodium comes from salt added during food processing. Many types of processed foods contribute to the high intake of sodium (Figure 3-2).

Some sodium-containing foods are high in sodium, but the problem of excess sodium intake also is due to frequent consumption of foods that contain lower amounts of sodium, such as yeast breads41 (which contribute 7% of the sodium in the U.S. diet). Other sources of sodium include chicken and chicken mixed dishes42 (7% of sodium intake), pizza (6%), and pasta and pasta dishes43 (5%). Some of the sources discussed here and in the following sections contain larger varieties of foods than others (e.g., chicken and chicken mixed dishes). Therefore, some of these sources include foods that can be purchased or prepared to be lower in sodium, as well as lower in other food components recommended to be reduced. For example, chicken naturally contains little sodium. Chicken and chicken mixed dishes can be prepared by purchasing chicken that has not had sodium added to it and by not adding salt or ingredients containing sodium.

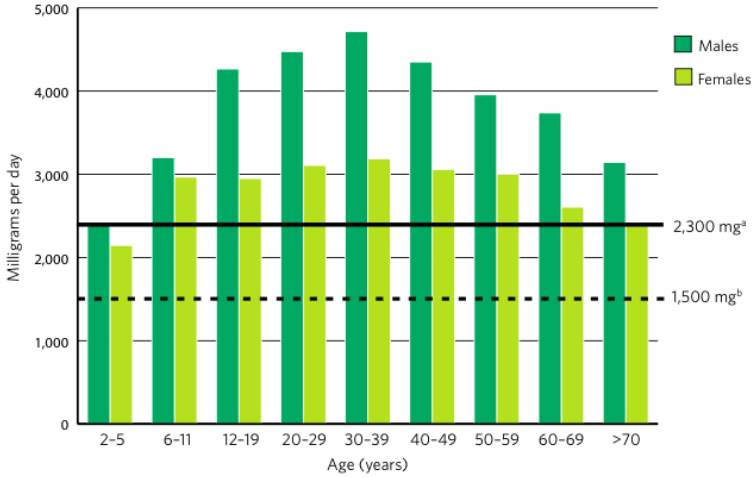



figure 3-1. estimated Mean daily sodium intake, by age–gender group, NHANES 2005–2006

a. 2,300 mg/day is the Tolerable Upper Intake Level (UL) for sodium intake in adults set by the Institute of Medicine (IOM). For children younger than age 14 years, the UL is less than 2,300 mg/day.

b. 1,500 mg/day is the Adequate Intake (AI) for individuals ages 9 years and older.

Source: U.S. Department of Agriculture, Agricultural Research Service and U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. What We Eat In America, NHANES 2005–2006. http://www.ars.usda.gov/Services/docs.htm?docid=13793. Accessed August 11, 2010.

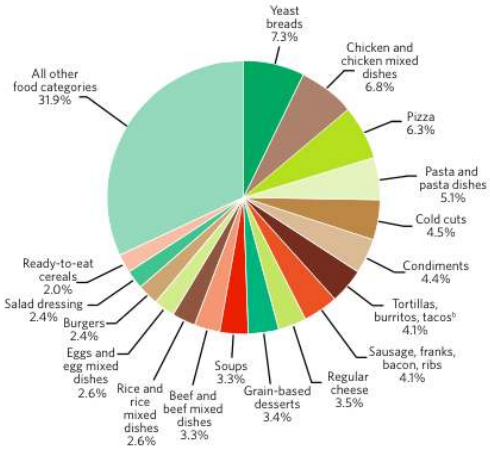



figure 3-2. sources of sodium in the diets of the u.s. Population ages 2 years and older, NHANES 2005–2006

a. Data are drawn from analyses of usual dietary intake conducted by the National Cancer Institute. Foods and beverages consumed were divided into 97 categories and ranked according to sodium contribution to the diet. “All other food categories” represents food categories that each contributes less than 2% of the total intake of sodium from foods.

b. Also includes nachos, quesadillas, and other Mexican mixed dishes.

Source: National Cancer Institute. Sources of Sodium in the Diets of the U.S. Population Ages 2 Years and Older, NHANES 2005–2006. Risk Factor Monitoring and Methods, Cancer Control and Population Sciences. http://riskfactor.cancer.gov/diet/fo...m/table1a.html. Accessed August 11, 2010.

Americans can reduce their consumption of sodium in a variety of ways:

- Read the Nutrition Facts label for information on the sodium content of foods and purchase foods that are low in sodium.
- Consume more fresh foods and fewer processed foods that are high in sodium.
- Eat more home-prepared foods, where you have more control over sodium, and use little or no salt or salt-containing seasonings when cooking or eating foods.
- When eating at restaurants, ask that salt not be added to your food or order lower sodium options, if available.

Sodium is found in a wide variety of foods, and calorie intake is associated with sodium intake (i.e., the more foods and beverages people consume, the more sodium they tend to consume). Therefore, reducing calorie intake can help reduce sodium intake, thereby contributing to the health benefits that occur with lowering sodium intake.

Because a Recommended Dietary Allowance for sodium could not be determined, the Institute of Medicine (IOM)44 set Adequate Intake (AI) levels for this nutrient. The AI is the recommended daily average intake level of a nutrient, and usual intakes at or above the AI have a low probability of inadequacy. The sodium AI is based on the amount that is needed to meet the sodium needs of healthy and moderately active individuals.45 It covers sodium sweat losses in unacclimatized individuals who are exposed to high temperatures or who become physically active, and ensures that recommended intake levels for other nutrients can be met. The sodium AI for individuals ages 9 to 50 years is 1,500 mg per day. Lower sodium AIs were established for children and older adults (ages 1 to 3 years: 1,000 mg/day; ages 4 to 8 years: 1,200 mg/day; ages 51 to 70 years: 1,300 mg/ day; ages 71 years and older: 1,200 mg/day) because their calorie requirements are lower.



For adolescents and adults of all ages (14 years and older), the IOM set the Tolerable Upper Intake Level (UL) at 2,300 mg per day. The UL is the highest daily nutrient intake level that is likely to pose no risk of adverse health effects (e.g., for sodium, increased blood pressure) to almost all individuals in the general population. The IOM recognized that the association between sodium intake and blood pressure was continuous and without a threshold (i.e., a level below which the association no longer exists). The UL was based on several trials, including data from the Dietary Approaches to Stop Hypertension (DASH)-Sodium trial. The IOM noted that in the DASH-Sodium trial, blood pressure was lowered when target sodium intake was reduced to 2,300 mg per day, and lowered even further when sodium was targeted to the level of 1,200 mg per day.46 An intake level of 2,300 mg per day was commonly the next level above the AI of 1,500 mg per day that was tested in the sodium trials evaluated by the IOM.

The DASH studies demonstrated that the total eating pattern, including sodium and a number of other nutrients and foods, affects blood pressure. In the original DASH trial, the DASH diet47 resulted in a significant reduction in blood pressure compared to the control diet, which was typical of what many Americans consume. In the DASH-Sodium trial, blood pressure levels declined with reduced sodium intake for those who consumed either the DASH or control diet. However, blood pressure declined most for those who both consumed the DASH diet and reduced their sodium intake.

Americans should reduce their sodium intake to less than 2,300 mg or 1,500 mg per day depending on age and other individual characteristics. African Americans, individuals with hypertension, diabetes, or chronic kidney disease and individuals ages 51 and older, comprise about half of the U.S. population ages 2 and older. While nearly everyone benefits from reducing their sodium

intake, the blood pressure of these individuals tends to be even more responsive to the blood pressure-raising effects of sodium than others; therefore, they should reduce their intake to 1,500 mg per day. Additional dietary modifications may be needed for people of all ages with hypertension, diabetes, or chronic kidney disease, and they are advised to consult a health care professional. Given the current U.S. marketplace and the resulting excessive high sodium intake, it is challenging to meet even the less than 2,300 mg recommendation—fewer than 15 percent of Americans do so currently. An immediate, deliberate reduction in the sodium content of foods in the marketplace is necessary to allow consumers to reduce sodium intake to less than 2,300 mg or 1,500 mg per day now.

## fats

Dietary fats are found in both plant and animal foods. Fats supply calories and essential fatty acids, and help in the absorption of the fat-soluble vitamins A, D, E, and K. The IOM established acceptable ranges for total fat intake for children and adults (children ages 1 to 3 years: 30–40% of calories; children and adolescents ages 4 to 18 years: 25–35%; adults ages 19 years and older: 20–35%) (see Table 2-4). These ranges are associated with reduced risk of chronic diseases, such as cardiovascular disease, while providing for adequate intake of essential nutrients. Total fat intake should fall within these ranges.

Fatty acids are categorized as being saturated, monounsaturated, or polyunsaturated. Fats contain a mixture of these different kinds of fatty acids. Trans fatty acids are unsaturated fatty acids. However, they are structurally different from the predominant unsaturated fatty acids that occur naturally in plant foods and have dissimilar health effects.

The types of fatty acids consumed are more important in influencing the risk of cardiovascular disease than is the total amount of fat in the diet. Animal fats tend to have a higher proportion of saturated fatty acids (seafood being the major exception), and plant foods tend to have a higher proportion of monounsaturated and/or polyunsaturated fatty acids (coconut oil, palm kernel oil, and palm oil being the exceptions) (Figure 3-3).

Most fats with a high percentage of saturated or trans fatty acids are solid at room temperature and are referred to as “solid fats,” while those with more unsaturated fatty acids are usually liquid at room temperature and are referred to as “oils.” Solid fats are found in most animal foods but also can be made from vegetable oils through the process of hydrogenation, as described below.

Despite longstanding recommendations on total fat, saturated fatty acids, and cholesterol, intakes of these fats have changed little from 1990 through 2005– 2006, the latest time period for which estimates are available. Total fat intake contributes an average of 34 percent of calories. The following sections provide details on types of fat to limit in the diet.

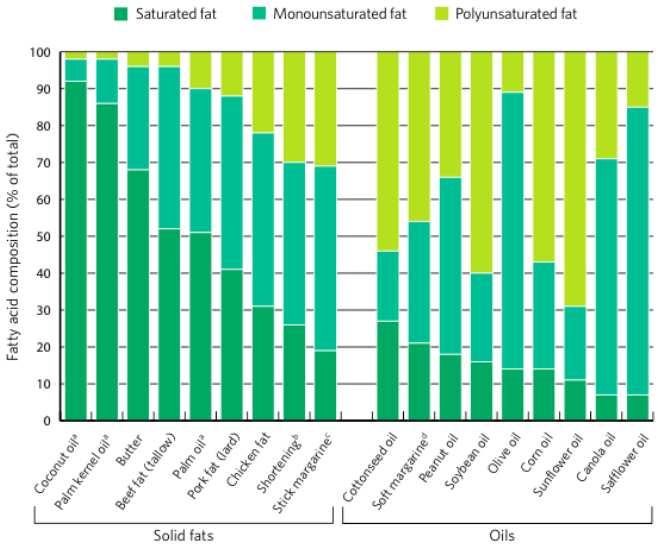



figure 3-3. fatty acid Profiles of common fats and oils

a. Coconut oil, palm kernel oil, and palm oil are called oils because they come from plants. However, they are semi-solid at room temperature due to their high content of short-chain saturated fatty acids. They are considered solid fats for nutritional purposes.

b. Partially hydrogenated vegetable oil shortening, which contains trans fats. c. Most stick margarines contain partially hydrogenated vegetable oil, a source of trans fats.

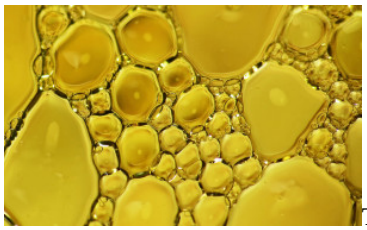
d. The primary ingredient in soft margarine with no trans fats is liquid vegetable oil.

Source: U.S. Department of Agriculture, Agricultural Research Service, Nutrient Data Laboratory. USDA National Nutrient Database for Standard Reference, Release 22, 2009. Available at http://www.ars.usda.gov/ba/ bhnrc/ndl. Accessed July 19, 2010.

## Saturated fatty acids

The body uses some saturated fatty acids for physiological and structural functions, but it makes more than enough to meet those needs. People therefore have no dietary requirement for saturated fatty acids. A strong body of evidence indicates that higher intake of most dietary saturated fatty acids is associated with higher levels of blood total cholesterol and low-density lipoprotein (LDL) cholesterol. Higher total and LDL cholesterol levels are risk factors for cardiovascular disease.

Consuming less than 10 percent of calories from saturated fatty acids and replacing them with monounsaturated and/or polyunsaturated fatty acids is associated with low blood cholesterol levels, and therefore a lower risk of cardiovascular disease. Lowering the percentage of calories from dietary saturated fatty acids even more, to 7 percent of calories, can further reduce the risk of cardiovascular disease. Saturated fatty acids contribute an average of 11 percent of calories to the diet, which is higher than recommended. Major sources of saturated fatty acids in the American diet include regular (full-fat) cheese (9% of total saturated fat intake); pizza (6%); grain-based desserts48 (6%); dairy-based desserts49 (6%); chicken and chicken mixed dishes (6%); and sausage, franks, bacon, and ribs (5%) (Figure 3-4).

 To reduce the intake of saturated fatty acids, many Americans should limit their consumption of the major sources that are high in saturated fatty acids and replace them with foods that are rich in mono-unsaturated and polyunsaturated fatty acids. For example, when preparing foods at home, solid fats (e.g., butter and lard) can be replaced with vegetable oils that are rich in monounsaturated and polyunsaturated fatty acids (Figure 3-3). In addition, many of the major food sources of saturated fatty acids can be purchased or prepared in ways that help reduce the consumption of saturated fatty acids (e.g., purchasing fat-free or low-fat milk, trimming fat from meat). Oils that are rich in monounsaturated fatty acids include canola, olive, and safflower oils. Oils that are good sources of polyunsaturated fatty acids include soybean, corn, and cottonseed oils.

## Trans fatty acids

Trans fatty acids are found naturally in some foods and are formed during food processing; they are not essential in the diet. A number of studies have observed an association between increased trans fatty acid intake and increased risk of cardiovascular disease. This increased risk is due, in part, to its LDL cholesterol-raising effect. Therefore, Americans should keep their intake of trans fatty acids as low as possible.

Some trans fatty acids that Americans consume are produced by a process referred to as hydrogenation. Hydrogenation is used by food manufacturers to make products containing unsaturated fatty acids solid at room temperature (i.e., more saturated)
and therefore more resistant to becoming spoiled or rancid. Partial hydrogenation means that some, but not all, unsaturated fatty acids are converted to saturated fatty acids; some of the unsaturated fatty acids are changed from a cis to trans configuration. Trans fatty acids produced this way are referred to as “synthetic” or “industrial” trans fatty acids. Synthetic trans fatty acids are found in the partially hydrogenated oils used in some margarines, snack foods, and prepared desserts as a replacement for saturated fatty acids. Trans fatty acids also are produced by grazing animals, and small quantities are therefore found in meat and milk products.50 These are called “natural” or “ruminant” trans fatty acids. There is limited evidence to conclude whether synthetic and natural trans fatty acids differ in their metabolic effects and health outcomes. Overall, synthetic trans fatty acid levels in the U.S. food supply have decreased dramatically since 2006 when the declaration of the amount of trans fatty acids on the Nutrition Facts label became mandatory. Consuming fat-free or low-fat milk and milk products and lean meats and poultry will reduce the intake of natural trans fatty acids. Because natural trans fatty acids are present in meat, milk, and milk products,50 their elimination is not recommended because this could have potential implications for nutrient adequacy.

## Cholesterol

The body uses cholesterol for physiological and structural functions, but it makes more than enough for these purposes. Therefore, people do not need to eat sources of dietary cholesterol. Cholesterol is found only in animal foods. The major sources of cholesterol

in the American diet include eggs and egg mixed dishes (25% of total cholesterol intake),51 chicken and chicken mixed dishes (12%), beef and beef mixed dishes (6%), and all types of beef burgers (5%).52 Cholesterol intake can be reduced by limiting the consumption of the specific foods that are high in cholesterol. Many of these major sources include foods that can be purchased or prepared in ways that limit the intake of cholesterol (e.g., using egg substitutes). Cholesterol intake by men averages about 350 mg per day, which exceeds the recommended level of less than 300 mg per day. Average cholesterol intake by women is 240 mg per day.

Dietary cholesterol has been shown to raise blood LDL cholesterol levels in some individuals. However, this effect is reduced when saturated fatty acid intake is low, and the potential negative effects of dietary cholesterol are relatively small compared to those of saturated and trans fatty acids. Moderate evidence shows a relationship between higher intake of cholesterol and higher risk of cardiovascular disease. Independent of other dietary factors, evidence suggests that one egg (i.e., egg yolk) per day does not result in increased blood cholesterol levels, nor does it increase the risk of cardiovascular disease in healthy people. Consuming less than 300 mg per day of cholesterol can help maintain normal blood cholesterol levels. Consuming less than 200 mg per day can further help individuals at high risk of cardiovascular disease.



figure 3-4. sources of saturated fat in the diets of the u.s. Population ages 2 years and older, NHANES 2005–2006

a. Data are drawn from analyses of usual dietary intake conducted by the National Cancer Institute. Foods and beverages consumed were divided into 97 categories and ranked according to the saturated fat contribution to the diet. “All other food categories” represents food categories that each contributes less than 2% of the total saturated fat intake.

b. Also includes nachos, quesadillas, and other Mexican mixed dishes.

Source: National Cancer Institute. Sources of saturated fat in the diets of the U.S. population ages 2 years and older, NHANES 2005–2006. Risk Factor Monitoring and Methods. Cancer Control and Population Sciences. http://riskfactor.cancer.gov/diet/fo...at_fat/sf.html. Accessed August 11, 2010.

## calories from solid fats and added sugars

### Solid fats

As noted previously, fats contain a mixture of different fatty acids, and much research has been conducted on the association between the intake
of saturated and trans fatty acids and the risk of chronic disease, especially cardiovascular disease. Most fats with a high percentage of saturated and/ or trans fatty acids are solid at room temperature and are referred to as “solid fats” (Figure 3-3). Common solid fats include butter, beef fat (tallow, suet), chicken fat, pork fat (lard), stick margarine, and shortening. The fat in fluid milk also is considered to be solid fat; milk fat (butter) is solid at room temperature but is suspended in fluid milk by the process of homogenization.

Although saturated and trans fatty acids are components of many foods, solid fats are foods themselves or ingredients (e.g., shortening in a cake or hydrogenated oils in fried foods). The purpose for discussing solid fats in addition to saturated and trans fatty acids is that, apart from the effects of saturated and trans fatty acids on cardiovascular disease risk, solid fats are abundant in the diets of Americans and contribute significantly to excess calorie intake.

Solid fats contribute an average of 19 percent of the total calories in American diets, but few essential nutrients and no dietary fiber. Some major food sources of solid fats in the American diet are grain-based desserts (11% of all solid fat intake); pizza (9%); regular (full-fat) cheese (8%); sausage, franks, bacon, and ribs (7%); and fried white potatoes (5%) (Figure 3-5).

In addition to being a major contributor of solid fats, moderate evidence suggests an association between the increased intake of processed meats (e.g., franks, sausage, and bacon) and increased risk of colorectal cancer and cardiovascular disease.53 To reduce the intake of solid fats, most Americans should limit their intake of those sources that are high in solid fats and/ or replace them with alternatives that are low in solid fats (e.g., fat-free milk). Reducing these sources of excess solid fats in the diet will result in reduced intake of saturated fatty acids, trans fatty acids, and calories.

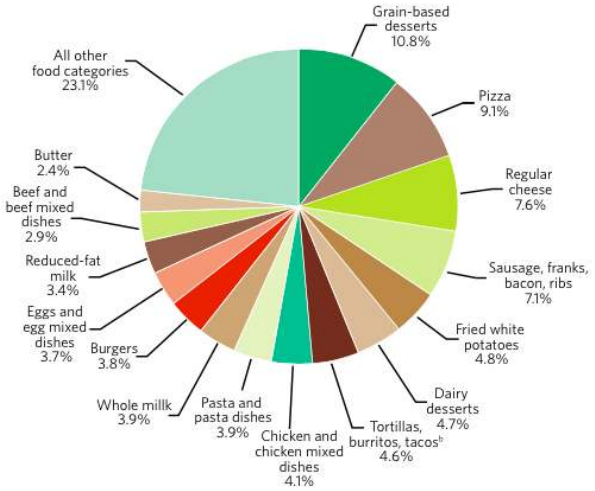



figure 3-5. sources of solid fats in the diets of the u.s. Population ages 2 years and older, NHANES 2003–2004

a. Data are drawn from analyses of usual dietary intake conducted by the National Cancer Institute. Foods and beverages consumed were divided into 97 categories and ranked according to solid fat contribution to the diet. “All other food categories” represents food categories that each contributes less than 2% of the total solid fat intake.

b. Also includes nachos, quesadillas, and other Mexican mixed dishes.

Source: National Cancer Institute. Sources of solid fats in the diets of U.S. population ages 2 years and older, NHANES 2003-2004. Risk Factor Monitoring and Methods. Cancer Control and Population Sciences. http://riskfactor.cancer.gov/diet/fo...ps/table3.html. Accessed August 11, 2010.

## Added sugars

Sugars are found naturally in fruits (fructose) and fluid milk and milk products (lactose). The majority of sugars in typical American diets are sugars added to foods during processing, preparation, or at the table. These “added sugars” sweeten the flavor of foods and beverages and improve their palatability. They also are added to foods for preservation purposes and to provide functional attributes, such as viscosity, texture, body, and browning capacity.

Although the body’s response to sugars does not depend on whether they are naturally present in food or added to foods, sugars found naturally in foods are part of the food’s total package of nutrients and other healthful components. In contrast, many foods that contain added sugars often supply calories, but few or no essential nutrients and no dietary fiber. Both naturally occurring sugars and added sugars increase the risk of dental caries.

Added sugars contribute an average of 16 percent of the total calories in American diets. Added sugars include high fructose corn syrup, white sugar, brown sugar, corn syrup, corn syrup solids, raw sugar, malt syrup, maple syrup, pancake syrup, fructose sweetener, liquid fructose, honey, molasses, anhydrous dextrose, and crystal dextrose.

As a percent of calories from total added sugars, the major sources of added sugars in the diets of Americans are soda, energy drinks, and sports drinks (36% of added sugar intake), grain-based desserts (13%), sugar-sweetened fruit drinks54 (10%), dairy-based desserts (6%), and candy (6%) (Figure 3-6).

Reducing the consumption of these sources of added sugars will lower the calorie content of the diet, without compromising its nutrient adequacy. Sweetened foods and beverages can be replaced with those that have no or are low in added sugars. For example,

sweetened beverages can be replaced with water and unsweetened beverages.

### Why calories from solid fats and added sugars are a particular concern

Solid fats and added sugars are consumed in excessive amounts, and their intake should be limited. Together, they contribute a substantial portion of the calories consumed by Americans—35 percent on average, or nearly 800 calories per day—without contributing importantly to overall nutrient adequacy of the diet. Moreover, they have implications for weight management. Foods containing solid fats and added sugars are no more likely to contribute to weight gain than any other source of calories in an eating pattern that is within calorie limits. However, as the amount of solid fats and/or added sugars increases in the diet, it becomes more difficult to also eat foods with sufficient dietary fiber and essential vitamins and minerals, and still stay within calorie limits. For most people, no more than about 5 to 15 percent of calories from solid fats and added sugars can be reasonably accommodated in the USDA Food Patterns, which are designed to meet nutrient needs within calorie limits.

Reducing the consumption of solid fats and added sugars allows for increased intake of nutrient-dense foods without exceeding overall calorie needs. Because solid fats and added sugars are added to foods and beverages by manufacturers and by consumers at home, Americans can reduce their consumption of these food components in a variety of ways:

- Focus on eating the most nutrient-dense forms of foods from all food groups.
- Limit the amount of solid fats and added sugars when cooking or eating (e.g., trimming fat from meat, using less butter and stick margarine, and using less table sugar).
- Consume fewer and smaller portions of foods and beverages that contain solid fats and/or added sugars, such as grain-based desserts, sodas, and other sugar-sweetened beverages.

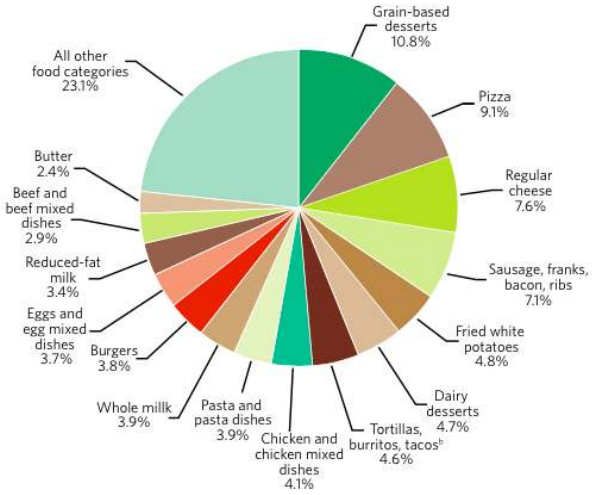



figure 3-6. sources of added sugars in the diets of the u.s. Population ages 2 years and older, NHANES 2005–2006

a. Data are drawn from analyses of usual dietary intake conducted by the National Cancer Institute. Foods and beverages consumed were divided into 97 categories and ranked according to added sugars contribution to the diet. “All other food categories” represents food categories that each contributes less than 2% of the total added sugar intake.

Source: National Cancer Institute. Sources of added sugars in the diets

of the U.S. population ages 2 years and older, NHANES 2005–2006. Risk Factor Monitoring and Methods. Cancer Control and Population Sciences. http://riskfactor.cancer.gov/diet/fo...sugars/table5a. html. Accessed August 11, 2010.

### refined grains

**The Food Label: A Useful Tool**“Using the Food Label to Track Calories, Nutrients, and Ingredients” (Appendix 4) provides detailed guidance that can help Americans make healthy food choices.

The Nutrition Facts label provides information on the amount of calories; beneficial nutrients, such as dietary fiber and calcium; as well as the amount of certain food components that should be limited in the diet, including saturated fat, trans fat, cholesterol, and sodium.

The ingredients list can be used to find out whether a food or beverage contains solid fats, added sugars, whole grains, and refined grains.

The refining of whole grains involves a process that results in the loss of vitamins, minerals, and dietary fiber. Most refined grains are enriched with iron, thiamin, riboflavin, niacin, and folic acid before being further used as ingredients in foods. This returns some, but not all, of the vitamins and minerals that were removed during the refining process.55 Dietary fiber and some vitamins and minerals that are present in whole grains are not routinely added back to refined grains. Unlike solid fats and added sugars, enriched refined grain products have a positive role in providing some vitamins and minerals. However, when consumed beyond recommended levels, they commonly provide excess calories, especially because many refined grain products also are high in solid fats and added sugars (e.g., cookies and cakes).

On average, Americans consume 6.3 ounce-equivalents of refined grains per day.56 At the 2,000-calorie level of the USDA Food Patterns, the recommended amount of refined grains is no more than 3 ounce- equivalents per day. Refined grains should be replaced with whole grains, such that at least half of all grains eaten are whole grains. Consumption of refined grain products that also are high in solid fats and/or added sugars, such as cakes, cookies, donuts, and other desserts, should be reduced. Major sources of refined grains in the diets of Americans are yeast breads (26% of total refined grain intake); pizza (11%); grain-based desserts (10%); and tortillas, burritos, and tacos (8%) (Figure 3-7).



figure 3-7. sources of refined grains in the diets of the u.s. Population ages 2 years and older, NHANES 2003–2004 a. Data are drawn from analyses of usual dietary intake conducted by the National Cancer Institute. Foods and beverages consumed were divided into 97 categories and ranked according to refined grain contribution to the diet. “All other food categories” represents food categories that each contributes less than 2% of the total intake of refined grains. b. Also includes nachos, quesadillas, and other Mexican mixed dishes. Source: National Cancer Institute. Sources of refined grains in the diets of the U.S. population ages 2 years and older, NHANES 2003–2004. Risk Factor Monitoring and Methods. Cancer Control and Population Sciences. http://riskfactor.cancer.gov/diet/fo...ps/table3.html. Accessed August 11, 2010.

## alcohol

In the United States, approximately 50 percent of adults are current regular drinkers and 14 percent are current infrequent drinkers. An estimated

9 percent of men consume an average of more than two drinks per day and 4 percent of women consume an average of more than one drink per day. Of those who drink, about 29 percent of U.S. adult drinkers report binge drinking within the past month, usually on multiple occasions. This results in about 1.5 billion episodes of binge drinking in the United States each year.

The consumption of alcohol can have beneficial or harmful effects, depending on the amount consumed, age, and other characteristics of the person consuming the alcohol. Alcohol consumption may have beneficial effects when consumed in moderation. Strong evidence from observational studies has shown that moderate alcohol consumption is associated with a lower risk of cardiovascular disease. Moderate alcohol consumption also is associated with reduced risk of all-cause mortality among middle-aged and older adults and may help to keep cognitive function intact with age. However, it is not recommended that anyone begin drinking or drink more frequently on the basis of potential health benefits because moderate alcohol intake also is associated with increased risk of breast cancer, violence, drowning, and injuries from falls and motor vehicle crashes.

Because of the substantial evidence clearly demonstrating the health benefits of breastfeeding, occasionally consuming an alcoholic drink does not warrant stopping breastfeeding. However, breastfeeding women should be very cautious about drinking alcohol, if they choose to drink at all. If the infant's breastfeeding behavior is well established, consistent, and predictable (no earlier than at 3 months of age), a mother may consume a single alcoholic drink if she then waits at least 4 hours before breastfeeding. Alternatively, she may express breast milk before consuming the drink and feed the expressed milk to her infant later.

Excessive (i.e., heavy, high-risk, or binge) drinking has no benefits, and the hazards of heavy alcohol intake are well known. Excessive drinking increases the risk of cirrhosis of the liver, hypertension, stroke, type 2 diabetes, cancer of the upper gastrointestinal tract and colon, injury, and violence. Excessive drinking over time is associated with increased body weight and can impair short- and long-term cognitive function. For the growing percentage of the population with elevated blood pressure, reducing alcohol intake can effectively lower blood pressure, although this is most effective when paired with changes in diet and physical activity patterns. Excessive alcohol consumption is responsible for an average of 79,000 deaths in the United States each year. More than half of these deaths are due to binge drinking. Binge drinking also is associated with a wide range of other health and social problems, including sexually transmitted diseases, unintended pregnancy, and violent crime.

### Key Definitions for Alcohol

**What is moderate alcohol consumption?**

Moderate alcohol consumption is defined as up to 1 drink per day for women and up to 2 drinks per day for men.

**What is heavy or high-risk drinking?**

Heavy or high-risk drinking is the consumption of more than 3 drinks on any day or more than 7 per week for women and more than 4 drinks on any day or more than 14 per week for men.

**What is binge drinking?**

Binge drinking is the consumption within 2 hours of 4 or more drinks for women and 5 or more drinks for men.

There are many circumstances in which people should not drink alcohol:

- Individuals who cannot restrict their drinking to moderate levels.
- Anyone younger than the legal drinking age. Besides being illegal, alcohol consumption increases the risk of drowning, car accidents, and traumatic injury, which are common causes of death in children and adolescents.
- Women who are pregnant or who may be pregnant. Drinking during pregnancy, especially in the first few months of pregnancy, may result in negative behavioral or neurological consequences in the offspring. No safe level of alcohol consumption during pregnancy has been established.
- Individuals taking prescription or over-the-counter medications that can interact with alcohol.
- Individuals with certain specific medical conditions (e.g., liver disease, hypertriglyceridemia, pancreatitis).
- Individuals who plan to drive, operate machinery, or take part in other activities that require attention, skill, or coordination or in situations where impaired judgment could cause injury or death (e.g., swimming).

## Chapter Summary

On average, American men, women, and children consume too much sodium, solid fats (the major source of saturated and trans fatty acids), added sugars, and refined grains. Men consume too much cholesterol, which also is found in some solid fats. In addition, some people consume too much alcohol.

Americans should follow the recommendations provided in this chapter to help achieve a dietary pattern that will meet their nutrient needs, control calorie intake, and help reduce the risk of certain chronic diseases. This goal can be achieved by consuming fewer foods high in sodium, solid fats, added sugars, and refined grains. For people who drink, alcohol should be consumed in moderation. It is not recommended that anyone begin drinking alcohol or drink more frequently on the basis of potential health benefits. The dietary patterns outlined in Chapter 5 can help Americans reduce their consumption of these foods, thereby meeting their nutrient needs within appropriate calorie levels. Appendix 4 discusses how food labels can help consumers evaluate and compare the nutritional content and/or ingredients of products, and assist them in purchasing foods that contain relatively lower amounts of certain undesirable nutrients and ingredients, such as sodium, saturated and trans fats, and added sugars.

### Notes

41. Includes white bread or rolls, mixed-grain bread, flavored bread, whole-wheat bread or rolls, bagels, flat breads, croissants, and English muffins.

42. Includes fried or baked chicken parts and chicken strips/patties, chicken stir-fries, chicken casseroles, chicken sandwiches, chicken salads, stewed chicken, and other chicken mixed dishes.

43. Includes macaroni and cheese, spaghetti and other pasta with or without sauces, filled pastas (e.g., lasagna and ravioli), and noodles.

44. Institute of Medicine. Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate. Washington (DC): The National Academies Press; 2005.

45. Because of increased loss of sodium from sweat, the AI does not apply to highly active individuals and workers exposed to extreme heat stress.

46. The average achieved levels of sodium intake, as reflected by urinary sodium excretion, was 2,500 and 1,500 mg/day.

47. The DASH diet emphasized fruits, vegetables, and low-fat milk and milk products; included whole grains, poultry, fish, and nuts; and contained only small amounts of red meat, sweets, sugar-containing beverages, and decreased amounts of total and saturated fat and cholesterol.

48. Includes cakes, cookies, pies, cobblers, sweet rolls, pastries, and donuts.

49. Includes ice cream, frozen yogurt, sherbet, milk shakes, and pudding.

50. Milk and milk products also can be referred to as dairy products.

51. Includes scrambled eggs, omelets, fried eggs, egg breakfast sandwiches/biscuits, boiled and poached eggs, egg salad, deviled eggs, quiche, and egg substitutes.

52. Beef and beef mixed dishes and all types of beef burgers would collectively contribute 11% of total cholesterol intake.

53. The DGAC did not evaluate the components of processed meats that are associated with increased risk of colorectal cancer and cardiovascular disease.

54. Includes fruit-flavored drinks, fruit juice drinks, and fruit punch.

55. Folic acid is added to enriched refined grains to a level that doubles the amount lost during the refining process.

56. One ounce-equivalent of grain is 1 one-ounce slice bread; 1 ounce uncooked pasta or rice; 1⁄2 cup cooked rice, pasta, or cereal; 1 tortilla (6″ diameter); 1 pancake (5″ diameter); 1 ounce ready-to-eat cereal (about 1 cup cereal flakes).

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# 20.13: Dietary Guidelines- Foods and Nutrients to Increase

A wide variety of nutritious foods are available in the United States. However, many Americans do not eat the array of foods that will provide all needed nutrients while staying within calorie needs. In the United States, intakes of vegetables, fruits, whole grains, milk and milk products,57 and oils are lower than recommended. As a result, dietary intakes of several nutrients—potassium, dietary fiber, calcium, and vitamin D—are low enough to be of public health concern for both adults and children. Several other nutrients also are of concern for specific population groups, such as folic acid for women who are capable of becoming pregnant.



This chapter describes food choices that should be emphasized to help Americans close nutrient gaps and move toward healthful eating patterns.

Recommendations are based on evidence that consuming these foods within the context of an overall healthy eating pattern is associated with a health benefit or meeting nutrient needs. Guidance on food choices for a healthy eating pattern generally groups foods based on commonalities in nutrients provided and how the foods are viewed and used by consumers. The following recommendations provide advice about making choices from all food groups while balancing calorie needs.

## Key Recommendations

- Individuals should meet the following recommendations as part of a healthy eating pattern and while staying within their calorie needs.
- Increase vegetable and fruit intake.
- Eat a variety of vegetables, especially dark-green and red and orange vegetables and beans and peas.
- Consume at least half of all grains as whole grains. Increase whole-grain intake by replacing refined grains with whole grains.
- Increase intake of fat-free or low-fat milk and milk products, such as milk, yogurt, cheese, or fortified soy beverages.58
- Choose a variety of protein foods, which include seafood, lean meat and poultry, eggs, beans and peas, soy products, and unsalted nuts and seeds.
- Increase the amount and variety of seafood consumed by choosing seafood in place of some meat and poultry.
- Replace protein foods that are higher in solid fats with choices that are lower in solid fats and calories and/or are sources of oils.
- Use oils to replace solid fats where possible.
- Choose foods that provide more potassium, dietary fiber, calcium, and vitamin D, which are nutrients of concern in American diets. These foods include vegetables, fruits, whole grains, and milk and milk products.

### Recommendations for Specific Population Groups

#### Women capable of becoming pregnant

- Choose foods that supply heme iron, which is more readily absorbed by the body, additional iron sources, and enhancers of iron absorption such as vitamin C-rich foods.
- Consume 400 micrograms (mcg) per day of synthetic folic acid (from fortified foods and/or supplements) in addition to food forms of folate from a varied diet.60

#### Women who are pregnant or breastfeeding

- Consume 8 to 12 ounces of seafood per week from a variety of seafood types.
- Due to their methyl mercury content, limit white (albacore) tuna to 6 ounces per week and do not eat the following four types of fish: tilefish, shark, swordfish, and king mackerel.
- If pregnant, take an iron supplement as recommended by an obstetrician or other health care provider.

### Individuals ages 50 years and older

- Consume foods fortified with vitamin B12, such as fortified cereals, or dietary supplements.

## Supporting the Recommendations

The following sections expand on the recommendations and review the evidence supporting the health benefits associated with increased emphasis on vegetables, fruits, whole grains, fat-free or low-fat milk and milk products, seafood, and oils. An important underlying principle is the need to control calories to manage body weight while making choices to support these food and nutrient recommendations. The best way to do this is to consume foods in nutrient-dense forms.

Nutrient-dense foods provide vitamins, minerals, and other substances that may have positive health effects, with relatively few calories. They are lean or low in solid fats, and minimize or exclude added solid fats, added sugars, and added refined starches, as these add calories but few essential nutrients or dietary fiber. Nutrient-dense foods also minimize or exclude added salt or other compounds high in sodium. Ideally, they are in forms that retain naturally occurring components such as dietary fiber. All vegetables, fruits, whole grains, fat-free or low-fat milk and milk products, seafood, lean meats and poultry, eggs, beans and peas (legumes), and nuts and seeds that are prepared without added solid fats, sugars, starches, and sodium are nutrient-dense.

**Beans and Peas Are Unique Foods**Beans and peas are the mature forms of legumes. They include kidney beans, pinto beans, black beans, garbanzo beans (chickpeas), lima beans, black-eyed peas, split peas, and lentils.

Beans and peas are excellent sources of protein. They also provide other nutrients, such as iron and zinc, similar to seafood, meat, and poultry. They are excellent sources of dietary fiber and nutrients such as potassium and folate, which also are found in other vegetables.

Because of their high nutrient content, beans and peas may be considered both as a vegetable and as a protein food. Individuals can count beans and peas as either a vegetable or a protein food.

Green peas and green (string) beans are not considered to be “Beans and Peas.” Green peas are similar to other starchy vegetables and are grouped with them. Green beans are grouped with other vegetables such as onions, lettuce, celery, and cabbage because their nutrient content is similar to those foods.

**Deciphering the Juice in Juice**The percent of juice in a beverage may be found on the package label, such as “contains 25% juice” or “100% fruit juice.” Some labels may say they provide 100% of a nutrient, such as “provides 100% Daily Value for vitamin C.” Unless the package also states it is “100% juice,” it is not 100% juice. Sweetened juice products with minimal juice content, such as juice drinks, are considered sugar-sweetened beverages rather than fruit juice.

### vegetables and fruits

Three reasons support the recommendation for Americans to eat more vegetables and fruits. First, most vegetables and fruits are major contributors of a number of nutrients that are underconsumed in the United States, including folate, magnesium, potassium, dietary fiber, and vitamins A, C, and K.61 Several of these are of public health concern for the general public (e.g., dietary fiber and potassium) or for a specific group (e.g., folic acid for women who are capable of becoming pregnant).



Second, consumption of vegetables and fruits is associated with reduced risk of many chronic diseases. Specifically, moderate evidence indicates that intake of at least 2 1/2 cups of vegetables and fruits per day is associated with a reduced risk of cardiovascular disease, including heart attack and stroke. Some vegetables and fruits may be protective against certain types of cancer.

Third, most vegetables and fruits, when prepared without added fats or sugars, are relatively low in calories. Eating them instead of higher calorie foods can help adults and children achieve and maintain a healthy weight.

Very few Americans consume the amounts of vegetables recommended as part of healthy eating patterns. (See Chapter 5 for specific information and recommendations.) For almost all Americans ages 2 years and older, usual intake falls below amounts recommended.

Similarly, although most Americans 2 to 3 years of age consume recommended amounts of total fruits, Americans ages 4 years and older do not. (See Chapter 5 for specific information and recommendations.) Children ages 2 to 18 years and adults ages 19 to 30 years consume more than half of their fruit intake as juice. Although 100% fruit juice can be part of a healthful diet, it lacks dietary fiber and when consumed in excess can contribute extra calories. The majority of the fruit recom- mended should come from whole fruits, including fresh, canned, frozen, and dried forms, rather than from juice. When juices are consumed, 100% juice should be encouraged. To limit intake of added sugars, fruit canned in 100% fruit juice is encouraged over fruit canned in syrup.

## grains

In the U.S. marketplace, consumers have a wide variety of grain-based food options. Although Americans generally eat enough total grains, most of the grains consumed are refined grains rather than whole grains. Some refined grain foods also are high in solid fats and added sugars.

**Whole, Refined, and Enriched Grains: What's the Difference?**

**Whole grains** include the entire grain seed, usually called the kernel. The kernel consists of three components—the bran, germ, and endosperm. If the kernel has been cracked, crushed, or flaked, then, to be called a "whole grain" a food must retain the same relative proportions of these components as they exist in the intact grain. Whole grains are consumed either as a single food (e.g., wild rice or popcorn) or as an ingredient in foods (e.g., in cereals, breads, and crackers). Some examples of whole-grain ingredients include buckwheat, bulgur, millet, oatmeal, quinoa, rolled oats, brown or wild rice, whole-grain barley, whole rye, and whole wheat.

**Refined grains** have been milled to remove the bran and germ from the grain. This is done to give grains a finer texture and improve their shelf life, but it also removes dietary fiber, iron, and many B vitamins.

**Enriched grains** are grain products with B vitamins (thiamin, riboflavin, niacin, folic acid) and iron added. Most refined-grain products are enriched.

## Whole grains

Whole grains are a source of nutrients such as iron, magnesium, selenium, B vitamins, and dietary fiber. Whole grains vary in their dietary fiber content. Moderate evidence indicates that whole-grain intake may reduce the risk of cardiovascular disease and is associated with a lower body weight. Limited evidence also shows that consuming whole grains is associated with a reduced incidence of type 2 diabetes. Consuming enough whole grains helps meet nutrient needs. Choosing whole grains that are higher in dietary fiber has additional health benefits.

At least half of recommended total grain intake should be whole grains. (See Chapter 5 for specific information and recommendations.) Less than 5 percent of Americans consume the minimum recommended amount of whole grains, which for many is about 3 ounce-equivalents62 per day. On average, Americans eat less than 1 ounce-equivalent of whole grains per day.

Americans should aim to replace many refined-grain foods with whole-grain foods that are in their nutrient-dense forms to keep total calorie intake within limits. When refined grains are eaten, they should be enriched. Individuals may choose to consume more than half of their grains as whole grains. To ensure nutrient adequacy, individuals who consume all of their grains as whole grains should include some that have been fortified with folic acid, such as some ready-to-eat whole-grain cereals. This is particularly important for women who are capable of becoming pregnant.

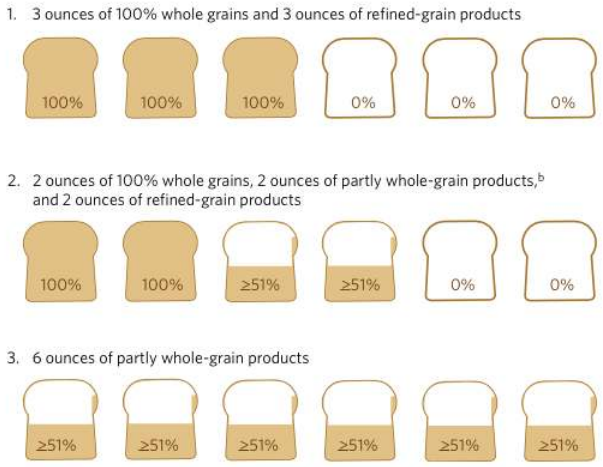



figure 4-1. three ways to Make at least half of total grains whole grains

a. Each one-ounce slice of bread represents a 1 ounce-equivalent of grains: 1 one-ounce slice bread; 1 ounce uncooked pasta or rice; 1/2

cup cooked rice, pasta, or cereal; 1 tortilla (6″ diameter); 1 pancake (5″ diameter); 1 ounce ready-to-eat cereal (about 1 cup cereal flakes). The figure uses an example for a person whose recommendation is 6 ounces

of total grains with at least 3 ounces from whole grains per day.

b. Partly whole-grain products depicted are those that contribute substantially to whole-grain intake. For example, products that contain at least 51% of total weight as whole grains or those that provide at least 8 grams of whole grains per ounce-equivalent.

The recommendation to consume at least half of total grains as whole grains can be met in a number of ways (Figure 4-1). The most direct way to meet the whole grain recommendation is to eat at least half of one's grain-based foods as 100% whole-grain foods. If the only grains in the ingredients list are whole grains, the food is a 100% whole-grain food. The relative amount of grain in the food can be inferred by the placement of the grain in the ingredients list. The whole grain should be the first ingredient or the second ingredient, after water. For foods with multiple whole-grain ingredients, they should appear near the beginning of the ingredients list.

Many grain foods contain both whole grains and refined grains. These foods also can help people meet the whole grain recommendation, especially
if a considerable proportion of the grain ingredients is whole grains. For example, foods with at least 51 percent of the total weight as whole-grain ingredients contain a substantial amount of whole grains. Another example is foods with at least 8 grams of whole grains per ounce-equivalent.63 Some product labels show the whole grains health claim64 or the grams of whole grain in the product. This information may help people identify food choices that have a substantial amount of whole grains.

### Milk and Milk Products

Milk and milk products contribute many nutrients, such as calcium, vitamin D (for products fortified with vitamin D), and potassium, to the diet. Moderate evidence shows that intake of milk and milk products is linked to improved bone health, especially in children and adolescents. Moderate evidence also indicates that intake of milk and milk products is associated with a reduced risk of cardiovascular disease and type 2 diabetes and with lower blood pressure in adults.

Intake of milk and milk products, including fortified soy beverages, is less than recommended amounts for most adults, children and adolescents ages 4 to 18 years, and many children ages 2 to 3 years. Recommended amounts are 3 cups per day of fat-free or low-fat milk and milk products for adults and children and adolescents ages 9 to 18 years, 21/2 cups per day for children ages 4 to 8 years, and 2 cups for children ages 2 to 3 years. (See Chapter 5 for specific information and recommendations.) In general, intake is lower for females than for males and declines with age.

 The majority of current fluid milk intake comes from reduced fat (2%) or whole (full-fat) milk, with smaller amounts consumed as fat-free (skim) or low-fat (1%) milk. Almost half of the milk and milk product intake in the United States comes from cheese, little of which is consumed in a lower-fat form. Choosing fat-free or low-fat milk and milk products provides the same nutrients with less solid fat and thus fewer calories. In addition, selecting more of milk group intake as fat-free or low-fat fluid milk or yogurt rather than as cheese can increase intake of potassium, vitamin A, and vitamin D and decrease intake of sodium, cholesterol, and saturated fatty acids.

It is especially important to establish the habit of drinking milk in young children, as those who consume milk at an early age are more likely to do so as adults. For individuals who are lactose-intolerant, low-lactose and lactose-free milk products are available. Those who do not consume milk or milk products should consume foods that provide the range of nutrients generally obtained from the milk group, including protein, calcium, potassium, magnesium, vitamin D, and vitamin A. Soy beverages fortified with calcium and vitamins A and D are considered part of the milk and milk products group because they are similar to milk both nutritionally66 and in their use in meals.

## Protein foods

Protein foods include seafood, meat, poultry, eggs, beans and peas, soy products, nuts, and seeds. In addition to protein, these foods contribute B vitamins (e.g., niacin, thiamin, riboflavin, and B6), vitamin E, iron, zinc, and magnesium to the diet. However, protein also is found in some foods that are classified in other food groups (e.g., milk and milk products). The fats in meat, poultry, and eggs are considered solid fats, while the fats in seafood, nuts, and seeds are considered oils. Meat and poultry should be consumed in lean forms to decrease intake of solid fats.

**Are Seafood and Fish the Same?**Seafood is a large category of marine animals that live in the sea and in freshwater lakes and rivers. **Seafood** includes fish, such as salmon, tuna, trout, and tilapia, and **shellfish**, such as shrimp, crab, and oyster

Some Americans need to increase their total intake of protein foods, while others are eating more than is recommended. Americans should consume protein foods in amounts recommended for their nutrient and calorie needs. (See Chapter 5 for specific information and recommendations.) Meat, poultry, and eggs are the most commonly consumed protein foods, while seafood, beans and peas, soy products, nuts, and seeds are consumed in proportionally smaller amounts.

Consumption of a balanced variety of protein foods can contribute to improved nutrient intake and health benefits. For example, moderate evidence indicates that eating peanuts and certain tree nuts (i.e., walnuts, almonds, and pistachios) reduces risk factors for cardiovascular disease when consumed as part of a diet that is nutritionally adequate and within calorie needs. Because nuts and seeds are high in calories, they should be eaten in small portions and used to replace other protein foods, like some meat or poultry, rather than being added to the diet. In addition, individuals should choose unsalted nuts and seeds to help reduce sodium intake. Beans and peas, as discussed previously under Vegetables and Fruits, confer health benefits as sources of important nutrients such as dietary fiber.

In recent years, moderate evidence has emerged about the health benefits of consuming seafood. Therefore, the Dietary Guidelines for Americans, 2010 includes a new quantitative recommendation for seafood intake. An intake of 8 or more ounces per week (less for young children), about 20% of total recommended intake of protein foods of a variety of seafood is recommended.67 Additional information about seafood and the recommendations follows.

## Seafood

Mean intake of seafood in the United States is approximately 3 1/2 ounces per week, and increased intake is recommended. Seafood contributes a range of nutrients, notably the omega-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Moderate evidence shows that consumption of about 8 ounces68 per week of a variety of seafood, which provide an average consumption of 250 mg per day of EPA and DHA, is associated with reduced cardiac deaths among individuals with and without pre-existing cardiovascular disease. Thus, this recommendation contributes to the prevention of heart disease. The recommendation is to consume seafood for the total package of benefits that seafood provides, including its EPA and DHA content.

 Seafood choices can include those with higher and lower amounts of EPA and DHA, but, some choices with higher amounts should be included. Smaller amounts of seafood are recommended for children. (See Chapter 5 for specific information and recommendations.)

Moderate, consistent evidence shows that the health benefits from consuming a variety of seafood in the amounts recommended outweigh the health risks associated with methyl mercury, a heavy metal found in seafood in varying levels.69 Benefits are maximized with seafood higher in EPA and DHA but lower in methyl mercury. In addition, eating a variety of seafood, as opposed to just a few choices, is likely to reduce the amount of methyl mercury consumed from any one seafood type. Individuals who regularly consume more than the recommended amounts of seafood should choose a mix of seafood that emphasizes choices relatively low in methyl mercury. Appendix 11 lists common seafood varieties with the EPA+DHA and mercury content in a 4-ounce cooked portion. A total of 1,750 mg per week of EPA+DHA provides an average of 250 mg per day of these omega-3 fatty acids. Seafood varieties that are commonly consumed in the United States that are higher in EPA and DHA and lower in mercury include salmon, anchovies, herring, sardines, Pacific oysters, trout, and Atlantic and Pacific mackerel (not king mackerel, which is high in mercury).

In addition to the health benefits for the general public, the nutritional value of seafood is of particular importance during fetal growth and development, as well as in early infancy and childhood. Moderate evidence indicates that intake of omega-3 fatty acids, in particular DHA, from at least 8 ounces of seafood per week for women who are pregnant or breastfeeding is associated with improved infant health outcomes, such as visual and cognitive development. Therefore, it is recommended that women who are pregnant or breast-feeding consume at least 8 and up to 12 ounces68 of a variety of seafood per week, from choices that are lower in methyl mercury. Obstetricians and pediatricians should provide guidance to women who are pregnant or breastfeeding to help them make healthy food choices that include seafood.

Women who are pregnant or breastfeeding should not eat four types of fish because they are high in methyl mercury. These are tilefish, shark, swordfish, and king mackerel (Appendix 11). Women who are pregnant or breastfeeding can eat all types of tuna, including white (albacore) and light canned tuna, but should limit white tuna to 6 ounces per week because it is higher in methyl mercury.

### oils

Fats with a high percentage of monounsaturated and polyunsaturated fatty acids are usually liquid at room temperature and are referred to as “oils” (see Figure 3-3). Oils are not a food group, but are emphasized because they contribute essential fatty acids and vitamin E to the diet. Replacing some saturated fatty acids with unsaturated fatty acids lowers both total and low-density lipoprotein (LDL) blood cholesterol levels.

Oils are naturally present in foods such as olives, nuts, avocados, and seafood. Many common oils are extracted from plants, such as canola, corn, olive, peanut, safflower, soybean, and sunflower oils. Foods that are mainly oil include mayonnaise, oil-based salad dressings, and soft (tub or squeeze) margarine with no trans fatty acids. Coconut oil, palm kernel oil, and palm oil are high in saturated fatty acids and partially hydrogenated oils contain trans fatty acids. For nutritional purposes, they should be considered solid fats.

Americans consume more solid fats but less oil than is desirable. (See Chapter 5 for specific information and recommendations.) Because oils are a concentrated source of calories, Americans should replace solid fats with oils, rather than add oil to the diet, and should use oils in small amounts. For example, individuals can use soft margarine instead of stick margarine, replace some meats and poultry with seafood or unsalted nuts, and use vegetable oils instead of solid fats, such as butter, in cooking.

## nutrients of concern

Because consumption of vegetables, fruits, whole grains, milk and milk products, and seafood is lower than recommended, intake by Americans of some nutrients is low enough to be of public health concern. These are potassium, dietary fiber, calcium, and vitamin D. In addition, as discussed below, intake of iron, folate, and vitamin B12 is of concern for specific population groups.

### Potassium



As described in chapter 3: foods and food components to reduce, high intake of sodium is related to the high prevalence of high blood pressure in the United States. Dietary potassium can lower blood pressure by blunting the adverse effects of sodium on blood pressure. Other possible benefits of an eating pattern rich in potassium include a reduced risk of developing kidney stones and decreased bone loss. The Adequate Intake (AI) for potassium for adults is 4,700 mg per day. AIs are amounts of a nutrient that are adequate for almost everyone in the population; therefore, intake below an AI may be adequate for some people. Available evidence suggests that African Americans and individuals with hypertension especially benefit from increasing intake of potassium.

Few Americans, including all age-gender groups, consume potassium in amounts equal to or greater than the AI. In view of the health benefits of adequate potassium intake and its relatively low current intake by the general population, increased intake of dietary potassium from food sources is warranted. Individuals with kidney disease and those who take certain medications, such as ACE inhibitors, should consult with their health care provider for specific guidance on potassium intake.

Dietary sources of potassium are found in all food groups, notably in vegetables, fruits, and milk and milk products. Appendix 12 lists food sources of potassium. Americans should select a variety of food sources of potassium to meet recommended intake rather than relying on supplements.

### Dietary fiber

Dietary fiber is the non-digestible form of carbohydrates and lignin. Dietary fiber naturally occurs in plants, helps provide a feeling of fullness, and is important in promoting healthy laxation. Some of the best sources of dietary fiber are beans and peas, such as navy beans, split peas, lentils, pinto beans, and black beans. Additional sources of dietary fiber include other vegetables, fruits, whole grains, and nuts. All of these foods are consumed below recommended levels in the typical American diet. Bran, although not a whole grain, is an excellent source of dietary fiber. Appendix 13 lists food sources of dietary fiber.

Dietary fiber that occurs naturally in foods may help reduce the risk of cardiovascular disease, obesity, and type 2 diabetes. Children and adults should consume foods naturally high in dietary fiber in order to increase nutrient density, promote healthy lipid profiles and glucose tolerance, and ensure normal gastrointestinal function. Fiber is sometimes added to foods and it is unclear if added fiber provides the same health benefits as naturally occurring sources.

The AI for fiber is 14 g per 1,000 calories, or 25 g per day for women and 38 g per day for men. Most Americans greatly underconsume dietary fiber, and usual intake averages only 15 g per day. Breads, rolls, buns, and pizza crust made with refined flour are not among the best sources of dietary fiber, but currently contribute substantially to dietary fiber consumption because they are ubiquitous in typical American diets. To meet the recommendation for fiber, Americans should increase their consumption of beans and peas, other vegetables, fruits, whole grains, and other foods with naturally occurring fiber. Whole grains vary in fiber content. The Nutrition Facts label can be used to compare whole-grain products and find choices that are higher in dietary fiber.

### Calcium

Adequate calcium status is important for optimal bone health. In addition, calcium serves vital roles in nerve transmission, constriction and dilation of blood vessels, and muscle contraction. A significant number of Americans have low bone mass, a risk factor for osteoporosis, which places them at risk of bone fractures. Age groups of particular concern due to low calcium intake from food include children ages 9 years and older, adolescent girls, adult women, as well as adults ages 51 years and older. All ages are encouraged to meet their Recommended Dietary Allowance (RDA) for calcium.

Milk and milk products contribute substantially to calcium intake by Americans. Calcium recommendations may be achieved by consuming recommended levels of fat-free or low-fat milk and milk products and/or consuming alternative calcium sources (Appendix 14). Removing milk and milk products from the diet requires careful replacement with other food sources of calcium, including fortified foods. Calcium in some plant foods is well absorbed, but consuming enough plant foods to achieve the RDA may be unrealistic for many.

### Vitamin D

Adequate vitamin D status is important for health. Extreme lack of vitamin D (i.e., vitamin D deficiency) results in rickets in children and osteomalacia (softening of bones) in adults. Adequate vitamin D also can help reduce the risk of bone fractures. Although dietary intakes of vitamin D are below recommendations, recent data from the National Health and Nutrition Examination Survey (NHANES) indicate that more than 80 percent of Americans have adequate vitamin D blood levels. Vitamin D is unique in that sunlight on the skin enables the body to make vitamin D.

In the United States, most dietary vitamin D is obtained from fortified foods, especially fluid milk and some yogurts (Appendix 15). Some other foods and beverages, such as breakfast cereals, margarine, orange juice, and soy beverages, also are commonly fortified with this nutrient. Natural sources of vitamin D include some kinds of fish (e.g., salmon, herring, mackerel, and tuna) and egg yolks, which have smaller amounts. It also is available in the form of dietary supplements.

The RDAs for vitamin D, which assume minimal sun exposure, are 600 IU (15 mcg) per day for children and most adults and 800 IU (20 mcg) for adults older than 70 years. As intake increases above 4,000 IU (100 mcg) per day, the potential risk of adverse effects increases.

### Additional nutrients of concern for specific groups

**iron**: Substantial numbers of women who are capable of becoming pregnant, including adolescent girls, are deficient in iron. They can improve their iron status by choosing foods that supply heme iron, which is more readily absorbed by the body, as well as additional iron sources and enhancers of iron absorption such as vitamin C-rich foods. Sources of heme iron include lean meat and poultry and seafood. Additional iron sources are non-heme iron in plant foods, such as white beans, lentils, and spinach, as well as foods enriched with iron, such as most breads and cereals. However, non-heme iron is not as readily absorbed by the body. Women who are pregnant are advised to take an iron supplement as recommended by an obstetrician or other health care provider.

**folate**: Folic acid fortification in the United States has been successful in reducing the incidence of neural tube defects. However, many women capable of becoming pregnant still do not meet the recommended intake for folic acid. All women capable of becoming pregnant are advised to consume 400 mcg of synthetic folic acid daily (from fortified foods and/or supplements) in addition to food forms of folate from a varied diet. Women who are pregnant are advised to consume 600 mcg of dietary folate equivalents70 daily from all sources. Sources of food folate include beans and peas, oranges and orange juice, and dark-green leafy vegetables such as spinach and mustard greens. Folic acid is the form added to foods such as fortified grain products.

**vitamin B12**: On average, Americans ages 50 years and older consume adequate vitamin B12. Nonetheless, a substantial proportion of individuals ages 50 years and older may have reduced ability to absorb naturally occurring vitamin B12. However, the crystalline form of the vitamin is well absorbed. Therefore, individuals ages 50 years and older are encouraged to include foods fortified with vitamin B12, such as fortified cereals, or take dietary supplements.

## Chapter Summary

Many Americans do not eat the variety and amounts of foods that will provide needed nutrients while avoiding excess calorie intake. They should increase their intake of vegetables, fruits, whole grains, fat-free or low-fat milk and milk products, seafood, and oils. These food choices
can help promote nutrient adequacy, keep calories in control, and reduce risks of chronic diseases. Consuming these foods is associated with a health benefit and/or with meeting nutrient needs. They should be emphasized to help Americans close nutrient gaps and move toward healthful eating patterns. They provide an array of nutrients, including those of public health concern: potassium, dietary fiber, calcium, and vitamin D. It is important that while increasing intake of these foods, Americans make choices that minimize intake of calories from solid fats and added sugars, which provide few essential nutrients.

### Notes

57. Milk and milk products also can be referred to as dairy products.

58. Fortified soy beverages have been marketed as “soymilk,” a product name consumers could see in supermarkets and consumer materials. However, FDA’s regulations do not contain provisions for the use of the term soymilk. Therefore, in this document, the term “fortified soy beverage” includes products that may be marketed as soymilk.

59. Includes adolescent girls.

60. “Folic acid” is the synthetic form of the nutrient, whereas “folate” is the form found naturally in foods.

61. Food sources of shortfall nutrients that are not of major concern for public health (e.g., magnesium, vitamin A, vitamin C) can be found in Chapter D.2 of the Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2010, found at www.dietaryguidelines.gov.

62. 1 ounce-equivalent of grain is: 1 one-ounce slice bread; 1 ounce uncooked pasta or rice; 1/2 cup cooked rice, pasta, or cereal; 1 tortilla (6″ diameter); 1 pancake (5″ diameter); 1 ounce ready-to-eat cereal (about 1 cup cereal flakes).

63. Adapted from the Food Safety and Inspection Service (FSIS) guidance on whole-grain claims. Available at http://www.fsis.usda.gov/OPPDE/larc/ Claims/Food_Guide_MyPyramid_Policy.pdf.

64. Products that bear the FDA health claim for whole grains have at least 51% or more of the total ingredients by weight as whole-grain ingredients, as well as meet other criteria.

65. Milk and milk products also can be referred to as dairy products.

66. Nutrition assistance programs may have additional nutrient specifications for soy beverages based on Federal requirements or the nutrient needs of target populations.

67. Protein foods recommendations for people who consume a vegetarian diet are described in Chapter 5.

68. Cooked, edible portion.

69. State and local advisories provide information to guide consumers who eat fish caught from local waters. This information can be found at www.epa. gov/fishadvisories. Accessed July 11, 2010.

70. Dietary Folate Equivalents (DFE) adjust for the difference in bioavailability of food folate compared with synthetic folic acid. 1 DFE = 1 mcg food folate = 0.6 mcg folic acid from supplements and fortified foods taken with meals.

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# 20.14: Dietary Guidelines- Building Healthy Eating Patterns



Individuals and families can incorporate the recommendations presented in each of the previous chapters into an overall healthy way to eat—a healthy eating pattern.71 A growing body of evidence from research on eating patterns supports these recommendations. A healthy eating pattern is not a rigid prescription, but rather an array of options that can accommodate cultural, ethnic, traditional, and personal preferences and food cost and availability. Americans have flexibility in making choices to create a healthy eating pattern that meets nutrient needs and stays within calorie limits. This chapter describes research findings from clinical trials of eating patterns and from observational studies of traditional eating patterns. The chapter also explains the principles for selecting a healthy eating pattern. Several templates—adaptable guides for healthy eating—have been developed that show how Americans can put these principles into action: the USDA Food Patterns, lacto-ovo vegetarian or vegan adaptations of the USDA Food Patterns, and the DASH72 Eating Plan. These templates translate and integrate dietary recommendations into an overall healthy way to eat. They identify average daily amounts of foods, in nutrient-dense forms, to eat from all food groups and include limits for some dietary components. Consumers, professionals, and organizations can make use of these templates to plan healthy eating patterns or assess food and beverage choices.

## Key Recommendations

Select an eating pattern that meets nutrient needs over time at an appropriate calorie level.

Account for all foods and beverages consumed and assess how they fit within a total healthy eating pattern.

Follow food safety recommendations when preparing and eating foods to reduce the risk of foodborne illnesses.

## Research Informs Us About Healthy Eating Patterns

Around the world and within the United States, people make strikingly different food choices and have different diet-related health outcomes. Although the study of eating patterns is complex, evidence from international scientific research has identified various eating patterns that may provide short- and long-term health benefits, including a reduced risk of chronic disease. Many traditional eating patterns can provide health benefits, and their variety demonstrates that people can eat healthfully in a number of ways.

Several types of research studies have been conducted on these eating patterns, including clinical trials and prospective studies that measure specific health outcomes or health-related risk factors, and observational studies of traditional eating patterns. Considerable research exists on health outcomes as well as information on nutrient and food group composition of some eating patterns constructed
for clinical trials (e.g., DASH and its variations) and traditional eating patterns (e.g., Mediterranean-style patterns). Some evidence for beneficial health outcomes for adults also exists for vegetarian eating patterns. In addition, investigators have studied traditional Japanese and Okinawan dietary patterns and have found associations with a low risk of coronary heart disease. However, detailed information on the composition of these Asian diets, and evidence on health benefits similar to that available for the other types of diets, is very limited.

### research on dietary approaches to stop hypertension (dash)

The DASH eating pattern and its variations have been tested in clinical trials. In these studies, specific foods are provided and health impacts monitored over time. Prospective studies also have been conducted in groups of people who make their own food choices, to identify and evaluate eating patterns that are similar to DASH.

DASH emphasizes vegetables, fruits, and low-fat milk and milk products;73 includes whole grains, poultry, seafood, and nuts; and is lower in sodium, red and processed meats, sweets, and sugar-containing beverages than typical intakes in the United States. One of the original DASH study diets also was lower in total fat (27% of calories) than typical American intakes.

However, modifications containing higher levels of either unsaturated fatty acids or protein have been tested. In research studies, each of these DASH-style patterns lowered blood pressure, improved blood lipids, and reduced cardiovascular disease risk compared to diets that were designed to resemble a typical American diet. The DASH-Sodium study of hypertensives and pre-hypertensives also reduced sodium, and resulted in lower blood pressure in comparison to the same eating pattern, but with a higher sodium intake. Eating patterns that are similar to DASH also have been associated with a reduced risk of cardiovascular disease and lowered mortality.

### research on Mediterranean-style eating patterns



A large number of cultures and agricultural patterns exist in countries that border the Mediterranean Sea, so the “Mediterranean diet” is not one eating pattern. No single set of criteria exists for what constitutes a traditional Mediterranean eating pattern. However, in general terms, it can be described as an eating pattern that emphasizes vegetables, fruits and nuts, olive oil, and grains (often whole grains). Only small amounts of meats and full-fat milk and milk products are usually included. It has a high mono-unsaturated to saturated fatty acid intake ratio and often includes wine with meals.

Traditional eating patterns found throughout the Mediterranean region, especially in Crete during the 1960s, are associated with a low risk of cardiovascular disease. Over time, the diet of Crete has changed remarkably and is now characterized by higher intake of saturated fatty acids and cholesterol, and reduced intake of monounsaturated fatty acids, while total fat consumption has fallen. Over this same period of time, the population of Crete has experienced a steady rise in risk of heart disease.

A number of studies with varying designs have examined the effects of Mediterranean-style eating patterns on cardiovascular disease and total mortality. Most of these studies apply a score that compares an individual’s food group or nutrient intake to median intake of the study population: a higher “Mediterranean diet score” is above the median intake for the study population in vegetables, fruits, nuts, legumes, whole grains/cereals, and fish; below the median intake for red and processed meats; moderate in alcohol intake; with a high monounsaturated fatty acid to saturated fatty acid ratio; and in many cases, below the median intake for milk and milk products. In most studies, individuals with a higher Mediterranean diet score have reduced cardiovascular disease risk factors, reduced incidence of cardiovascular disease, and a lower rate of total mortality.

### research on vegetarian eating patterns

The types of vegetarian diets consumed in the United States vary widely. Vegans do not consume any animal products, while lacto-ovo vegetarians consume milk and eggs. Some individuals eat diets that are primarily vegetarian but may include small amounts of meat, poultry, or seafood.

In prospective studies of adults, compared to non-vegetarian eating patterns, vegetarian-style eating patterns have been associated with improved health outcomes—lower levels of obesity, a reduced risk of cardiovascular disease, and lower total mortality. Several clinical trials have documented that vegetarian eating patterns lower blood pressure.

On average, vegetarians consume a lower proportion of calories from fat (particularly saturated fatty acids); fewer overall calories; and more fiber, potassium, and vitamin C than do non-vegetarians. Vegetarians generally have a lower body mass index. These characteristics and other lifestyle factors associated with a vegetarian diet may contribute to the positive health outcomes that have been identified among vegetarians.

### common elements of the healthy eating patterns examined

Although healthy eating patterns around the world are diverse, some common threads exist. They are abundant in vegetables and fruits. Many emphasize whole grains. They include moderate amounts and a variety of foods high in protein (seafood, beans and peas, nuts, seeds, soy products, meat, poultry, and eggs). They include only limited amounts of foods high in added sugars and may include more oils than solid fats. Most are low in full-fat milk and milk products. However, some include substantial amounts of low-fat milk and milk products. In some patterns, wine is included with meals. Compared to typical American diets, these patterns tend to have a high unsaturated to saturated fatty acid ratio and a high dietary fiber and potassium content. In addition, some are relatively low in sodium compared to current American intake.

These elements of healthy traditional and constructed (e.g., DASH) eating patterns are generally consistent with the recommendations from Chapters 2, 3, and 4 about what Americans should eat. The recommendations in these chapters, summarized below, are based on studies of specific dietary components:

- Limit calorie intake to the amount needed to attain or maintain a healthy weight for adults, and for appropriate weight gain in children and adolescents.
- Consume foods from all food groups in nutrient-dense forms and in recommended amounts.
- Reduce intake of solid fats (major sources of saturated and trans fatty acids).
- Replace solid fats with oils (major sources of polyunsaturated and monounsaturated fatty acids) when possible.
- Reduce intake of added sugars.
- Reduce intake of refined grains and replace some refined grains with whole grains.
- Reduce intake of sodium (major component of salt).
- If consumed, limit alcohol intake to moderate levels.
- Increase intake of vegetables and fruits.
- Increase intake of whole grains.

- Increase intake of milk and milk products and replace whole milk and full-fat milk products with fat-free or low-fat choices to reduce solid fat intake.
- Increase seafood intake by replacing some meat or poultry with seafood.

Although there is no single “American” or “Western” eating pattern, average American eating patterns currently bear little resemblance to these dietary recommendations. Americans eat too many calories and too much solid fat, added sugars, refined grains, and sodium. Americans also consume too little potassium; dietary fiber; calcium; vitamin D; unsaturated fatty acids from oils, nuts, and seafood; and other important nutrients. These nutrients are mostly found in vegetables, fruits, whole grains, and low-fat milk and milk products. Figure 5-1 graphically shows how the typical American diet compares to recommended intakes or limits.

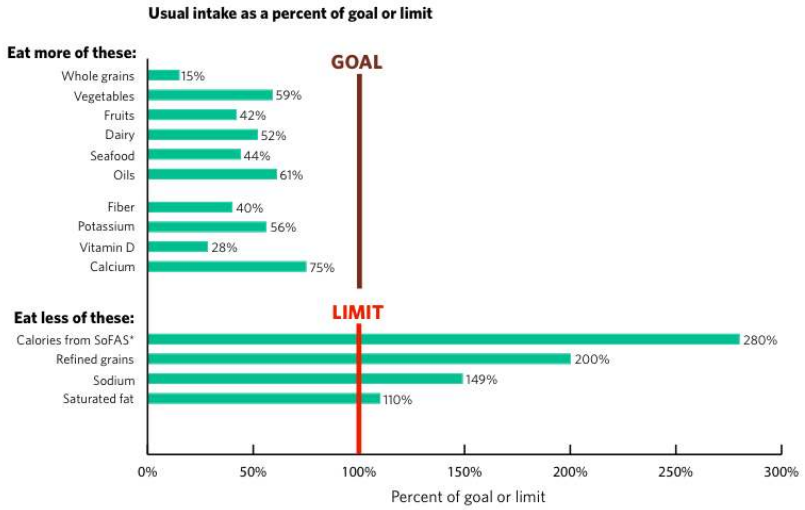



figure 5-1. how do typical american diets compare to recommended intake levels or limits?

*SoFAS = solid fats and added sugars.

Note: Bars show average intakes for all individuals (ages 1 or 2 years or older, depending on the data source) as a percent of the recommended intake level or limit. Recommended intakes for food groups and limits for refined grains and solid fats and added sugars are based on amounts in the USDA 2000-calorie food pattern. Recommended intakes for fiber, potassium, vitamin D, and calcium are based on the highest AI or RDA for ages 14 to 70 years. Limits for sodium are based on the UL and for

saturated fat on 10% of calories. The protein foods group is not shown here because, on average, intake is close to recommended levels.

Based on data from: U.S. Department of Agriculture, Agricultural Research Service and U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. What We Eat in America, NHANES 2001–2004 or 2005–2006.

## Principles for Achieving a Healthy Eating Pattern

### focus on nutrient-dense foods

A healthy eating pattern focuses on nutrient-dense foods—vegetables, fruits, whole grains, fat-free
or low-fat milk and milk products, lean meats and poultry, seafood, eggs, beans and peas, and nuts and seeds that are prepared without added solid fats, sugars, starches, and sodium. Combined into an eating pattern, these foods can provide the full range of essential nutrients and fiber, without excessive calories. The oils contained in seafood, nuts and seeds, and vegetable oils added to foods also contribute essential nutrients.

Most people’s eating patterns can accommodate only a limited number of calories from solid fats and added sugars. These calories are best used to increase the palatability of nutrient-dense foods rather than to consume foods or beverages that are primarily solid fats, added sugars, or both. A few examples of nutrient-dense foods containing some solid fats or added sugars include whole-grain breakfast cereals that contain small amounts of added sugars, cuts of meat that are marbled with fat, poultry baked with skin on, vegetables topped with butter or stick margarine, fruit sprinkled with sugar, and fat-free chocolate milk. In addition, for those who consume alcohol, the calories in these beverages need to be considered as part of total calorie intake; they reduce the allowance for calories from solid fats and added sugars that can be accommodated in an eating pattern.

Too often, however, Americans choose foods that are not in nutrient-dense forms. Figure 5-2 shows examples of typical food choices from each food group, and the number of additional calories in these foods compared to a nutrient-dense version of the same food. In these examples, the extra calories from added fats and sugars, or refined grains (breading) are from about one-quarter to more than half of the total calories in the food product.

### remember that beverages count

Beverages contribute substantially to overall dietary and calorie intake for most Americans. Although they provide needed water, many beverages add calories to the diet without providing essential nutrients. Their consumption should be planned in the context of total calorie intake and how they can fit into the eating pattern of each individual. Currently, American adults ages 19 years and older consume an average of about 400 calories per

day as beverages. The major types of beverages consumed by adults, in descending order by average calorie intake, are: regular soda, energy, and sports drinks; alcoholic beverages; milk (including whole, 2%, 1%, and fat-free); 100% fruit juice; and fruit drinks. Children ages 2 to 18 years also consume an average of 400 calories per day as beverages. The major beverages for children are somewhat different and, in order by average calorie intake, are: milk (including whole, 2%, 1%, and fat-free); regular soda, energy, and sports drinks; fruit drinks; and 100% fruit juice. Among children and adolescents, milk and 100% fruit juice intake is higher for younger children, and soda intake is higher for adolescents.

The calorie content of beverages varies widely, and some of the beverages with the highest intake, including regular sodas, fruit drinks, and alcoholic beverages, contain calories but provide few or no essential nutrients. Other beverages, however, such as fat-free or low-fat milk and 100% fruit juice, provide a substantial amount of nutrients along with the calories they contain. Water and unsweetened beverages, such as coffee and tea, contribute to total water intake without adding calories. To limit excess calories and maintain healthy weight, individuals are encouraged to drink water and other beverages with few or no calories, in addition to recommended amounts of low-fat or fat-free milk and 100% fruit juices.

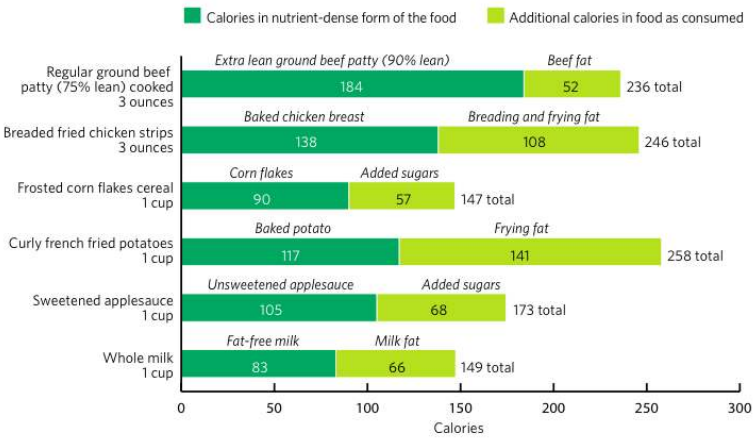



figure 5-2. examples of the calories in food choices that are not in nutrient-dense forms and the calories in nutrient-dense forms of these foods

Based on data from the U.S. Department of Agriculture, Agricultural Research Service, Food and Nutrient Database for Dietary Studies 4.1. http://www.ars.usda.gov/Services/docs.htm?docid=20511 and USDA National Nutrient Database for Standard Reference, Release 23. http://www.nal.usda.gov/fnic/foodcomp/search/.

## follow food safety principles

Ensuring food safety is an important principle for building healthy eating patterns. Foodborne illness affects more than 76 million individuals in the United States every year and leads to 325,000 hospitalizations and 5,000 deaths.74 The proportion of outbreaks that can be attributed to unsafe food safety practices in the home is unknown, but is assumed to be substantial. Washing hands, rinsing vegetables and fruits, preventing cross-contamination, cooking foods to safe internal temperatures, and storing foods safely in the home kitchen are the behaviors most likely to prevent food safety problems. These behaviors are highlighted in the four basic food safety principles that work together to reduce the risk of foodborne illnesses. These principles are:

- clean hands, food contact surfaces, and vegetables and fruits.
- separate raw, cooked, and ready-to-eat foods while shopping, storing, and preparing foods.
- cook foods to a safe temperature.
- chill (refrigerate) perishable foods promptly.

In addition, some foods pose high risk of foodborne illness. These include raw (unpasteurized) milk, cheeses, and juices; raw or undercooked animal foods, such as seafood, meat, poultry, and eggs; and raw sprouts. These foods should be avoided.

**A Special Note about Water Intake**

Total water intake includes water from fluids (drinking water and other beverages) and the water that is contained in foods. Healthy individuals, in general, have an adequate total water intake to meet their needs when they have regular access to drinking water and other beverages. The combination of thirst and typical behaviors, such as drinking beverages with meals, provides sufficient total water intake.

Individual water intake needs vary widely, based in part on level of physical activity and exposure to heat stress. Heat waves have the potential to result in an increased risk of dehydration, especially in older adults.

Although the IOM set an Adequate Intake (AI) for total water, it was based on median total water intake estimated from U.S. dietary surveys. Therefore, the AI should not be considered as a specific requirement level.

**Fluoride and Hygiene Are Keys to Oral Health**

Drinking fluoridated water and/or using fluoride-containing dental products helps reduce the risk of dental caries. Most bottled water is not fluoridated. With the increase in consumption of bottled water, Americans may not be getting enough fluoride to maintain oral health.

During the time that sugars and starches are in contact with teeth, they also contribute to dental caries. A combined approach of reducing the amount of time sugars and starches are in the mouth, drinking fluoridated water, and brushing and flossing teeth, is the most effective way to reduce dental caries.

### consider the role of supplements and fortified foods

A fundamental premise of the Dietary Guidelines is that nutrients should come primarily from foods. Foods in nutrient-dense, mostly intact forms contain not only the essential vitamins and minerals that are often contained in nutrient supplements, but also dietary fiber and other naturally occurring substances that may have positive health effects.



Americans should aim to meet their nutrient requirements through a healthy eating pattern that includes nutrient-dense forms of foods, while balancing calorie intake with energy expenditure.

Dietary supplements or fortification of certain foods may be advantageous in specific situations to increase intake of a specific vitamin or mineral. In some cases, fortification can provide a food-based means for increasing intake of particular nutrients or providing nutrients in highly bioavailable forms. For example:

- **vitamin d**. For many years, most fluid milk has been fortified with vitamin D to increase calcium absorption and prevent rickets. Vitamin D-fortified milk is now the major dietary source of vitamin D for many Americans. Other beverages and foods that often are fortified with vitamin D include orange juice, soy beverages,75 and yogurt. Vitamin D also is available as a dietary supplement. As intake increases above 4,000 IU (100 mcg) per day, the potential risk of adverse effects increases.
- **folic acid**. More recently, folic acid fortification of enriched grains was mandated to reduce the incidence of neural tube defects, which are serious birth defects of the brain and spine. Subsequently, folate intake has increased substantially. It is recommended that all women who are capable of becoming pregnant consume 400 mcg per day of folic acid from these fortified foods or from dietary supplements, in addition to eating food sources of folate.
- **vitamin B12**. Foods fortified with the crystalline form of vitamin B12, such as fortified cereals, or vitamin B12 supplements, are encouraged for individuals older than age 50 years. A substantial proportion of these individuals may have reduced ability to absorb naturally occurring vitamin B12, but their ability to absorb the crystalline form is not affected. In addition, vegans should ensure adequate intake of vitamin B12 through fortified foods or supplements.
- **iron supplements for pregnant women**. Iron supplementation during pregnancy is routinely recommended for all pregnant women to help meet their iron requirements. Obstetricians often monitor the need for iron supplementation during pregnancy and provide individualized recommendations to pregnant women.

Sufficient evidence is not available to support a recommendation for or against the use of multivitamin/ mineral supplements in the primary prevention of chronic disease for the healthy American population. Supplements containing combinations of certain nutrients may be beneficial in reducing the risks of some chronic diseases when used by special populations. For example, calcium and vitamin D supplements may be useful in postmenopausal women who have low levels of these nutrients in their diets, to reduce their risk of osteoporosis. In contrast, high levels of certain nutrient supplements may be harmful, if a nutrient's Tolerable Upper Intake Level is exceeded. Supplement use may be discussed with a health care provider to establish need and correct dosage.

**Coping with Food Allergies or Intolerances**Some individuals may have an allergy or intolerance to one or more foods that are part of a healthy eating pattern. Common food allergies include those to milk, eggs, fish, crustacean shellfish, tree nuts, wheat, peanuts, and soybeans. Proteins in these foods trigger an abnormal immune response in persons allergic to the food. In comparison, food intolerances are due to the inability of the body to digest or metabolize a food component. For example, lactose intolerance is caused by a deficiency of the enzyme lactase that breaks down the sugar lactose in milk and milk products.

Because food allergies and food intolerances can cause some of the same symptoms (e.g., stomach cramps, vomiting, and diarrhea), they are often mistaken for one another. Those who think they may have a food allergy or a food intolerance should be medically evaluated to avoid unnecessarily eliminating foods from their diet. Most persons who have a food allergy need to totally eliminate the offending food and ingredients that contain the food's protein from their diet. However, for some food intolerances, like lactose intolerance, smaller portions (e.g., 4 ounces of milk) or a modified version of the offending food (e.g., lactose- reduced or lactose-free milk, yogurt, or cheese) may be well tolerated. More information on food allergies and food intolerances can be found at http://www.niaid.nih.gov/topics/foodallergy/Pages/default.aspx.

## Putting the Principles For a Healthy Eating Pattern Into Action

The principles of a healthy eating pattern can be applied by following one of several templates for healthy eating. The USDA Food Patterns, their lacto-ovo vegetarian or vegan adaptations, and the DASH Eating Plan are illustrations of varied approaches to healthy eating patterns. The USDA

Food Patterns and their vegetarian variations were developed to help individuals carry out Dietary Guidelines recommendations. The DASH Eating Plan, based on the DASH research studies, was developed to help individuals prevent high blood pressure and other risk factors for heart disease.

Compared with average consumption in the United States, these patterns feature increased amounts of vegetables, fruits, beans and peas, whole grains, fat-free and low-fat milk and milk products, and oils, and decreased amounts of solid fats, added sugars, and sodium. They also all feature less red and processed meat and more seafood76 than typical American diets. Table 5-1 shows the amounts consumed from each food group and subgroup in typical American diets, in comparison to amounts in two healthy, traditional Mediterranean-style eating patterns (from Greece and Spain) and the DASH diet used in research studies, all adjusted to a 2,000 calorie intake level, and to the 2,000 calorie USDA Food Pattern. Although the Mediterranean patterns do not specify amounts of whole grains, intake of minimally refined cereal grains is typical for many of these patterns. Amounts of milk and milk products vary in the Mediterranean patterns, but both DASH and USDA patterns contain substantially more milk and milk products than are currently consumed in the United States and focus on fat-free and low-fat versions.

### usda food Patterns

The USDA Food Patterns identify daily amounts of foods, in nutrient-dense forms, to eat from five major food groups and their subgroups (Table 5-2 and Appendices 7, 8, and 9). The patterns also include an allowance for oils and limits on the maximum number of calories that should be consumed from solid fats and added sugars. The food patterns were developed to meet nutrient needs, as identified by the Dietary Reference Intakes and the Dietary Guidelines (Appendix 5), while not exceeding calorie requirements. Though they have not been specifically tested for health benefits, they are similar to the DASH research diet and consistent with most of the measures of adherence to Mediterranean-type eating patterns.

Recommended amounts and limits in the USDA Food Patterns at 12 calorie levels, ranging from 1,000 calories to 3,200 calories, are shown in Appendix 7. Patterns at 1,000, 1,200, and 1,400 calorie levels meet the nutritional needs of children ages 2 to 8 years. Patterns at 1,600 calories and above meet needs for adults and children ages 9 years and older. Individuals should follow a pattern that meets their estimated calorie needs (Appendix 6).

The USDA Food Patterns emphasize selection of most foods in nutrient-dense forms—that is, with little or no solid fats and added sugars. A maximum limit for calories from solid fats and added sugars in each pattern allows for some foods that have a higher level of solid fat, or a small amount of added solid fat or added sugars. Figure 5-2 provides examples of both nutrient-dense and of more typical choices in each food group, and the resulting difference in calorie content. If choices that are not nutrient dense are routinely eaten, total calories will be overconsumed due to increased calories from solid fats and added sugars. If all food and beverage choices were in forms typically consumed rather than nutrient-dense forms, intake from the food groups and oils in the 2,000-calorie pattern would actually be about 2,400 calories, or 400 calories above the target calorie level.

The USDA Food Patterns recommend selecting a variety of foods within each food group. This allows for personal choice, and helps to ensure that the foods and beverages selected by individuals over time provide a mix of nutrients that will meet their needs. Recommended weekly intake amounts are specified for the five vegetable subgroups (dark-green, red and orange, beans and peas, starchy, and other vegetables). In the protein foods group, 8 or more ounces per week of seafood is recommended (less in patterns for young children), and in the grain group, selecting at least half of all grains as whole grains is recommended. In the fruit and dairy groups, there are no quantitative recommendations for making selections within the group. However, selecting more fruit rather than juice, and more fat-free or low-fat vitamin D-fortified milk or yogurt than cheese is encouraged.

**Table 5-1. Eating Pattern Comparison: Usual U.S. Intake, Mediterranean, DASH, and USDA food Patterns, average daily intake at or adjusted to a 2,000 calorie level**

| Pattern | usual U.S. intake adults a | Mediterranean Patterns b<br>greece (g)<br>spain (s) | DASH b | USDA food Pattern |
|---|---|---|---|---|
| food groups | | | | |
| vegetables: total (c) | 1.6 | 1.2 (S) – 4.1 (G) | 2.1 | 2.5 |
| Dark-green (c) | 0.1 | ndc | nd | 0.2 |
| Beans and peas (c) | 0.1 | <0.1 (G) – 0.4 (S) | See protein foods | 0.2 |
| Red and orange (c) | 0.4 | nd | nd | 0.8 |
| Other (c) | 0.5 | nd | nd | 0.6 |

| | | | | |
|---|---|---|---|---|
| Starchy (c) | 0.5 | nd – 0.6 (G) | nd | 0.7 |
| fruit and juices (c) | 1.0 | 1.4 (S) – 2.5 (G) (including nuts) | 2.5 | 2.0 |
| grains: total (oz) | 6.4 | 2.0 (S) – 5.4 (G) | 7.3 | 6.0 |
| Whole grains (oz) | 0.6 | nd | 3.9 | >—3.0 |
| Milk and milk products (dairy products) (c) | 1.5 | 1.0 (G) – 2.1 (S) | 2.6 | 3.0 |
| Protein foods: | | | | |
| Meat (oz) | 2.5 | 3.5 (G) – 3.6 (S) (including poultry) | 1.4 | 1.8 |
| Poultry (oz) | 1.2 | nd | 1.7 | 1.5 |
| Eggs (oz) | 0.4 | nd – 1.9 (S) | nd | 0.4 |
| Fish/seafood (oz) | 0.5 | 0.8 (G) – 2.4 (S) | 1.4 | 1.2 |
| Beans and peas (oz) | See vegetables | See vegetables | 0.4 (0.1 c) | See vegetables |
| Nuts, seeds, and soy products (oz) | 0.5 | See fruits | 0.9 | 0.6 |
| oils (g) | 18 | 19 (S) – 40 (G) | 25 | 27 |
| solid fats (g) | 43 | nd | nd | 16d |
| added sugars (g) | 79 | nd – 24 (G) | 12 | 32d |
| alcohol (g) | 9.9 | 7.1 (S) – 7.9 (G) | nd | nde |

a Source: U.S. Department of Agriculture, Agricultural Research Service and U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. What We Eat In America, NHANES 2001-2004, 1 day mean intakes for adult males and females, adjusted to 2,000 calories and averaged.
b See the DGAC report for additional information and references at www.dietaryguidelines.gov.
c nd = Not determined.
d Amounts of solid fats and added sugars are examples only of how calories from solid fats and added sugars in the USDA Food Patterns could be divided.
e In the USDA Food Patterns, some of the calories assigned to limits for solid fats and added sugars may be used for alcohol consumption instead.

## vegetarian adaptations of the usda food patterns

The USDA Food Patterns allow for additional flexibility in choices through their adaptations for vegetarians—a vegan pattern that contains only plant foods and a lacto-ovo vegetarian pattern that includes milk and milk products and eggs. The adaptations include changes in the protein foods group and, in the vegan adaptation, in the dairy group.

The changes made in the protein foods group at the 2,000 calorie level are shown in Table 5-3. The vegan dairy group includes calcium-fortified beverages and foods commonly used as substitutes for milk and milk products. Complete patterns at all calorie levels are shown in Appendices 8 and 9. These vegetarian variations represent healthy eating patterns, but rely on fortified foods for some nutrients. In the vegan patterns especially, fortified foods provide much of the calcium and vitamin B12, and either fortified foods or supplements should be selected to provide adequate intake of these nutrients.

### dash eating Plan

The DASH Eating Plan was developed based on findings from the DASH research studies. It limits saturated fatty acids and cholesterol and focuses on increasing intake of foods rich in potassium, calcium, magnesium, protein, and fiber. The DASH Eating Plan also is very consistent with Dietary Guidelines recommendations and with most measures of adherence to Mediterranean-type eating patterns. It is rich in fruits, vegetables, fat-free or low-fat milk and milk products, whole grains, fish, poultry, seeds, and nuts. It contains less sodium, sweets, added sugars, and sugar-containing beverages, fats, and red meats than the typical American diet. The DASH Eating Plan food groups77 and amounts recommended at seven calorie levels are shown in Appendix 10. Sample menus for the DASH Eating Plan at the 2,000 calorie level78 provide either 2,300 mg or 1,500 mg of sodium and include nutrient-rich foods to meet other nutrient recommendations.

**Table 5-2. USDA food Patterns—Food Groups and Subgroups**

| food group | subgroups and examples |
|---|---|
| vegetables | dark-green vegetables: All fresh, frozen, and canned dark-green leafy vegetables and broccoli, cooked or raw: for example, broccoli; spinach; romaine; collard, turnip, and mustard greens. |
| | red and orange vegetables: All fresh, frozen, and canned red and orange vegetables, cooked or raw: for example, tomatoes, red peppers, carrots, sweet potatoes, winter squash, and pumpkin. |
| | Beans and peas: All cooked and canned beans and peas: for example, kidney beans, lentils, chickpeas, and pinto beans. Does not include green beans or green peas. (See additional com- ment under protein foods group.) |
| | starchy vegetables: All fresh, frozen, and canned starchy vegetables: for example, white potatoes, corn, and green peas. |
| | other vegetables: All fresh, frozen, and canned other vegetables, cooked or raw: for example, iceberg lettuce, green beans, and onions. |
| fruits | All fresh, frozen, canned, and dried fruits and fruit juices: for example, oranges and orange juice, apples and apple juice, bananas, grapes, melons, berries, and raisins. |
| grains | whole grains: All whole-grain products and whole grains used as ingredients: for example, whole-wheat bread, whole-grain cereals and crackers, oatmeal, and brown rice. |
| | enriched grains: All enriched refined-grain products and enriched refined grains used as ingredients: for example, white breads, enriched grain cereals and crackers, enriched pasta, and white rice. |
| dairy products | All milks, including lactose-free and lactose-reduced products and fortified soy beverages; yogurts; frozen yogurts; dairy desserts; and cheeses. Most choices should be fat-free or low-fat. Cream, sour cream, and cream cheese are not included due to their low calcium content. |

| | |
|---|---|
| Protein foods | All meat, poultry, seafood, eggs, nuts, seeds, and processed soy products. Meat and poultry should be lean or low-fat. Beans and peas are considered part of this group, as well as the vegetable group, but should be counted in one group only. |

## Chapter Summary



This chapter integrates the individual recommendations from each previous chapter of the Dietary Guidelines for Americans, 2010 into healthy eating patterns. Research on overall eating patterns, such as Mediterranean and DASH patterns, has documented the health benefits of following an eating pattern that applies most of these recommendations. The evidence shows that following such an eating pattern can meet a person's nutrient needs within their calorie needs and provide substantial health benefits. The USDA Food Patterns and the DASH Eating Plan apply these Dietary Guidelines recommendations and provide flexible templates for making healthy choices within and among various food groups. They include recommended amounts from all food groups, targets for total calorie intake and limits on calories from solid fats and added sugars. Individuals can use or adapt these healthy eating patterns to suit their personal and cultural preferences.

An overall healthy eating pattern also needs to account for all foods and beverages consumed, whether at home or away from home. Beverages are currently a major source of calories, and many do not provide essential nutrients. Therefore, water or other calorie-free beverages, along with fat-free or low-fat milk and 100% fruit juice, are recommended to meet total water needs.

Because a healthy eating pattern provides for most or all nutrient needs, dietary supplements are recommended only for specific population subgroups or in specific situations. A healthy eating pattern needs to not only promote health and help to decrease the risk of chronic diseases, but it also should prevent foodborne illness, so food safety recommendations need to be followed.

### Notes

71. Dietary Guidelines for Americans, 2010 uses the term "eating pattern," rather than the term "total diet" (the term used in the 2010 DGAC report), to refer to the combination of foods and beverages that constitute an individual's complete dietary intake over time. The term "diet" may be misconstrued as an eating pattern intended for weight loss.

72. Dietary Approaches to Stop Hypertension.

73. Milk and milk products also can be referred to as dairy products.

74. Centers for Disease Control and Prevention. Food Safety Web site. http://www.cdc.gov/foodsafety/. Accessed November 12, 2010.

75. Fortified soy beverages have been marketed as "soymilk," a product name consumers could see in supermarkets and consumer materials. However, FDA's regulations do not contain provisions for the use of the term soymilk. Therefore, in this document, the term "fortified soy beverage" includes products that may be marketed as soymilk.

76. Vegetarian patterns do not include any meat or seafood.

77. Food groups in the DASH Eating Plan are Grains; Vegetables; Fruits; Fat-free or Low-fat Milk and Milk Products; Lean Meats, Poultry, and Fish; and Nuts, Seeds, and Legumes.

78. Sample menus and additional information on the DASH Eating Plan are available at http://www.nhlbi.nih.gov/health/publ...h/new_dash.pdf.

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# 20.15: Dietary Guidelines- Using the Food Label

The Nutrition Facts label and the ingredients list on packages of foods and beverages are useful tools that can help consumers learn about what is in foods and beverages (Figure A4-1). Food labeling can help consumers evaluate and compare the nutritional content and/or the ingredients in foods and beverages. This can help them identify the calorie and nutrient content of a food and select foods with higher or lower amounts of certain nutrients that fit within an overall healthy eating pattern.

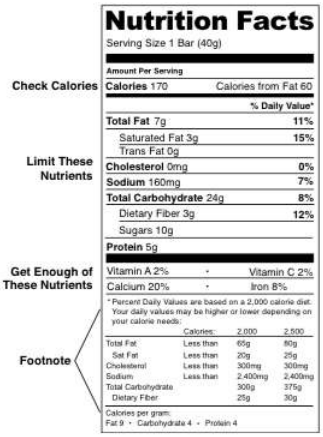



figure a4-1. the nutrition facts label and ingredients list of a granola Bar

ingredients

Granola Bar (Brown Rice Syrup, Granola [rolled oats, honey, canola oil], Dry Roasted Peanuts, Soy Crisps [soy protein isolate, rice flour, malt extract, calcium carbonate], Crisp Brown Rice [organic brown rice flour, evaporated cane juice, molasses, rice bran extract, sea salt], Glycerine, Peanut Butter [ground dry roasted peanuts], Inulin, Whey Protein Isolate, Gold Flax Seeds, Quinoa Flakes, Calcium Carbonate, Salt, Natural Flavors, Water, Soy Lecithin [an emulsifier]), Dark Compound Coating (evaporated cane juice, palm kernel oil, cocoa [processed with alkali], palm oil, soy lecithin [an emulsifier]).

## Nutrition Facts Label

The Nutrition Facts label provides the number of calories that are in a serving of food and the number of servings that are in a package (e.g., can or box). This information can be used to determine how many calories are being consumed from one serving, or from that portion eaten if it is more or less than one serving. For example, if a package contains two servings and the entire package is consumed, then twice the calories and nutrients listed in the Nutrition Facts label are being consumed.

The Nutrition Facts label also provides information on the amount (i.e., grams [g] or milligrams [mg]) per serving of dietary fiber, as well as the amount of certain nutrients that should be limited in the diet, including saturated fat, trans fat, cholesterol, and sodium. It is mandatory for this information to be provided on the Nutrition Facts label.

The label also provides the percent Daily Value for these nutrients (except trans fat and sugars) and several shortfall nutrients, including dietary fiber and calcium. The Daily Value is based on a reference intake level that should be consumed or should not be exceeded. The percent Daily Value can be used to determine whether a serving of a food contributes a lot or a little of a particular nutrient and provides information on how a serving of the food fits in the context of a total daily diet. The higher the percent Daily Value, the more that serving of food contributes to an individual's intake of a specific nutrient. Foods that are "low" in a nutrient generally contain less than 5 percent of the Daily Value. Foods that are a "good" source of a nutrient generally contain 10 to 19

percent of the Daily Value per serving. Foods that are “high” or “rich” in or are an “excellent” source of a nutrient generally contain 20 percent or more of the Daily Value per serving.

The footnote at the bottom of the Nutrition Facts label provides the Daily Values for total fat, saturated fat, cholesterol, sodium, total carbohydrate, and fiber, based on a 2,000 or 2,500 calorie diet. The Daily Value for these nutrients, other than cholesterol and sodium, would be higher or lower depending on an individual’s calorie needs (e.g., the lower one’s calorie needs, the lower the Daily Value for the particular nutrients).

Solid fats are not specified on the Nutrition Facts label. However, consumers can look at the saturated fat and trans fat content of a food in the Nutrition Facts label for a rough estimate of the amount of solid fat in it. Foods that are low in saturated fats or contain zero grams of trans fats contain low amounts of solid fats. The ingredients list (see below) also can be used to help identify foods that contain solid fats.

The Nutrition Facts label provides the total amount of sugars (natural and added), but does not list added sugars separately. Natural sugars are found mainly in fruit and milk products. Therefore, for all foods that do not contain any fruit or milk ingredients, the total amount of sugars listed in the Nutrition Facts label approximates the amount of added sugars. For foods that contain fruit or milk products, added sugars can be identified in the ingredients list.

## ingredients list

The ingredients list can be used to find out whether a food or beverage contains synthetic trans fats, solid fats, added sugars, whole grains, and refined grains. Ingredients are listed in the order of weight; that is, the ingredient with the greatest contribution to the product weight is listed first and the ingredient contributing the least is listed last (Figure A4-1). The ingredients list is usually located near the name of the food’s manufacturer and often under the Nutrition Facts label.

### trans fats

Although the amount by weight of trans fat is provided on the Nutrition Facts label, the ingredients list can help identify the type of trans fat in the food (i.e., synthetic vs. natural). Synthetic trans fats can be produced during the hydrogenation of oils (see Chapter 3). If the ingredients list includes partially hydrogenated oils, then the product is likely to contain trans fatty acids.

### oils, solid fats, and added sugars

To determine whether foods contain oils or solid fats, consumers can read the ingredients list to make sure that fats in the foods are oils containing primarily unsaturated fatty acids and that solid fats are not one of the first few ingredients. Examples of unsaturated oils that may be listed as an ingredient are provided in Chapter 3, Figure 3-3. Examples of solid fats that may be used in the ingredients list are provided in Table A4-1. The ingredients list can be used in the same way to identify foods that are high in added sugars. Added sugars that are often used as ingredients are provided in Table A4-2.

| Table A4-1. Examples of Solid Fats (a) That Can Be Listed As An Ingredient |
|---|
| Beef fat (tallow, suet) |
| Butter |
| Chicken fat |
| Coconut oil |
| Cream |
| Hydrogenated oils |
| Palm kernel oil |

| |
|---|
| Palm oil |
| Partially hydrogenated oils |
| Pork fat (lard) |
| Shortening |
| Stick margarine |
| a. The oils listed here are high in saturated fat, and partially hydrogenated oils contain trans fat; therefore, for nutritional purposes, these oils are considered solid fats. |

### whole grains

The ingredients list also can be used to find out if a food contains whole grains. Whole grains are consumed either as a single food (e.g., wild rice or popcorn) or as a food that contains whole grains as an ingredient (e.g., cereals, breads, and crackers). If whole grains are the primary ingredient listed, the food could be considered a 100% whole-grain food. The relative amount of grain in the food is important and can be inferred by placement of the grain in the ingredients list. The whole grain should be the first or second ingredient, after water. For foods with multiple whole-grain ingredients, they should appear near the beginning of the ingredients list. Examples of whole grains that can be listed as an ingredient are provided in Table A4-3.

Table A4-2. Examples of Added Sugars That Can Be Listed as an Ingredient

| | |
|---|---|
| Anhydrous dextrose | Lactose |
| Brown sugar | Malt syrup |
| Confectioner’s powdered sugar | Maltose |
| Corn syrup | Maple syrup |
| Corn syrup solids | Molasses |
| Dextrin | Nectars (e.g., peach nectar, pear nectar) |
| Fructose | Pancake syrup |
| High-fructose corn syrup | Raw sugar |
| Honey | Sucrose |
| Invert sugar | Sugar |
| | White granulated sugar |

Other added sugars may be listed as an ingredient but are not recognized by FDA as an ingredient name. These include cane juice, evaporated corn sweetener, fruit juice concentrate, crystal dextrose, glucose, liquid fructose, sugar cane juice, and fruit nectar.

Some foods are labeled “made with whole grains.” Although some foods are labeled as being a “good source of whole grains,” no definition for a “good” or “excellent” source of whole grains has been established. Foods in which a substantial proportion of the grain ingredients are whole grains can help consumers increase their whole-grain intake (see Chapter 4). Many, but not all whole-grain products are good or excellent sources of dietary fiber. Use the Nutrition Facts label on whole-grain products to choose foods that are a good or excellent source of dietary fiber. For example, Figure A4-1 shows that the granola bar is a good source (12% of the Daily Value) of dietary fiber.

Table A4-3. Examples of Whole Grains That Can Be Listed As An Ingredient

| | |
|---|---|
| Brown rice | Whole-grain sorghum |
| Buckwheat | Whole-grain triticale |
| Bulgur (cracked wheat) | Whole-grain barley |
| Millet | Whole-grain corn |
| Oatmeal | Whole oats/oatmeal |
| Popcorn | Whole rye |
| Quinoa | Whole wheat |
| Rolled oats | Wild rice |

## refined grains

When refined grains (e.g., white bread and white rice) are consumed, they should be enriched. Often the package will state that it is “enriched.” The ingredients list also can be used to determine whether a refined grain has been enriched with iron, thiamin, riboflavin, niacin, and fortified with folic acid.

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# 20.16: Discussion- Grocery Shopping

## Purpose

You will research and compare the nutritional characteristics and affordability of foods from various sources. You will discuss this information with your classmates.

## Directions

Go to discussion board to complete this assignment. You will need to complete an independent experiment and then answer these questions based on your findings:

- Pretend I gave you ten dollars to purchase food (in this pretend world there is no such thing as taxes).
- Go to a fast food restaurant, look at the menu, and see how much you can purchase (I am not encouraging you to buy anything and I hope you will not).
- Your items should include something to eat and something to drink. Make a list of everything you could buy.
- Then, go to a grocery store and see how much you can purchase for the same ten dollars (again, I am not encouraging you to buy anything and you do not need to buy anything to complete this assignment). Again, make a list of everything you could buy.
- For comparative purposes, the end meals should be as similar as possible. To make your comparison easier to see (for you and for your classmates), it is best to make your lists either side by side or one right after the other (a chart is a very good idea) before you begin your discussion.
- Your discussion and comparison should include the approximate number of meals/servings you could make from your purchases, and should also address any differences in calories between the two.
- Also suggest a similar but healthier alternative to these meals.
- Submit your original response.
- Respond to 2 of your classmates' discussions. No attachments, please!

Note: You will not be able to see your classmates' discussions until you post your own.

### Grading

This assignment is worth 10 points maximum. Your grade will be assessed based on the Grocery Shopping Grading Rubric:

| Criteria | Novice | Competent | Proficient |
|---|---|---|---|
| Original entry | 0 points | 3.5 points<br>Up to 3.5 points if submitted late or missing parts. | 7 points<br>Thorough entry submitted by the deadline. The entry must include food/drink items from both locations (fast food restaurant and grocery store) and the comparison addressing all discussion points listed in the assignment instructions. |
| Response to two classmates | 0 points | 1 Point<br>Up to 1 point if late or response to one classmate only | 2 Points<br>Well-constructed responses to two classmates addressing the classmate original posting and submitted by the deadline. |
| Grammar and organization | 0 points | 0 points | 1 Point |

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# 20.17: Assessment- Food Tracker

## Directions

For one weekday (select a day that reflects how you normally eat), record all food and liquid you consume. Don't forget about snacks, sodas, and high calorie condiments such as mayonnaise. Then, analyze your intake:

- Go to the USDA SuperTracker website and select the Food Tracker.
- Create a profile and follow the site directions to input your food data into the Food Tracker (write your user name and password somewhere so you do not forget them). You will use your data to compile two reports. First, click on "My Reports" at the top of the page and select the "Food Groups and Calories" report. Create your report and export it as a .pdf file. Then, select "Nutrients Reports," create your report and save it as a .pdf file.
- Once you have compiled these reports, in a separate document write your reflections about your information. In your reflections, answer the following questions:
    - What was your daily caloric intake? Did you exceed your recommended caloric intake? Did you meet your fruit and vegetable recommendation? Did you meet your fiber requirement? If not, what could you do to improve? How much saturated fat did you consume? Did you exceed the recommendation? Did you consume too much sodium? Enough calcium? Did you consume too much cholesterol? How many empty calories did you consume? Did you exceed your empty calorie limit? Are you happy with the overall results of the analysis? What do you need to change about your diet?
- There will be three separate documents for this assignment: two pdf files (your reports) and one Word document (your reflections).
- Upload all three directly via the link above **in the same submission.**

## Grading

This assignment is worth 10 points maximum. Your work will be assessed using the following Nutrition Analysis Grading Rubric:

| Criteria | Absent | Incomplete | Complete |
|---|---|---|---|
| Food groups and calories report | 0 Points | 0 Points | 2 Points |
| Nutrients report | 0 Points | 0 Points | 2 Points |
| Reflection | 0 Points | 2.5 Points<br>Up to 2.5 if missing answers to some of the questions listed in the assignment instructions | 5 Points<br>Well thought out reflection addressing all questions listed in the instructions. If you score poorly in one or more sections, be specific about the strategies you will use to correct the problem. For instance: write consume more yogurt, rather than consume more calcium; write limit frozen dinners (which are high in sodium), rather than decrease sodium consumption. When you name the food you create a more specific strategy. |

| | | | |
|---|---|---|---|
| Results make sense | 0 Points | 0 Points | 1 Point<br>Always make sure your results make sense. If your caloric intake for the day was 600 kcal for example, go back and see if you forgot to enter one or more of your meals/snacks. If you were sick and did not eat much all day, this is not a good day to select for this assignment (see instructions). If your daily calorie intake really is abnormally low (or high), please address it in the reflections so that I know you are aware of it and that you did not simply make a mistake when entering the data. |

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# CHAPTER OVERVIEW

## 21: Introduction


21.1: Unit 1 Overview and Objectives
21.2: Reading Links- Introduction
21.3: Adding Physical Activity to Your Life
21.4: Assessment- Safety of Exercise Participation
21.5: Assessment- Time Management


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# 21.1: Unit 1 Overview and Objectives

**Overview**

As with any journey, it is easier to get started if you prepare appropriately. The assessments in Unit 1 will help you do just that.

**Learning Objectives**

At the end of unit, you will be able to:

- Determine your compatibility with distance learning
- Identify course related policies and procedures
- Identify health characteristics that affect exercise safety
- Differentiate between physical activity and exercise
- Evaluate your current dimensions of wellness
- List behaviors that contribute to a wellness lifestyle and how your behaviors compare with them
- Describe the stages of behavior change and determine your stage for several wellness-related behaviors
- Identify the strategies in creating an individualized plan to change a wellness-related behavior

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# 21.2: Reading Links- Introduction

## Purpose

Before you can move forward in this class, it's important that you understand the basic definitions of physical activity and exercise. In addition, the article below lists some of the common barriers to physical activity and how to overcome them.

## Directions

- Read the following article: Barriers to Physical Activity (Brinks, Jenna & Franklin, Barry "Physical Activity, Barriers to" *Encyclopedia of Lifestyle Medicine & Health*. Ed. James M. Rippe Vol. 2 Thousand Oaks: SAGE, 2012. 863-872. *Gale Virtual Reference Library.*

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# 21.3: Adding Physical Activity to Your Life

## Overcoming Barriers to Physical Activity

Given the health benefits of regular physical activity, we might have to ask why two out of three (60%) Americans are not active at recommended levels.

Many technological advances and conveniences that have made our lives easier and less active, as well as many personal variables, including physiological, behavioral, and psychological factors, may affect our plans to become more physically active. In fact, the 10 most common reasons adults cite for not adopting more physically active lifestyles are (Sallis and Hovell, 1990; Sallis et al., 1992):

- Do not have enough time to exercise
- Find it inconvenient to exercise
- Lack self-motivation
- Do not find exercise enjoyable
- Find exercise boring
- Lack confidence in their ability to be physically active (low self-efficacy)
- Fear being injured or have been injured recently
- Lack self-management skills, such as the ability to set personal goals, monitor progress, or reward progress toward such goals
- Lack encouragement, support, or companionship from family and friends, and
- Do not have parks, sidewalks, bicycle trails, or safe and pleasant walking paths convenient to their homes or offices.

Understanding common barriers to physical activity and creating strategies to overcome them may help you make physical activity part of your daily life.

| Suggestions for Overcoming Physical Activity Barriers | |
|---|---|
| Lack of time | Identify available time slots. Monitor your daily activities for one week. Identify at least three 30-minute time slots you could use for physical activity. |
| | Add physical activity to your daily routine. For example, walk or ride your bike to work or shopping, organize school activities around physical activity, walk the dog, exercise while you watch TV, park farther away from your destination, etc. |
| | Select activities requiring minimal time, such as walking, jogging, or stairclimbing. |
| **Social influence** | Explain your interest in physical activity to friends and family. Ask them to support your efforts. |
| | Invite friends and family members to exercise with you. Plan social activities involving exercise. |
| | Develop new friendships with physically active people. Join a group, such as the YMCA or a hiking club. |
| **Lack of energy** | Schedule physical activity for times in the day or week when you feel energetic. |
| | Convince yourself that if you give it a chance, physical activity will increase your energy level; then, try it. |
| **Lack of motivation** | Plan ahead. Make physical activity a regular part of your daily or weekly schedule and write it on your calendar. |
| | Invite a friend to exercise with you on a regular basis and write it on both your calendars. |

| | |
|---|---|
| | Join an exercise group or class. |
| **Fear of injury** | Learn how to warm up and cool down to prevent injury. |
| | Learn how to exercise appropriately considering your age, fitness level, skill level, and health status. |
| | Choose activities involving minimum risk. |
| **Lack of skill** | Select activities requiring no new skills, such as walking, climbing stairs, or jogging. |
| | Take a class to develop new skills. |
| **Lack of resources** | Select activities that require minimal facilities or equipment, such as walking, jogging, jumping rope, or calisthenics. |
| | Identify inexpensive, convenient resources available in your community (community education programs, park and recreation programs, worksite programs, etc.). |
| **Weather conditions** | Develop a set of regular activities that are always available regardless of weather (indoor cycling, aerobic dance, indoor swimming, calisthenics, stair climbing, rope skipping, mall walking, dancing, gymnasium games, etc.) |
| **Travel** | Put a jump rope in your suitcase and jump rope. |
| | Walk the halls and climb the stairs in hotels. |
| | Stay in places with swimming pools or exercise facilities. |
| | Join the YMCA or YWCA (ask about reciprocal membership agreement). |
| | Visit the local shopping mall and walk for half an hour or more. |
| | Bring your mp3 player your favorite aerobic exercise music. |
| **Family obligations** | Trade babysitting time with a friend, neighbor, or family member who also has small children. |
| | Exercise with the kids-go for a walk together, play tag or other running games, get an aerobic dance or exercise tape for kids (there are several on the market) and exercise together. You can spend time together and still get your exercise. |
| | Jump rope, do calisthenics, ride a stationary bicycle, or use other home gymnasium equipment while the kids are busy playing or sleeping. |
| | Try to exercise when the kids are not around (e.g., during school hours or their nap time). |
| **Retirement years** | Look upon your retirement as an opportunity to become more active instead of less. Spend more time gardening, walking the dog, and playing with your grandchildren. Children with short legs and grandparents with slower gaits are often great walking partners. |
| | Learn a new skill you've always been interested in, such as ballroom dancing, square dancing, or swimming. |

| | |
|---|---|
| | Now that you have the time, make regular physical activity a part of every day. Go for a walk every morning or every evening before dinner. Treat yourself to an exercycle and ride every day while reading a favorite book or magazine. |

Content in the “Personal Barriers” section was taken from *Promoting Physical Activity: A Guide for Community Action*(USDHHS, 1999).

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# 21.4: Assessment- Safety of Exercise Participation

To complete the assignment,

1. Go to the Canadian Society of Exercise Physiology webpage below and read the Physical Activity Readiness Questionnaire (PAR-Q),

http://www.csep.ca/cmfiles/publications/parq/par-q.pdf

2. Open a Word document and summarize the information from the PAR-Q (for example, I answered “yes” to __ questions and “no” to __ questions). If you answer “Yes” to one or more questions, you may need to consult with your healthcare provider prior to beginning the exercise phase. **Therefore, explain any “Yes” answers and if you have already been cleared by your healthcare provider to exercise**. To submit the assignment,

3. Save the document and upload it to the course. **This assignment is worth 5 points maximum.**

Note: You must complete the PAR-Q before you engage in any physical activity related to this course. Failure to submit this assignment will prevent the release of your assignment grades and your grade for the course. Submission of this assignment indicates that you have read and understand the Health & Safety information.

| Criteria | Answer absent | Answer present |
|---|---|---|
| Question #1 | 0 Points | **0.8 Points** If your answer is “yes” you must further explain the answer and if you have been cleared by a health care provider to exercise. Otherwise you will not receive credit for the answer. |
| Question #2 | 0 Points | **0.7 Points** If your answer is “yes” you must further explain the answer and if you have been cleared by a health care provider to exercise. Otherwise you will not receive credit for the answer. |
| Question #3 | 0 Points | **0.7 Points** If your answer is “yes” you must further explain the answer and if you have been cleared by a health care provider to exercise. Otherwise you will not receive credit for the answer. |
| Question #4 | 0 Points | **0.7 Points** If your answer is “yes” you must further explain the answer and if you have been cleared by a health care provider to exercise. Otherwise you will not receive credit for the answer. |

| | | |
|---|---|---|
| Question #5 | 0 Points | **0.7 Points**<br>If your answer is “yes” you must further explain the answer and if you have been cleared by a health care provider to exercise. Otherwise you will not receive credit for the answer. |
| Question #6 | 0 Points | **0.7 Points**<br>If your answer is “yes” you must further explain the answer and if you have been cleared by a health care provider to exercise. Otherwise you will not receive credit for the answer. |
| Question #7 | 0 Points | **0.7 Points**<br>If your answer is “yes” you must further explain the answer and if you have been cleared by a health care provider to exercise. Otherwise you will not receive credit for the answer. |

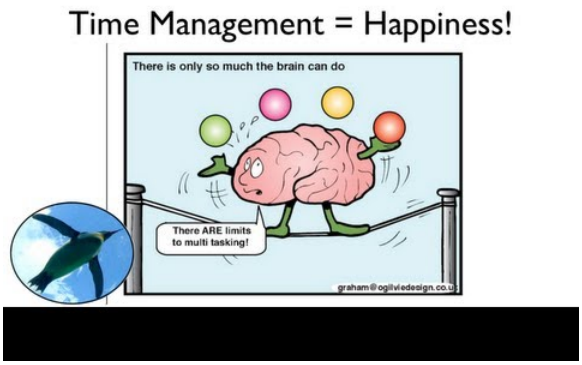
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# 21.5: Assessment- Time Management

Students' lives can be very stressful and being able to manage your time effectively is essential. Watch the video below and complete the time management assessment below.




A YouTube element has been excluded from this version of the text. You can view it online here: http://pb.libretexts.org/w/?p=298

For this assessment, keep track of your activities for one typical weekday and one typical weekend day. Then, provide the following information for each day (note: you do not have to submit the actual tracking record that you kept):

Amount of time per day spent sleeping:

Amount of time per day spent on personal care and family responsibilities;

Amount of time per day spent working:

Amount of time per day spent on school assignments:

Amount of time per day spent on social activities, including social media:

Are you overscheduled or do you need to prioritize your time differently? If yes, where can you make changes?

It is okay to just provide categories (Sleeping, Personal, Work, School, Social) and the amount of time before answering the final question. Upload your responses to Blackboard. **The assessment is worth a maximum of 5 points.**

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- How to Manage Time, Reduce Stress and Increase Happiness. **Authored by**: ThePenguinProf. **Located at**: https://youtu.be/N4YVLkuRBe8. **License**: *All Rights Reserved*. **License Terms**: Standard YouTube License

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# CHAPTER OVERVIEW

## 22: Muscle Strength and Endurance


22.1: Muscle Strength and Endurance Reading
22.2: Types of Muscle Tissues
22.3: Skeletal Muscle
22.4: Muscle Fiber Contraction and Relaxation
22.5: SELF-CHECK QUESTIONS- Muscle Fiber Contraction and Relaxation
22.6: Nervous System Control of Muscle Tension
22.7: Types of Muscle Fibers
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22.16: Effect of Exercise on Muscles
22.17: Muscular Atrophy and Hypertrophy
22.18: Exercise-Induced Muscle Damage
22.19: Aerobic Training versus Strength Training
22.20: Videos- Muscle Groups and Strength Training



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# 22.1: Muscle Strength and Endurance Reading

## Purpose

This section will focus on the last two components of fitness: muscular strength and muscular endurance.

## Directions

The rest of this chapter contains your reading for this section.

Additionally, information on these external sources will be useful to deepen your understanding:

- ACSM:Delayed Onset Muscle Soreness (DOMS)
- Read Musculoskeletal Fitness (Kravitz, Len. “Musculoskeletal Fitness.” *Encyclopedia of Lifestyle Medicine & Health*. Ed. James M. Rippe. Vol. 2. Thousand Oaks, CA: SAGE Reference, 2012. 734-737. *Gale Virtual Reference Library*. Retrieved from http://go.galegroup.com/ps/i.do?id=G...9e21e93a586875)

This article explains in detail the benefits of improving musculoskeletal fitness.

- Review sections one, two, and four in this document: Health-Related Fitness Overview

You have already read this document before. Therefore, this time you can focus specifically on the information about muscular strength, muscular endurance, and resistance training.

- Resistance exercise videos

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# 22.2: Types of Muscle Tissues



Figure 10.1. Tennis Player Athletes rely on toned skeletal muscles to supply the force required for movement. (credit: Emmanuel Huybrechts/flickr)

## Introduction

### Learning Objectives

- Explain the organization of muscle tissue
- Describe the function and structure of skeletal, cardiac muscle, and smooth muscle
- Explain how muscles work with tendons to move the body
- Describe how muscles contract and relax
- Define the process of muscle metabolism
- Explain how the nervous system controls muscle tension
- Relate the connections between exercise and muscle performance
- Explain the development and regeneration of muscle tissue

When most people think of muscles, they think of the muscles that are visible just under the skin, particularly of the limbs. These are skeletal muscles, so-named because most of them move the skeleton. But there are two other types of muscle in the body, with distinctly different jobs. Cardiac muscle, found in the heart, is concerned with pumping blood through the circulatory system. Smooth muscle is concerned with various involuntary movements, such as having one's hair stand on end when cold or frightened, or moving food through the digestive system. This chapter will examine the structure and function of these three types of muscles.

## Overview of Muscle Tissues

### Learning Objectives

- Describe the different types of muscle
- Explain contractibility and extensibility

Muscle is one of the four primary tissue types of the body, and the body contains three types of muscle tissue: skeletal muscle, cardiac muscle, and smooth muscle (Figure 10.2). All three muscle tissues have some properties in common; they all exhibit a quality called ***excitability*** as their plasma membranes can change their electrical states (from polarized to depolarized) and send an electrical wave called an action potential along the entire length of the membrane. While the nervous system can influence the excitability of cardiac and smooth muscle to some degree, skeletal muscle completely depends on signaling from the nervous system to work properly. On the other hand, both cardiac muscle and smooth muscle can respond to other stimuli, such as hormones and local stimuli.

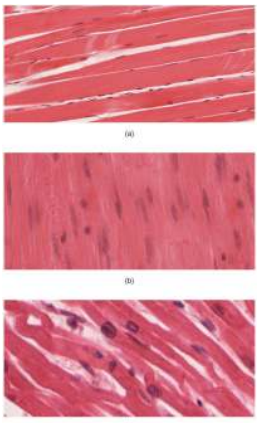


*Figure 10.2. The Three Types of Muscle Tissue*
*The body contains three types of muscle tissue: (a) skeletal muscle, (b) smooth muscle, and (c) cardiac muscle. From top, LM × 1600, LM × 1600, LM × 1600. (Micrographs provided by the Regents of University of Michigan Medical School © 2012)*

The muscles all begin the actual process of contracting (shortening) when a protein called actin is pulled by a protein called myosin. This occurs in striated muscle (skeletal and cardiac) after specific binding sites on the actin have been exposed in response to the interaction between calcium ions ($Ca^{++}$) and proteins (troponin and tropomyosin) that "shield" the actin-binding sites. $Ca^{++}$ also is required for the contraction of smooth muscle, although its role is different: here $Ca^{++}$ activates enzymes, which in turn activate myosin heads. All muscles require adenosine triphosphate (ATP) to continue the process of contracting, and they all relax when the $Ca^{++}$ is removed and the actin-binding sites are re-shielded.

A muscle can return to its original length when relaxed due to a quality of muscle tissue called ***elasticity***. It can recoil back to its original length due to elastic fibers. Muscle tissue also has the quality of ***extensibility***; it can stretch or extend. ***Contractility*** allows muscle tissue to pull on its attachment points and shorten with force.

Differences among the three muscle types include the microscopic organization of their contractile proteins—actin and myosin. The actin and myosin proteins are arranged very regularly in the cytoplasm of individual muscle cells (referred to as fibers) in both skeletal muscle and cardiac muscle, which creates a pattern, or stripes, called striations. The striations are visible with a light microscope under high magnification (see Figure 10.2). ***Skeletal muscle*** fibers are multinucleated structures that compose the skeletal muscle. *Cardiac muscle*Home fibers each have one to two nuclei and are physically and electrically connected to each other so that the entire heart contracts as one unit (called a syncytium).

Because the actin and myosin are not arranged in such regular fashion in ***smooth muscle***, the cytoplasm of a smooth muscle fiber (which has only a single nucleus) has a uniform, nonstriated appearance (resulting in the name smooth muscle). However, the less organized appearance of smooth muscle should not be interpreted as less efficient. Smooth muscle in the walls of arteries is a critical component that regulates blood pressure necessary to push blood through the circulatory system; and smooth muscle in the skin, visceral organs, and internal passageways is essential for moving all materials through the body.

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# 22.3: Skeletal Muscle

## Learning Objectives

- Describe the layers of connective tissues packaging skeletal muscle
- Explain how muscles work with tendons to move the body
- Identify areas of the skeletal muscle fibers
- Describe excitation-contraction coupling

The best-known feature of skeletal muscle is its ability to contract and cause movement. Skeletal muscles act not only to produce movement but also to stop movement, such as resisting gravity to maintain posture. Small, constant adjustments of the skeletal muscles are needed to hold a body upright or balanced in any position. Muscles also prevent excess movement of the bones and joints, maintaining skeletal stability and preventing skeletal structure damage or deformation. Joints can become misaligned or dislocated entirely by pulling on the associated bones; muscles work to keep joints stable. Skeletal muscles are located throughout the body at the openings of internal tracts to control the movement of various substances. These muscles allow functions, such as swallowing, urination, and defecation, to be under voluntary control. Skeletal muscles also protect internal organs (particularly abdominal and pelvic organs) by acting as an external barrier or shield to external trauma and by supporting the weight of the organs.

Skeletal muscles contribute to the maintenance of homeostasis in the body by generating heat. Muscle contraction requires energy, and when ATP is broken down, heat is produced. This heat is very noticeable during exercise, when sustained muscle movement causes body temperature to rise, and in cases of extreme cold, when shivering produces random skeletal muscle contractions to generate heat.

Each skeletal muscle is an organ that consists of various integrated tissues. These tissues include the skeletal muscle fibers, blood vessels, nerve fibers, and connective tissue. Each skeletal muscle has three layers of connective tissue (called “mysia”) that enclose it and provide structure to the muscle as a whole, and also compartmentalize the muscle fibers within the muscle (Figure 10.3). Each muscle is wrapped in a sheath of dense, irregular connective tissue called the *epimysium*, which allows a muscle to contract and move powerfully while maintaining its structural integrity. The epimysium also separates muscle from other tissues and organs in the area, allowing the muscle to move independently.

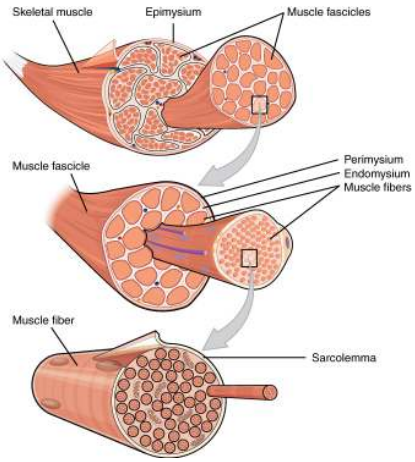



Figure 10.3. The Three Connective Tissue Layers Bundles of muscle fibers, called fascicles, are covered by the perimysium. Muscle fibers are covered by the endomysium.

Inside each skeletal muscle, muscle fibers are organized into individual bundles, each called a ***fascicle***, by a middle layer of connective tissue called the ***perimysium***. This fascicular organization is common in muscles of the limbs; it allows the nervous system to trigger a specific movement of a muscle by activating a subset of muscle fibers within a bundle, or fascicle of the muscle. Inside each fascicle, each muscle fiber is encased in a thin connective tissue layer of collagen and reticular fibers called the ***endomysium***. The endomysium contains the extracellular fluid and nutrients to support the muscle fiber. These nutrients are supplied via blood to the muscle tissue.

In skeletal muscles that work with tendons to pull on bones, the collagen in the three tissue layers (the mysia) intertwines with the collagen of a tendon. At the other end of the tendon, it fuses with the periosteum coating the bone. The tension created by contraction of the muscle fibers is then transferred though the mysia, to the tendon, and then to the periosteum to pull on the bone for movement of the skeleton. In other places, the mysia may fuse with a broad, tendon-like sheet called an ***aponeurosis***, or to fascia, the connective tissue between skin and bones. The broad sheet of connective tissue in the lower back that the latissimus dorsi muscles (the “lats”) fuse into is an example of an aponeurosis.

Every skeletal muscle is also richly supplied by blood vessels for nourishment, oxygen delivery, and waste removal. In addition, every muscle fiber in a skeletal muscle is supplied by the axon branch of a somatic motor neuron, which signals the fiber to contract. Unlike cardiac and smooth muscle, the only way to functionally contract a skeletal muscle is through signaling from the nervous system.

## Skeletal Muscle Fibers

Because skeletal muscle cells are long and cylindrical, they are commonly referred to as muscle fibers. Skeletal muscle fibers can be quite large for human cells, with diameters up to 100 $\mu$m and lengths up to 30 cm (11.8 in) in the Sartorius of the upper leg. During early development, embryonic

myoblasts, each with its own nucleus, fuse with up to hundreds of other myoblasts to form the multinucleated skeletal muscle fibers. Multiple nuclei mean multiple copies of genes, permitting the production of the large amounts of proteins and enzymes needed for muscle contraction.

Some other terminology associated with muscle fibers is rooted in the Greek *sarco*, which means "flesh." The plasma membrane of muscle fibers is called the ***sarcolemma***, the cytoplasm is referred to as ***sarcoplasm***, and the specialized smooth endoplasmic reticulum, which stores, releases, and retrieves calcium ions ($Ca^{++}$) is called the ***sarcoplasmic reticulum (SR)*** (Figure 10.4). As will soon be described, the functional unit of a skeletal muscle fiber is the sarcomere, a highly organized arrangement of the contractile myofilaments ***actin***Home (thin filament) and ***myosin*** (thick filament), along with other support proteins.

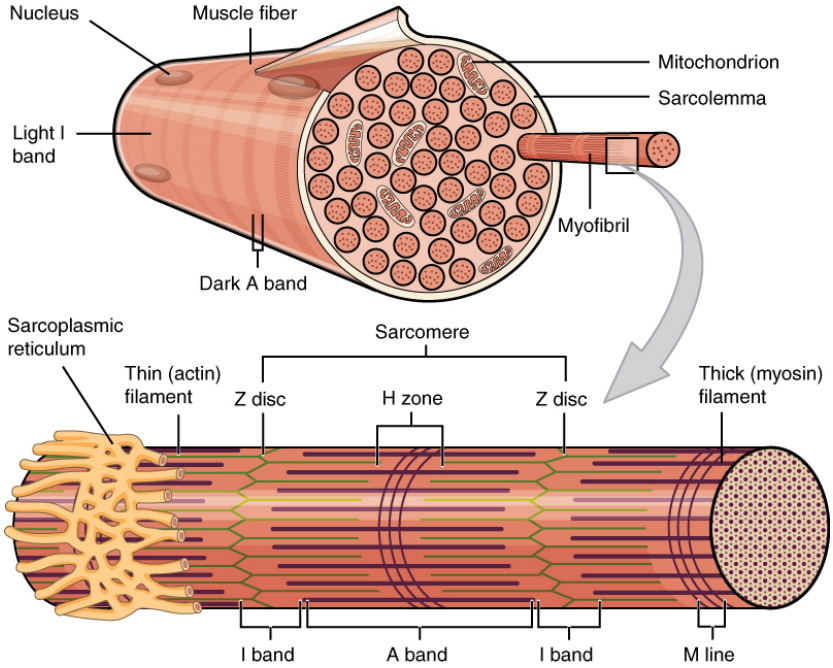



Figure 10.4. Muscle Fiber A skeletal muscle fiber is surrounded by a plasma membrane called the sarcolemma, which contains sarcoplasm, the cytoplasm of muscle cells. A muscle fiber is composed of many fibrils, which give the cell its striated appearance.

## The Sarcomere

The striated appearance of skeletal muscle fibers is due to the arrangement of the myofilaments of actin and myosin in sequential order from one end of the muscle fiber to the other. Each packet of these microfilaments and their regulatory proteins, ***troponin*** and ***tropomyosin*** (along with other proteins) is called a ***sarcomere***.

## Interactive Link

Watch this video to learn more about macro- and microstructures of skeletal muscles. (a) What are the names of the "junction points" between sarcomeres? (b) What are the names of the "subunits" within the myofibrils that run the length of skeletal muscle fibers? (c) What is the "double strand of pearls" described in the video? (d) What gives a skeletal muscle fiber its striated appearance?

The sarcomere is the functional unit of the muscle fiber. The sarcomere itself is bundled within the myofibril that runs the entire length of the muscle fiber and attaches to the sarcolemma at its end. As myofibrils contract, the entire muscle cell contracts. Because myofibrils are only approximately 1.2 $\mu$m in diameter, hundreds to thousands (each with thousands of sarcomeres) can be found inside one muscle fiber. Each sarcomere is approximately 2 $\mu$m in length with a three-dimensional cylinder-like arrangement and is bordered by structures called Z-discs (also called Z-lines, because pictures are two-dimensional), to which the actin myofilaments are anchored (Figure 10.5). Because the actin and its troponin-tropomyosin complex (projecting from the Z-discs toward the center of the sarcomere) form strands that are thinner than the myosin, it is called the ***thin filament*** of the sarcomere. Likewise, because the myosin strands and their multiple heads (projecting from the center of the sarcomere, toward but not all to way to, the Z-discs) have more mass and are thicker, they are called the ***thick filament*** of the sarcomere.

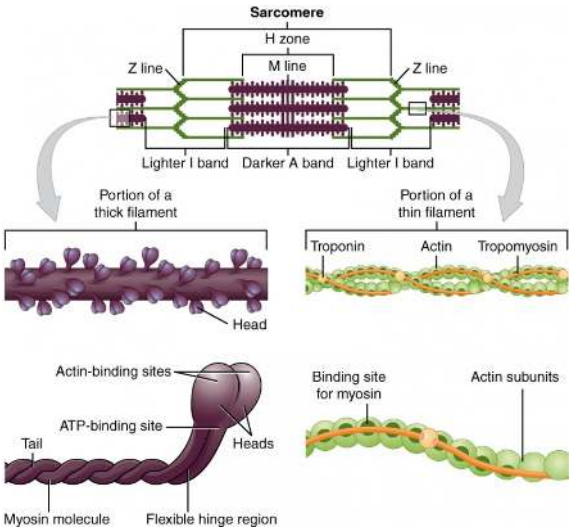



Figure 10.5. The Sarcomere The sarcomere, the region from one Z-line to the next Z-line, is the functional unit of a skeletal muscle fiber.

## The Neuromuscular Junction

Another specialization of the skeletal muscle is the site where a motor neuron's terminal meets the muscle fiber—called the ***neuromuscular junction (NMJ)***. This is where the muscle fiber first responds to signaling by the motor neuron. Every skeletal muscle fiber in every skeletal muscle is innervated by a motor neuron at the NMJ. Excitation signals from the neuron are the only way to functionally activate the fiber to contract.

## Interactive Link

Every skeletal muscle fiber is supplied by a motor neuron at the NMJ. Watch this video to learn more about what happens at the NMJ. (a) What is the definition of a motor unit? (b) What is the structural and functional difference between a large motor unit and a small motor unit? (c) Can you give an example of each? (d) Why is the neurotransmitter acetylcholine degraded after binding to its receptor?

## Excitation-Contraction Coupling

All living cells have membrane potentials, or electrical gradients across their membranes. The inside of the membrane is usually around -60 to -90 mV, relative to the outside. This is referred to as a cell's membrane potential. Neurons and muscle cells can use their membrane potentials to generate electrical signals. They do this by controlling the movement of charged particles, called ions, across their membranes to create electrical currents. This is achieved by opening and closing specialized proteins in the membrane called ion channels. Although the currents generated by ions moving through these channel proteins are very small, they form the basis of both neural signaling and muscle contraction.

Both neurons and skeletal muscle cells are electrically excitable, meaning that they are able to generate action potentials. An action potential is a special type of electrical signal that can travel along a cell membrane as a wave. This allows a signal to be transmitted quickly and faithfully over long distances.

Although the term ***excitation-contraction coupling*** confuses or scares some students, it comes down to this: for a skeletal muscle fiber to contract, its membrane must first be "excited"—in other words, it must be stimulated to fire an action potential. The muscle fiber action potential, which sweeps along the sarcolemma as a wave, is "coupled" to the actual contraction through the release of calcium ions ($Ca^{++}$) from the SR. Once released, the $Ca^{++}$ interacts with the shielding proteins, forcing them to move aside so that the actin-binding sites are available for attachment by myosin heads. The myosin then pulls the actin filaments toward the center, shortening the muscle fiber.

In skeletal muscle, this sequence begins with signals from the somatic motor division of the nervous system. In other words, the "excitation" step in skeletal muscles is always triggered by signaling from the nervous system (Figure 10.6).

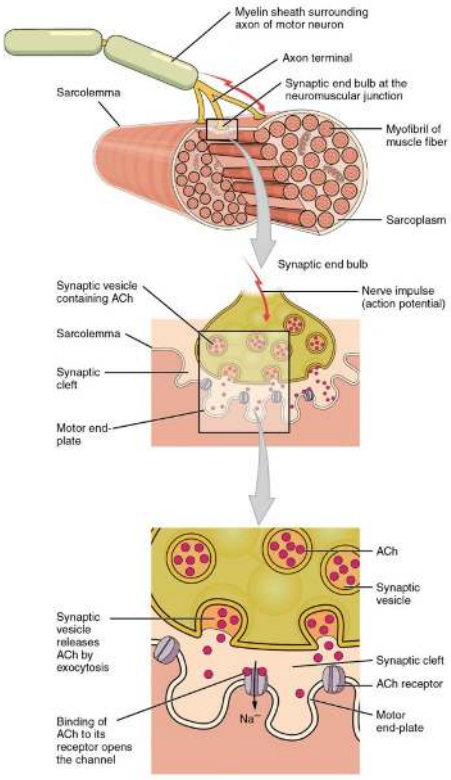



Figure 10.6. Motor End-Plate and Innervation At the NMJ, the axon terminal releases ACh. The motor end-plate is the location of the ACh-receptors in the muscle fiber sarcolemma. When ACh molecules are released, they diffuse across a minute space called the synaptic cleft and bind to the receptors.

The motor neurons that tell the skeletal muscle fibers to contract originate in the spinal cord, with a smaller number located in the brainstem for activation of skeletal muscles of the face, head, and neck. These neurons have long processes, called axons, which are specialized to transmit action potentials long distances— in this case, all the way from the spinal cord to the muscle itself (which may be up to three feet away). The axons of multiple neurons bundle together to form nerves, like wires bundled together in a cable.

Signaling begins when a neuronal ***action potential*** travels along the axon of a motor neuron, and then along the individual branches to terminate at the NMJ. At the NMJ, the axon terminal releases a chemical messenger, or*neurotransmitter* called ***acetylcholine (ACh)***. The ACh molecules diffuse across a minute space called the ***synaptic cleft*** and bind to ACh receptors located within the ***motor end-plate*** of the sarcolemma on the other side of the synapse. Once ACh binds, a channel in the ACh receptor opens and positively charged ions can pass through into the muscle fiber, causing it to ***depolarize***, meaning that the membrane potential of the muscle fiber becomes less negative (closer to zero.)

As the membrane depolarizes, another set of ion channels called ***voltage-gated sodium channels*** are triggered to open. Sodium ions enter the muscle fiber, and an action potential rapidly spreads (or "fires") along the entire membrane to initiate excitation-contraction coupling.

Things happen very quickly in the world of excitable membranes (just think about how quickly you can snap your fingers as soon as you decide to do it). Immediately following depolarization of the membrane, it repolarizes, re-establishing the negative membrane potential. Meanwhile, the ACh in the synaptic cleft is degraded by the enzyme acetylcholinesterase (AChE) so that the ACh cannot rebind to a receptor and reopen its channel, which would cause unwanted extended muscle excitation and contraction.

Propagation of an action potential along the sarcolemma is the excitation portion of excitation-contraction coupling. Recall that this excitation actually triggers the release of calcium ions ($Ca^{++}$) from its storage in the cell's SR. For the action potential to reach the membrane of the SR, there are periodic invaginations in the sarcolemma, called ***T-tubules*** ("T" stands for "transverse"). You will recall that the diameter of a muscle fiber can be up to 100 $\mu$m, so these T-tubules ensure that the membrane can get close to the SR in the sarcoplasm. The arrangement of a T-tubule with the membranes of SR on either side is called a ***triad*** (Figure 10.7). The triad surrounds the cylindrical structure called a ***myofibril***, which contains actin and myosin.

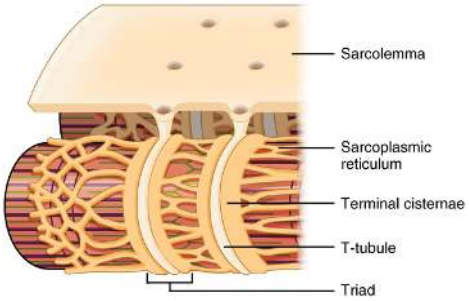



Figure 10.7. The T-tubule Narrow T-tubules permit the conduction of electrical impulses. The SR functions to regulate intracellular levels of calcium. Two terminal cisternae (where enlarged SR connects to the T-tubule) and one T-tubule comprise a triad—a “threesome” of membranes, with those of SR on two sides and the T-tubule sandwiched between them.

The T-tubules carry the action potential into the interior of the cell, which triggers the opening of calcium channels in the membrane of the adjacent SR, causing $Ca^{++}$ to diffuse out of the SR and into the sarcoplasm. It is the arrival of $Ca^{++}$ in the sarcoplasm that initiates contraction of the muscle fiber by its contractile units, or sarcomeres.

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# 22.4: Muscle Fiber Contraction and Relaxation

## Learning Objectives

- Describe the components involved in a muscle contraction
- Explain how muscles contract and relax
- Describe the sliding filament model of muscle contraction

The sequence of events that result in the contraction of an individual muscle fiber begins with a signal—the neurotransmitter, ACh—from the motor neuron innervating that fiber. The local membrane of the fiber will depolarize as positively charged sodium ions ($Na^{+}$) enter, triggering an action potential that spreads to the rest of the membrane will depolarize, including the T-tubules. This triggers the release of calcium ions ($Ca^{++}$) from storage in the sarcoplasmic reticulum (SR). The $Ca^{++}$ then initiates contraction, which is sustained by ATP (Figure 10.8). As long as $Ca^{++}$ ions remain in the sarcoplasm to bind to troponin, which keeps the actin-binding sites "unshielded," and as long as ATP is available to drive the cross-bridge cycling and the pulling of actin strands by myosin, the muscle fiber will continue to shorten to an anatomical limit.

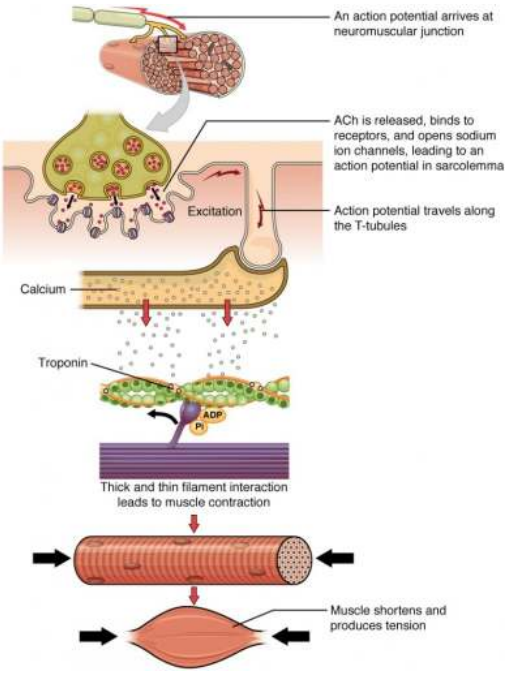



Figure 10.8. Contraction of a Muscle Fiber A cross-bridge forms between actin and the myosin heads triggering contraction. As long as Ca++ ions remain in the sarcoplasm to bind to troponin, and as long as ATP is available, the muscle fiber will continue to shorten.

Muscle contraction usually stops when signaling from the motor neuron ends, which repolarizes the sarcolemma and T-tubules, and closes the voltage-gated calcium channels in the SR. $Ca^{++}$ ions are then pumped back into the SR, which causes the tropomyosin to reshield (or re-cover) the binding sites on the actin strands. A muscle also can stop contracting when it runs out of ATP and becomes fatigued (Figure 10.9).

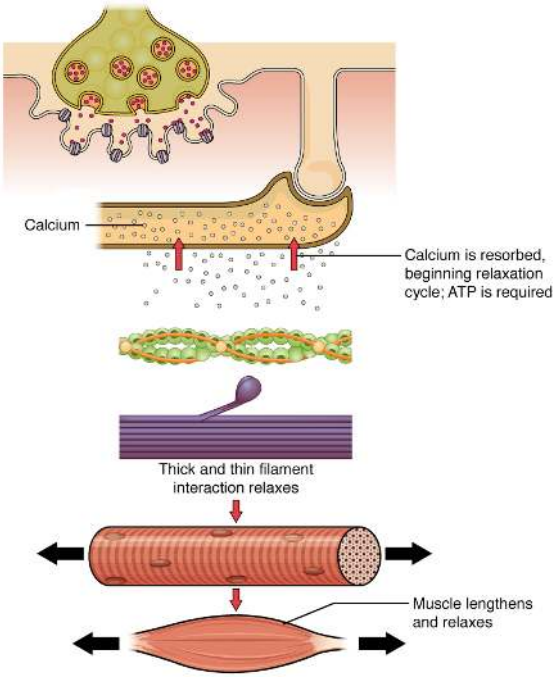



Figure 10.9. Relaxation of a Muscle Fiber Ca++ ions are pumped back into the SR, which causes the tropomyosin to reshield the binding sites on the actin strands. A muscle may also stop contracting when it runs out of ATP and becomes fatigued.

### Interactive Link

The release of calcium ions initiates muscle contractions. Watch this video to learn more about the role of calcium. (a) What are "T-tubules" and what is their role? (b) Please describe how actin-binding sites are made available for cross-bridging with myosin heads during contraction.

The molecular events of muscle fiber shortening occur within the fiber's sarcomeres (see Figure 10.10). The contraction of a striated muscle fiber occurs as the sarcomeres, linearly arranged within myofibrils, shorten as myosin heads pull on the actin filaments.

The region where thick and thin filaments overlap has a dense appearance, as there is little space between the filaments. This zone where thin and thick filaments overlap is very important to muscle contraction, as it is the site where filament movement starts. Thin filaments, anchored at their ends by the Z-discs, do not extend completely into the central region that only contains thick filaments, anchored at their bases at a spot called the M-line. A myofibril is composed of many sarcomeres running along its length; thus, myofibrils and muscle cells contract as the sarcomeres contract.

### The Sliding Filament Model of Contraction

When signaled by a motor neuron, a skeletal muscle fiber contracts as the thin filaments are pulled and then slide past the thick filaments within the fiber's sarcomeres. This process is known as the sliding filament model of muscle contraction (Figure 10.10). The sliding can only occur when myosin-binding sites on the actin filaments are exposed by a series of steps that begins with $Ca^{++}$ entry into the sarcoplasm.

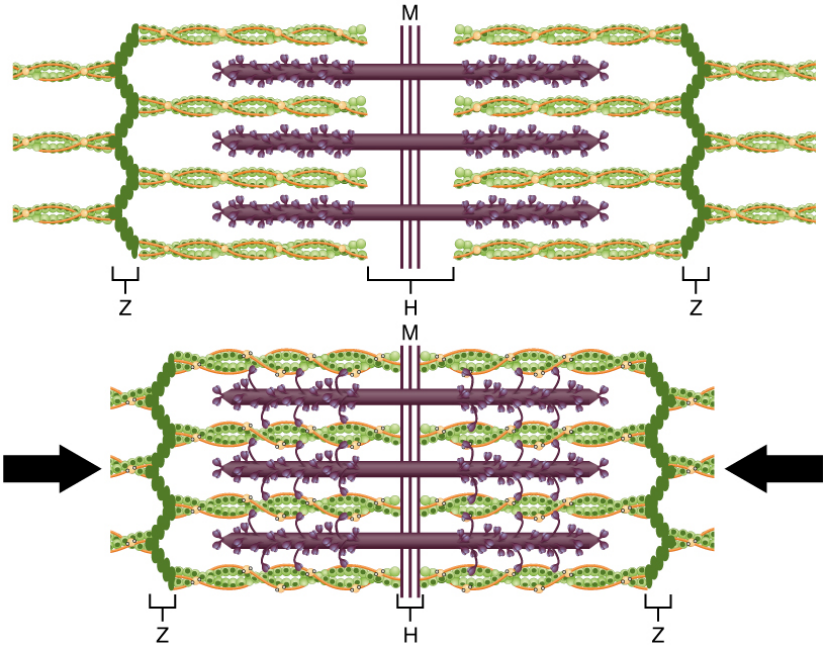



Figure 10.10. The Sliding Filament Model of Muscle Contraction When a sarcomere contracts, the Z lines move closer together, and the I band becomes smaller. The A band stays the same width. At full contraction, the thin and thick filaments overlap.

Tropomyosin is a protein that winds around the chains of the actin filament and covers the myosin-binding sites to prevent actin from binding to myosin. Tropomyosin binds to troponin to form a troponin-tropomyosin complex. The troponin-tropomyosin complex prevents the myosin "heads" from binding to the active sites on the actin microfilaments. Troponin also has a binding site for $Ca^{++}$ ions.

To initiate muscle contraction, tropomyosin has to expose the myosin-binding site on an actin filament to allow cross-bridge formation between the actin and myosin microfilaments. The first step in the process of contraction is for $Ca^{++}$ to bind to troponin so that tropomyosin can slide away from the binding sites on the actin strands. This allows the myosin heads to bind to these exposed binding sites and form cross-bridges. The thin filaments are then pulled by the myosin heads to slide past the thick filaments toward the center of the sarcomere. But each head can only pull a very short distance before it has reached its limit and must be "re-cocked" before it can pull again, a step that requires ATP.

### ATP and Muscle Contraction

For thin filaments to continue to slide past thick filaments during muscle contraction, myosin heads must pull the actin at the binding sites, detach, re-cock, attach to more binding sites, pull, detach, re-cock, etc. This repeated movement is known as the cross-bridge cycle. This motion of the myosin heads is similar to the oars when an individual rows a boat: The paddle of the oars (the myosin heads) pull, are lifted from the water (detach), repositioned (re-cocked) and then immersed again to pull (Figure 10.11). Each cycle requires energy, and the action of the myosin heads in the sarcomeres repetitively pulling on the thin filaments also requires energy, which is provided by ATP.

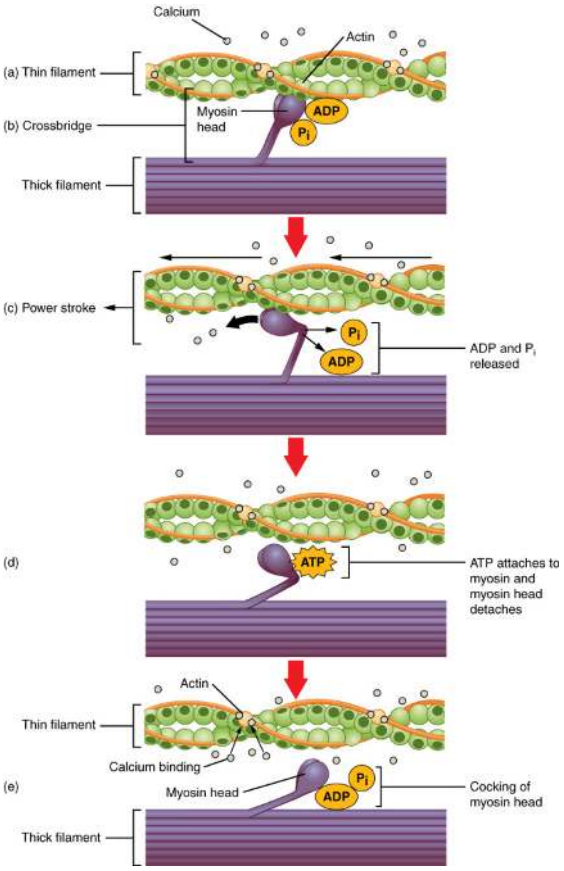



Figure 10.11. Skeletal Muscle Contraction (a) The active site on actin is exposed as calcium binds to troponin. (b) The myosin head is attracted to actin, and myosin binds actin at its actin-binding site, forming the cross-bridge. (c) During the power stroke, the phosphate generated in the previous contraction cycle is released. This results in the myosin head pivoting toward the center of the sarcomere, after which the attached ADP and phosphate group are released. (d) A new molecule of ATP attaches to the myosin head, causing the cross-bridge to detach. (e) The myosin head hydrolyzes ATP to ADP and phosphate, which returns the myosin to the cocked position.

Cross-bridge formation occurs when the myosin head attaches to the actin while adenosine diphosphate (ADP) and inorganic phosphate ($P_i$) are still bound to myosin (Figure 10.11a,b). $P_i$ is then released, causing myosin to form a stronger attachment to the actin, after which the myosin head moves toward the M-line, pulling the actin along with it. As actin is pulled, the filaments move approximately 10 nm toward the M-line. This movement is called the ***power stroke***, as movement of the thin filament occurs at this step (Figure 10.11**c**). In the absence of ATP, the myosin head will not detach from actin.

One part of the myosin head attaches to the binding site on the actin, but the head has another binding site for ATP. ATP binding causes the myosin head to detach from the actin (Figure 10.11d). After this occurs, ATP is converted to ADP and $P_i$ by the intrinsic ***ATPase*** activity of myosin. The energy released during ATP hydrolysis changes the angle of the myosin head into a cocked position (Figure 10.11e). The myosin head is now in position for further movement.

When the myosin head is cocked, myosin is in a high-energy configuration. This energy is expended as the myosin head moves through the power stroke, and at the end of the power stroke, the myosin head is in a low-energy position. After the power stroke, ADP is released; however, the formed cross-bridge is still in place, and actin and myosin are bound together. As long as ATP is available, it readily attaches to myosin, the cross-bridge cycle can recur, and muscle contraction can continue.

Note that each thick filament of roughly 300 myosin molecules has multiple myosin heads, and many cross-bridges form and break continuously during muscle contraction. Multiply this by all of the sarcomeres in one myofibril, all the myofibrils in one muscle fiber, and all of the muscle fibers in one skeletal muscle, and you can understand why so much energy (ATP) is needed to keep skeletal muscles working. In fact, it is the loss of ATP that results in the rigor mortis observed soon after someone dies. With no further ATP production possible, there is no ATP available for myosin heads to detach from the actin-binding sites, so the cross-bridges stay in place, causing the rigidity in the skeletal muscles.

## Sources of ATP

ATP supplies the energy for muscle contraction to take place. In addition to its direct role in the cross-bridge cycle, ATP also provides the energy for the active-transport $Ca^{++}$ pumps in the SR. Muscle contraction does not occur without sufficient amounts of ATP. The amount of ATP stored in muscle is very low, only sufficient to power a few seconds worth of contractions. As it is broken down, ATP must therefore be regenerated and replaced quickly to allow for sustained contraction. There are three mechanisms by which ATP can be regenerated: creatine phosphate metabolism, anaerobic glycolysis, fermentation and aerobic respiration.

***Creatine phosphate*** is a molecule that can store energy in its phosphate bonds. In a resting muscle, excess ATP transfers its energy to creatine, producing ADP and creatine phosphate. This acts as an energy reserve that can be used to quickly create more ATP. When the muscle starts to contract and needs energy, creatine phosphate transfers its phosphate back to ADP to form ATP and creatine. This reaction is catalyzed by the enzyme creatine kinase and occurs very quickly; thus, creatine phosphate-derived ATP powers the first few seconds of muscle contraction. However, creatine phosphate can only provide approximately 15 seconds worth of energy, at which point another energy source has to be used (Figure 10.12).

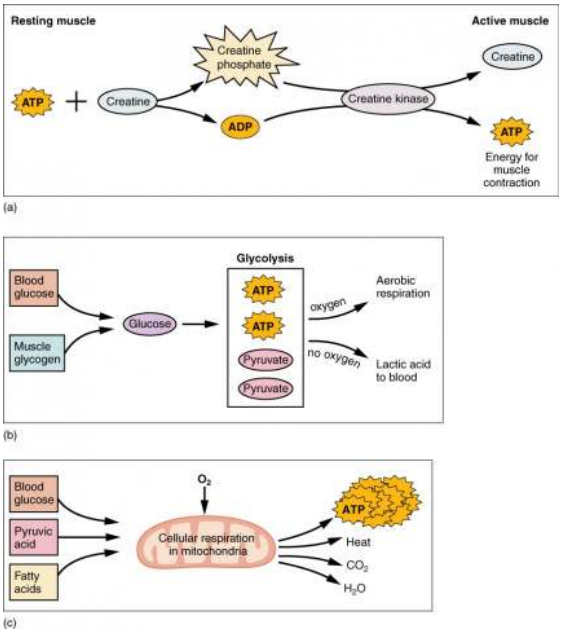



Figure 10.12. Muscle Metabolism (a) Some ATP is stored in a resting muscle. As contraction starts, it is used up in seconds. More ATP is generated from creatine phosphate for about 15 seconds. (b) Each glucose molecule produces two ATP and two molecules of pyruvic acid, which can be used in aerobic respiration or converted to lactic acid. If oxygen is not available, pyruvic acid is converted to lactic acid, which may contribute to muscle fatigue. This occurs during strenuous exercise when high amounts of energy are needed but oxygen cannot be sufficiently delivered to muscle. (c) Aerobic respiration is the breakdown of glucose in the presence of oxygen (O2) to produce carbon dioxide, water, and ATP. Approximately 95 percent of the ATP required for resting or moderately active muscles is provided by aerobic respiration, which takes place in mitochondria.

As the ATP produced by creatine phosphate is depleted, muscles turn to glycolysis as an ATP source. ***Glycolysis*** is an anaerobic (non-oxygen-dependent) process that breaks down glucose (sugar) to produce ATP; however, glycolysis cannot generate ATP as quickly as creatine phosphate. Thus, the switch to glycolysis results in a slower rate of ATP availability to the muscle. The sugar used in glycolysis can be provided by blood glucose or by metabolizing glycogen that is stored in the muscle. The breakdown of one glucose molecule produces two ATP and two molecules of ***pyruvic acid***, which can be used in aerobic respiration or when oxygen levels are low, converted to lactic acid (Figure 10.12**b**).

If oxygen is available, pyruvic acid is used in aerobic respiration. However, if oxygen is not available, pyruvic acid is converted to ***lactic acid***, which may contribute to muscle fatigue. This conversion allows the recycling of the enzyme $NAD^+$ from NADH, which is needed for glycolysis to continue. This occurs during strenuous exercise when high amounts of energy are needed but oxygen cannot be sufficiently delivered to muscle. Glycolysis itself cannot be sustained for very long (approximately 1 minute of muscle activity), but it is useful in facilitating short bursts of high-intensity output. This is because glycolysis does not utilize glucose very efficiently, producing a net gain of two ATPs per molecule of glucose, and the end product of lactic acid, which may contribute to muscle fatigue as it accumulates.

***Aerobic respiration*** is the breakdown of glucose or other nutrients in the presence of oxygen ($O_2$) to produce carbon dioxide, water, and ATP. Approximately 95 percent of the ATP required for resting or moderately active muscles is provided by aerobic respiration, which takes place in mitochondria. The inputs for aerobic respiration include glucose circulating in the bloodstream, pyruvic acid, and fatty acids. Aerobic respiration is much more efficient than anaerobic glycolysis, producing approximately 36 ATPs per molecule of glucose versus four from glycolysis. However, aerobic respiration cannot be sustained without a steady supply of $O_2$ to the skeletal muscle and is much slower (Figure 10.12**c**). To compensate, muscles store small amount of excess oxygen in proteins call myoglobin, allowing for more efficient muscle contractions and less fatigue. Aerobic training also increases the efficiency of the circulatory system so that $O_2$ can be supplied to the muscles for longer periods of time.

Muscle fatigue occurs when a muscle can no longer contract in response to signals from the nervous system. The exact causes of muscle fatigue are not fully known, although certain factors have been correlated with the decreased muscle contraction that occurs during fatigue. ATP is needed for normal muscle contraction, and as ATP reserves are reduced, muscle function may decline. This may be more of a factor in brief, intense muscle output rather than sustained, lower intensity efforts. Lactic acid buildup may lower intracellular pH, affecting enzyme and protein activity. Imbalances in $Na^+$ and $K^+$ levels as a result of membrane depolarization may disrupt $Ca^{++}$ flow out of the SR. Long periods of sustained exercise may damage the SR and the sarcolemma, resulting in impaired $Ca^{++}$ regulation.

Intense muscle activity results in an ***oxygen debt***Home, which is the amount of oxygen needed to compensate for ATP produced without oxygen during muscle contraction. Oxygen is required to restore ATP and creatine phosphate levels, convert lactic acid to pyruvic acid, and, in the liver, to convert lactic acid into glucose or glycogen. Other systems used during exercise also require oxygen, and all of these combined processes result in the increased breathing rate that occurs after exercise. Until the oxygen debt has been met, oxygen intake is elevated, even after exercise has stopped.

### Relaxation of a Skeletal Muscle

Relaxing skeletal muscle fibers, and ultimately, the skeletal muscle, begins with the motor neuron, which stops releasing its chemical signal, ACh, into the synapse at the NMJ. The muscle fiber will repolarize, which closes the gates in the SR where $Ca^{++}$ was being released. ATP-driven pumps will move $Ca^{++}$ out of the sarcoplasm back into the SR. This results in the "reshielding" of the actin-binding sites on the thin filaments. Without the ability to form cross-bridges between the thin and thick filaments, the muscle fiber loses its tension and relaxes.

### Muscle Strength

The number of skeletal muscle fibers in a given muscle is genetically determined and does not change. Muscle strength is directly related to the amount of myofibrils and sarcomeres within each fiber. Factors, such as hormones and stress (and artificial anabolic steroids), acting on the muscle can increase the production of sarcomeres and myofibrils within the muscle fibers, a change called hypertrophy, which results in the increased mass and bulk in a skeletal muscle. Likewise, decreased use of a skeletal muscle results in atrophy, where the number of sarcomeres and myofibrils disappear (but not the number of muscle fibers). It is common for a limb in a cast to show atrophied muscles when the cast is removed, and certain diseases, such as polio, show atrophied muscles.

### Disorders of the Muscular System

Duchenne muscular dystrophy (DMD) is a progressive weakening of the skeletal muscles. It is one of several diseases collectively referred to as "muscular dystrophy." DMD is caused by a lack of the protein dystrophin, which helps the thin filaments of myofibrils bind to the sarcolemma. Without sufficient dystrophin, muscle contractions cause the sarcolemma to tear, causing an influx of $Ca^{++}$, leading to cellular damage and muscle fiber degradation. Over time, as muscle damage accumulates, muscle mass is lost, and greater functional impairments develop.

DMD is an inherited disorder caused by an abnormal X chromosome. It primarily affects males, and it is usually diagnosed in early childhood. DMD usually first appears as difficulty with balance and motion, and then progresses to an inability to walk. It continues progressing upward in the body from the lower extremities to the upper body, where it affects the muscles responsible for breathing and circulation. It ultimately causes death due to respiratory failure, and those afflicted do not usually live past their 20s.

Because DMD is caused by a mutation in the gene that codes for dystrophin, it was thought that introducing healthy myoblasts into patients might be an effective treatment. Myoblasts are the embryonic cells responsible for muscle development, and ideally, they would carry healthy genes that could produce the dystrophin needed for normal muscle contraction. This approach has been largely unsuccessful in humans. A recent approach has involved attempting to boost the muscle's production of utrophin, a protein similar to dystrophin that may be able to assume the role of dystrophin and prevent cellular damage from occurring.

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# 22.5: SELF-CHECK QUESTIONS- Muscle Fiber Contraction and Relaxation

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# 22.6: Nervous System Control of Muscle Tension

## Learning Objectives

- Explain concentric, isotonic, and eccentric contractions
- Describe the length-tension relationship
- Describe the three phases of a muscle twitch
- Define wave summation, tetanus, and treppe

To move an object, referred to as load, the sarcomeres in the muscle fibers of the skeletal muscle must shorten. The force generated by the contraction of the muscle (or shortening of the sarcomeres) is called ***muscle tension***. However, muscle tension also is generated when the muscle is contracting against a load that does not move, resulting in two main types of skeletal muscle contractions: isotonic contractions and isometric contractions.

In ***isotonic contractions***, where the tension in the muscle stays constant, a load is moved as the length of the muscle changes (shortens). There are two types of isotonic contractions: concentric and eccentric. A ***concentric contraction*** involves the muscle shortening to move a load. An example of this is the biceps brachii muscle contracting when a hand weight is brought upward with increasing muscle tension. As the biceps brachii contract, the angle of the elbow joint decreases as the forearm is brought toward the body. Here, the biceps brachii contracts as sarcomeres in its muscle fibers are shortening and cross-bridges form; the myosin heads pull the actin. An ***eccentric contraction*** occurs as the muscle tension diminishes and the muscle lengthens. In this case, the hand weight is lowered in a slow and controlled manner as the amount of cross-bridges being activated by nervous system stimulation decreases. In this case, as tension is released from the biceps brachii, the angle of the elbow joint increases. Eccentric contractions are also used for movement and balance of the body.

An ***isometric contraction*** occurs as the muscle produces tension without changing the angle of a skeletal joint. Isometric contractions involve sarcomere shortening and increasing muscle tension, but do not move a load, as the force produced cannot overcome the resistance provided by the load. For example, if one attempts to lift a hand weight that is too heavy, there will be sarcomere activation and shortening to a point, and ever-increasing muscle tension, but no change in the angle of the elbow joint. In everyday living, isometric contractions are active in maintaining posture and maintaining bone and joint stability. However, holding your head in an upright position occurs not because the muscles cannot move the head, but because the goal is to remain stationary and not produce movement. Most actions of the body are the result of a combination of isotonic and isometric contractions working together to produce a wide range of outcomes (Figure 10.13).

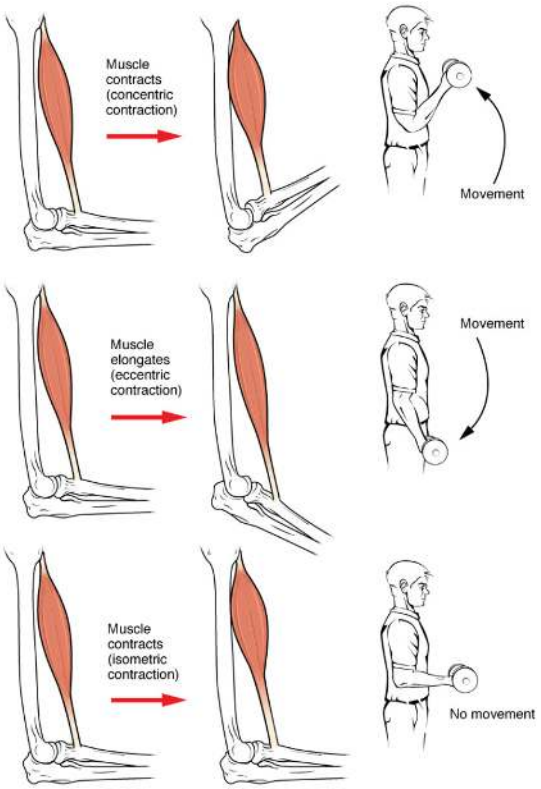



Figure 10.13. Types of Muscle Contractions During isotonic contractions, muscle length changes to move a load. During isometric contractions, muscle length does not change because the load exceeds the tension the muscle can generate.

All of these muscle activities are under the exquisite control of the nervous system. Neural control regulates concentric, eccentric and isometric contractions, muscle fiber recruitment, and muscle tone. A crucial aspect of nervous system control of skeletal muscles is the role of motor units.

## Motor Units

As you have learned, every skeletal muscle fiber must be innervated by the axon terminal of a motor neuron in order to contract. Each muscle fiber is innervated by only one motor neuron. The actual group of muscle fibers in a muscle innervated by a single motor neuron is called a ***motor unit***. The size of a motor unit is variable depending on the nature of the muscle.

A small motor unit is an arrangement where a single motor neuron supplies a small number of muscle fibers in a muscle. Small motor units permit very fine motor control of the muscle. The best example in humans is the small motor units of the extraocular eye muscles that move the eyeballs. There are thousands of muscle fibers in each muscle, but every six or so fibers are supplied by a single motor neuron, as the axons branch to form synaptic connections at their individual NMJs. This allows for exquisite control of eye movements so that both eyes can quickly focus on the same object. Small motor units are also involved in the many fine movements of the fingers and thumb of the hand for grasping, texting, etc.

A large motor unit is an arrangement where a single motor neuron supplies a large number of muscle fibers in a muscle. Large motor units are concerned with simple, or “gross,” movements, such as powerfully extending the knee joint. The best example is the large motor units of the thigh muscles or back muscles, where a single motor neuron will supply thousands of muscle fibers in a muscle, as its axon splits into thousands of branches.

There is a wide range of motor units within many skeletal muscles, which gives the nervous system a wide range of control over the muscle. The small motor units in the muscle will have smaller, lower-threshold motor neurons that are more excitable, firing first to their skeletal muscle fibers, which also tend to be the smallest. Activation of these smaller motor units, results in a relatively small degree of contractile strength (tension) generated in the muscle. As more strength is needed, larger motor units, with bigger, higher-threshold motor neurons are enlisted to activate larger muscle fibers. This increasing activation of motor units produces an increase in muscle contraction known as ***recruitment***. As more motor units are recruited, the muscle contraction grows progressively stronger. In some muscles, the largest motor units may generate a contractile force of 50 times more than the smallest

motor units in the muscle. This allows a feather to be picked up using the biceps brachii arm muscle with minimal force, and a heavy weight to be lifted by the same muscle by recruiting the largest motor units.

When necessary, the maximal number of motor units in a muscle can be recruited simultaneously, producing the maximum force of contraction for that muscle, but this cannot last for very long because of the energy requirements to sustain the contraction. To prevent complete muscle fatigue, motor units are generally not all simultaneously active, but instead some motor units rest while others are active, which allows for longer muscle contractions. The nervous system uses recruitment as a mechanism to efficiently utilize a skeletal muscle.

### The Length-Tension Range of a Sarcomere

When a skeletal muscle fiber contracts, myosin heads attach to actin to form cross-bridges followed by the thin filaments sliding over the thick filaments as the heads pull the actin, and this results in sarcomere shortening, creating the tension of the muscle contraction. The cross-bridges can only form where thin and thick filaments already overlap, so that the length of the sarcomere has a direct influence on the force generated when the sarcomere shortens. This is called the length-tension relationship.

The ideal length of a sarcomere to produce maximal tension occurs at 80 percent to 120 percent of its resting length, with 100 percent being the state where the medial edges of the thin filaments are just at the most-medial myosin heads of the thick filaments (Figure 10.14). This length maximizes the overlap of actin-binding sites and myosin heads. If a sarcomere is stretched past this ideal length (beyond 120 percent), thick and thin filaments do not overlap sufficiently, which results in less tension produced. If a sarcomere is shortened beyond 80 percent, the zone of overlap is reduced with the thin filaments jutting beyond the last of the myosin heads and shrinks the H zone, which is normally composed of myosin tails. Eventually, there is nowhere else for the thin filaments to go and the amount of tension is diminished. If the muscle is stretched to the point where thick and thin filaments do not overlap at all, no cross-bridges can be formed, and no tension is produced in that sarcomere. This amount of stretching does not usually occur, as accessory proteins and connective tissue oppose extreme stretching.

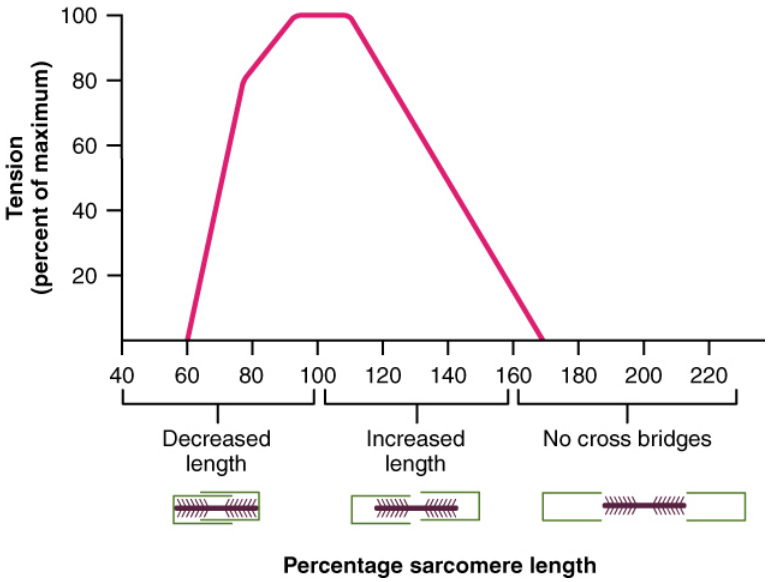



Figure 10.14. The Ideal Length of a Sarcomere Sarcomeres produce maximal tension when thick and thin filaments overlap between about 80 percent to 120 percent.

### The Frequency of Motor Neuron Stimulation

A single action potential from a motor neuron will produce a single contraction in the muscle fibers of its motor unit. This isolated contraction is called a ***twitch***. A twitch can last for a few milliseconds or 100 milliseconds, depending on the muscle type. The tension produced by a single twitch can be measured by a ***myogram***, an instrument that measures the amount of tension produced over time (Figure 10.15). Each twitch undergoes three phases. The first phase is the ***latent period***, during which the action potential is being propagated along the sarcolemma and $Ca^{++}$ ions are released from the SR. This is the phase during which excitation and contraction are being coupled but contraction has yet to occur. The ***contraction phase*** occurs next. The $Ca^{++}$ ions in the sarcoplasm have bound to troponin, tropomyosin has shifted away from actin-binding sites, cross-bridges formed, and sarcomeres are actively shortening to the point of peak tension. The last phase is the ***relaxation phase***, when tension decreases as contraction stops. $Ca^{++}$ ions are pumped out of the sarcoplasm into the SR, and cross-bridge cycling stops, returning the muscle fibers to their resting state.

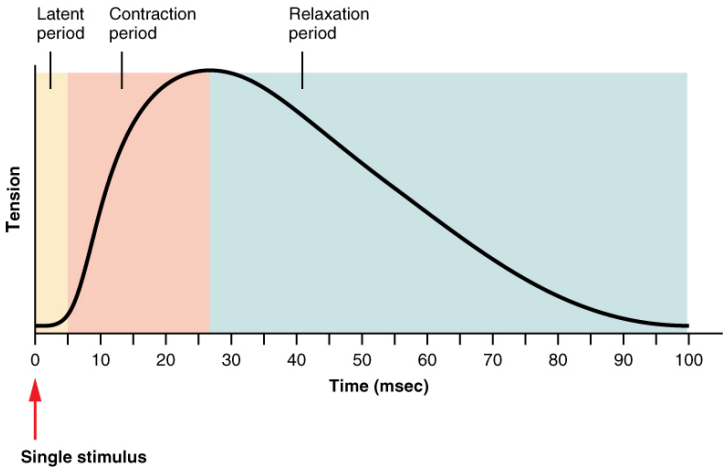



Figure 10.15. A Myogram of a Muscle Twitch A single muscle twitch has a latent period, a contraction phase when tension increases, and a relaxation phase when tension decreases. During the latent period, the action potential is being propagated along the sarcolemma. During the contraction phase, Ca++ ions in the sarcoplasm bind to troponin, tropomyosin moves from actin-binding sites, cross-bridges form, and sarcomeres shorten. During the relaxation phase, tension decreases as Ca++ ions are pumped out of the sarcoplasm and cross-bridge cycling stops.

Although a person can experience a muscle "twitch," a single twitch does not produce any significant muscle activity in a living body. A series of action potentials to the muscle fibers is necessary to produce a muscle contraction that can produce work. Normal muscle contraction is more sustained, and it can be modified by input from the nervous system to produce varying amounts of force; this is called a ***graded muscle response***. The frequency of action potentials (nerve impulses) from a motor neuron and the number of motor neurons transmitting action potentials both affect the tension produced in skeletal muscle.

The rate at which a motor neuron fires action potentials affects the tension produced in the skeletal muscle. If the fibers are stimulated while a previous twitch is still occurring, the second twitch will be stronger. This response is called ***wave summation***, because the excitation-contraction coupling effects of successive motor neuron signaling is summed, or added together (Figure 10.16a). At the molecular level, summation occurs because the second stimulus triggers the release of more $Ca^{++}$ ions, which become available to activate additional sarcomeres while the muscle is still contracting from the first stimulus. Summation results in greater contraction of the motor unit.

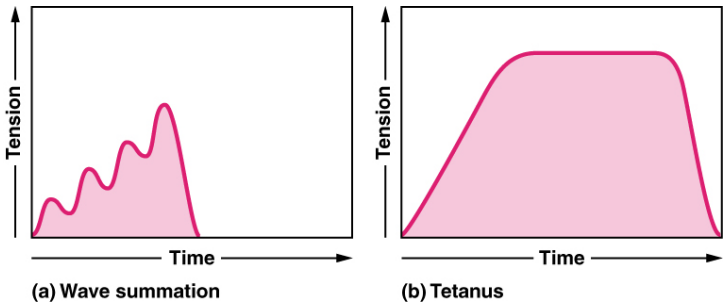



Figure 10.16. Wave Summation and Tetanus (a) The excitation-contraction coupling effects of successive motor neuron signaling is added together which is referred to as wave summation. The bottom of each wave, the end of the relaxation phase, represents the point of stimulus. (b) When the stimulus frequency is so high that the relaxation phase disappears completely, the contractions become continuous; this is called tetanus.

If the frequency of motor neuron signaling increases, summation and subsequent muscle tension in the motor unit continues to rise until it reaches a peak point. The tension at this point is about three to four times greater than the tension of a single twitch, a state referred to as incomplete tetanus. During incomplete tetanus, the muscle goes through quick cycles of contraction with a short relaxation phase for each. If the stimulus frequency is so high that the relaxation phase disappears completely, contractions become continuous in a process called complete ***tetanus*** (Figure 10.16**b**).

During tetanus, the concentration of $Ca^{++}$ ions in the sarcoplasm allows virtually all of the sarcomeres to form cross-bridges and shorten, so that a contraction can continue uninterrupted (until the muscle fatigues and can no longer produce tension).

## Treppe

When a skeletal muscle has been dormant for an extended period and then activated to contract, with all other things being equal, the initial contractions generate about one-half the force of later contractions. The muscle tension increases in a graded manner that to some looks like a set of stairs. This tension increase is called ***treppe,*** a condition where muscle contractions become more efficient. It's also known as the "staircase effect" (Figure 10.17).

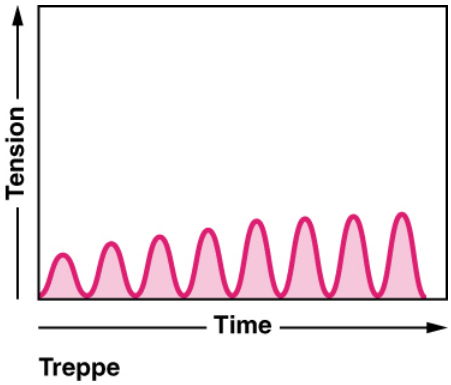



Figure 10.17. Treppe When muscle tension increases in a graded manner that looks like a set of stairs, it is called treppe. The bottom of each wave represents the point of stimulus.

It is believed that treppe results from a higher concentration of $Ca^{++}$ in the sarcoplasm resulting from the steady stream of signals from the motor neuron. It can only be maintained with adequate ATP.

## Muscle Tone

Skeletal muscles are rarely completely relaxed, or flaccid. Even if a muscle is not producing movement, it is contracted a small amount to maintain its contractile proteins and produce ***muscle tone***. The tension produced by muscle tone allows muscles to continually stabilize joints and maintain posture.

Muscle tone is accomplished by a complex interaction between the nervous system and skeletal muscles that results in the activation of a few motor units at a time, most likely in a cyclical manner. In this manner, muscles never fatigue completely, as some motor units can recover while others are active.

The absence of the low-level contractions that lead to muscle tone is referred to as ***hypotonia*** or atrophy, and can result from damage to parts of the central nervous system (CNS), such as the cerebellum, or from loss of innervations to a skeletal muscle, as in poliomyelitis. Hypotonic muscles have a flaccid appearance and display functional impairments, such as weak reflexes. Conversely, excessive muscle tone is referred to as ***hypertonia***, accompanied by hyperreflexia (excessive reflex responses), often the result of damage to upper motor neurons in the CNS. Hypertonia can present with muscle rigidity (as seen in Parkinson's disease) or spasticity, a phasic change in muscle tone, where a limb will "snap" back from passive stretching (as seen in some strokes).

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# 22.7: Types of Muscle Fibers

## Learning Objectives

- Describe the types of skeletal muscle fibers
- Explain fast and slow muscle fibers

Two criteria to consider when classifying the types of muscle fibers are how fast some fibers contract relative to others, and how fibers produce ATP. Using these criteria, there are three main types of skeletal muscle fibers. ***Slow oxidative*** *(SO)* fibers contract relatively slowly and use aerobic respiration (oxygen and glucose) to produce ATP. ***Fast oxidative*** *(FO)* fibers have fast contractions and primarily use aerobic respiration, but because they may switch to anaerobic respiration (glycolysis), can fatigue more quickly than SO fibers. Lastly, ***fast glycolytic (FG)*** fibers have fast contractions and primarily use anaerobic glycolysis. The FG fibers fatigue more quickly than the others. Most skeletal muscles in a human contain(s) all three types, although in varying proportions.

The speed of contraction is dependent on how quickly myosin's ATPase hydrolyzes ATP to produce cross-bridge action. Fast fibers hydrolyze ATP approximately twice as quickly as slow fibers, resulting in much quicker cross-bridge cycling (which pulls the thin filaments toward the center of the sarcomeres at a faster rate). The primary metabolic pathway used by a muscle fiber determines whether the fiber is classified as oxidative or glycolytic. If a fiber primarily produces ATP through aerobic pathways it is oxidative. More ATP can be produced during each metabolic cycle, making the fiber more resistant to fatigue. Glycolytic fibers primarily create ATP through anaerobic glycolysis, which produces less ATP per cycle. As a result, glycolytic fibers fatigue at a quicker rate.

The oxidative fibers contain many more mitochondria than the glycolytic fibers, because aerobic metabolism, which uses oxygen ($O_2$) in the metabolic pathway, occurs in the mitochondria. The SO fibers possess a large number of mitochondria and are capable of contracting for longer periods because of the large amount of ATP they can produce, but they have a relatively small diameter and do not produce a large amount of tension. SO fibers are extensively supplied with blood capillaries to supply $O_2$ from the red blood cells in the bloodstream. The SO fibers also possess myoglobin, an $O_2$-carrying molecule similar to $O_2$-carrying hemoglobin in the red blood cells. The myoglobin stores some of the needed $O_2$ within the fibers themselves (and gives SO fibers their red color). All of these features allow SO fibers to produce large quantities of ATP, which can sustain muscle activity without fatiguing for long periods of time.

The fact that SO fibers can function for long periods without fatiguing makes them useful in maintaining posture, producing isometric contractions, stabilizing bones and joints, and making small movements that happen often but do not require large amounts of energy. They do not produce high tension, and thus they are not used for powerful, fast movements that require high amounts of energy and rapid cross-bridge cycling.

FO fibers are sometimes called intermediate fibers because they possess characteristics that are intermediate between fast fibers and slow fibers. They produce ATP relatively quickly, more quickly than SO fibers, and thus can produce relatively high amounts of tension. They are oxidative because they produce ATP aerobically, possess high amounts of mitochondria, and do not fatigue quickly. However, FO fibers do not possess significant myoglobin, giving them a lighter color than the red SO fibers. FO fibers are used primarily for movements, such as walking, that require more energy than postural control but less energy than an explosive movement, such as sprinting. FO fibers are useful for this type of movement because they produce more tension than SO fibers but they are more fatigue-resistant than FG fibers.

FG fibers primarily use anaerobic glycolysis as their ATP source. They have a large diameter and possess high amounts of glycogen, which is used in glycolysis to generate ATP quickly to produce high levels of tension. Because they do not primarily use aerobic metabolism, they do not possess substantial numbers of mitochondria or significant amounts of myoglobin and therefore have a white color. FG fibers are used to produce rapid, forceful contractions to make quick, powerful movements. These fibers fatigue quickly, permitting them to only be used for short periods. Most muscles possess a mixture of each fiber type. The predominant fiber type in a muscle is determined by the primary function of the muscle.

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# 22.8: Exercise and Muscle Performance

## Learning Objectives

- Describe hypertrophy and atrophy
- Explain how resistance exercise builds muscle
- Explain how performance-enhancing substances affect muscle

Physical training alters the appearance of skeletal muscles and can produce changes in muscle performance. Conversely, a lack of use can result in decreased performance and muscle appearance. Although muscle cells can change in size, new cells are not formed when muscles grow. Instead, structural proteins are added to muscle fibers in a process called ***hypertrophy***, so cell diameter increases. The reverse, when structural proteins are lost and muscle mass decreases, is called ***atrophy***. Age-related muscle atrophy is called ***sarcopenia***. Cellular components of muscles can also undergo changes in response to changes in muscle use.

## Endurance Exercise

Slow fibers are predominantly used in endurance exercises that require little force but involve numerous repetitions. The aerobic metabolism used by slow-twitch fibers allows them to maintain contractions over long periods. Endurance training modifies these slow fibers to make them even more efficient by producing more mitochondria to enable more aerobic metabolism and more ATP production. Endurance exercise can also increase the amount of myoglobin in a cell, as increased aerobic respiration increases the need for oxygen. Myoglobin is found in the sarcoplasm and acts as an oxygen storage supply for the mitochondria.

The training can trigger the formation of more extensive capillary networks around the fiber, a process called ***angiogenesis,*** to supply oxygen and remove metabolic waste. To allow these capillary networks to supply the deep portions of the muscle, muscle mass does not greatly increase in order to maintain a smaller area for the diffusion of nutrients and gases. All of these cellular changes result in the ability to sustain low levels of muscle contractions for greater periods without fatiguing.

The proportion of SO muscle fibers in muscle determines the suitability of that muscle for endurance, and may benefit those participating in endurance activities. Postural muscles have a large number of SO fibers and relatively few FO and FG fibers, to keep the back straight (Figure 10.18). Endurance athletes, like marathon-runners also would benefit from a larger proportion of SO fibers, but it is unclear if the most-successful marathoners are those with naturally high numbers of SO fibers, or whether the most successful marathon runners develop high numbers of SO fibers with repetitive training. Endurance training can result in overuse injuries such as stress fractures and joint and tendon inflammation.




Figure 10.18. Marathoners Long-distance runners have a large number of SO fibers and relatively few FO and FG fibers. (credit: “Tseo2”/Wikimedia Commons)

## Resistance Exercise

Resistance exercises, as opposed to endurance exercise, require large amounts of FG fibers to produce short, powerful movements that are not repeated over long periods. The high rates of ATP hydrolysis and cross-bridge formation in FG fibers result in powerful muscle contractions. Muscles used for power have a higher ratio of FG to SO/FO fibers, and trained athletes possess even higher levels of FG fibers in their muscles. Resistance exercise affects muscles by increasing the formation of myofibrils, thereby increasing the thickness of muscle fibers. This added structure causes hypertrophy, or the enlargement of muscles, exemplified by the large skeletal muscles seen in body builders and other athletes (Figure 10.19). Because this muscular enlargement is achieved by the addition of structural proteins, athletes trying to build muscle mass often ingest large amounts of protein.



Figure 10.19. Hypertrophy Body builders have a large number of FG fibers and relatively few FO and SO fibers. (credit: Lin Mei/flickr)

Except for the hypertrophy that follows an increase in the number of sarcomeres and myofibrils in a skeletal muscle, the cellular changes observed during endurance training do not usually occur with resistance training. There is usually no significant increase in mitochondria or capillary density. However, resistance training does increase the development of connective tissue, which adds to the overall mass of the muscle and helps to contain muscles as they produce increasingly powerful contractions. Tendons also become stronger to prevent tendon damage, as the force produced by muscles is transferred to tendons that attach the muscle to bone.

For effective strength training, the intensity of the exercise must continually be increased. For instance, continued weight lifting without increasing the weight of the load does not increase muscle size. To produce ever-greater results, the weights lifted must become increasingly heavier, making it more difficult for muscles to move the load. The muscle then adapts to this heavier load, and an even heavier load must be used if even greater muscle mass is desired.

If done improperly, resistance training can lead to overuse injuries of the muscle, tendon, or bone. These injuries can occur if the load is too heavy or if the muscles are not given sufficient time between workouts to recover or if joints are not aligned properly during the exercises. Cellular damage to muscle fibers that occurs after intense exercise includes damage to the sarcolemma and myofibrils. This muscle damage contributes to the feeling of soreness after strenuous exercise, but muscles gain mass as this damage is repaired, and additional structural proteins are added to replace the damaged ones. Overworking skeletal muscles can also lead to tendon damage and even skeletal damage if the load is too great for the muscles to bear.

## Performance-Enhancing Substances

Some athletes attempt to boost their performance by using various agents that may enhance muscle performance. Anabolic steroids are one of the more widely known agents used to boost muscle mass and increase power output. Anabolic steroids are a form of testosterone, a male sex hormone that stimulates muscle formation, leading to increased muscle mass.

Endurance athletes may also try to boost the availability of oxygen to muscles to increase aerobic respiration by using substances such as erythropoietin (EPO), a hormone normally produced in the kidneys, which triggers the production of red blood cells. The extra oxygen carried by these blood cells can then be used by muscles for aerobic respiration. Human growth hormone (hGH) is another supplement, and although it can facilitate building muscle mass, its main role is to promote the healing of muscle and other tissues after strenuous exercise. Increased hGH may allow for faster recovery after muscle damage, reducing the rest required after exercise, and allowing for more sustained high-level performance.

Although performance-enhancing substances often do improve performance, most are banned by governing bodies in sports and are illegal for nonmedical purposes. Their use to enhance performance raises ethical issues of cheating because they give users an unfair advantage over nonusers. A greater concern, however, is that their use carries serious health risks. The side effects of these substances are often significant, nonreversible, and in some cases fatal. The physiological strain caused by these substances is often greater than what the body can handle, leading to effects that are unpredictable and dangerous. Anabolic steroid use has been linked to infertility, aggressive behavior, cardiovascular disease, and brain cancer.

Similarly, some athletes have used creatine to increase power output. Creatine phosphate provides quick bursts of ATP to muscles in the initial stages of contraction. Increasing the amount of creatine available to cells is thought to produce more ATP and therefore increase explosive power output, although its effectiveness as a supplement has been questioned.

## Everyday Connection: Aging and Muscle Tissue

Although atrophy due to disuse can often be reversed with exercise, muscle atrophy with age, referred to as sarcopenia, is irreversible. This is a primary reason why even highly trained athletes succumb to declining performance with age. This decline is

noticeable in athletes whose sports require strength and powerful movements, such as sprinting, whereas the effects of age are less noticeable in endurance athletes such as marathon runners or long-distance cyclists. As muscles age, muscle fibers die, and they are replaced by connective tissue and adipose tissue (Figure 10.20). Because those tissues cannot contract and generate force as muscle can, muscles lose the ability to produce powerful contractions. The decline in muscle mass causes a loss of strength, including the strength required for posture and mobility. This may be caused by a reduction in FG fibers that hydrolyze ATP quickly to produce short, powerful contractions. Muscles in older people sometimes possess greater numbers of SO fibers, which are responsible for longer contractions and do not produce powerful movements. There may also be a reduction in the size of motor units, resulting in fewer fibers being stimulated and less muscle tension being produced.

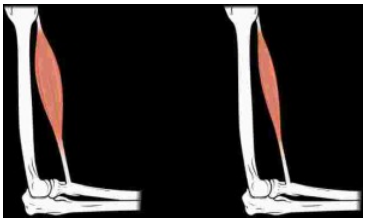


Figure 10.20. Atrophy Muscle mass is reduced as muscles atrophy with disuse.

Sarcopenia can be delayed to some extent by exercise, as training adds structural proteins and causes cellular changes that can offset the effects of atrophy. Increased exercise can produce greater numbers of cellular mitochondria, increase capillary density, and increase the mass and strength of connective tissue. The effects of age-related atrophy are especially pronounced in people who are sedentary, as the loss of muscle cells is displayed as functional impairments such as trouble with locomotion, balance, and posture. This can lead to a decrease in quality of life and medical problems, such as joint problems because the muscles that stabilize bones and joints are weakened. Problems with locomotion and balance can also cause various injuries due to falls.

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# 22.9: Interactions of Skeletal Muscles



*Figure 11.1. A Body in Motion The muscular system allows us to move, flex and contort our bodies. Practicing yoga, as pictured here, is a good example of the voluntary use of the muscular system. (credit: Dmitry Yanchylenko)*

## Introduction

### Learning Objectives

- Describe the actions and roles of agonists and antagonists
- Explain the structure and organization of muscle fascicles and their role in generating force
- Explain the criteria used to name skeletal muscles
- Identify the skeletal muscles and their actions on the skeleton and soft tissues of the body
- Identify the origins and insertions of skeletal muscles and the prime movements

Think about the things that you do each day—talking, walking, sitting, standing, and running—all of these activities require movement of particular skeletal muscles. Skeletal muscles are even used during sleep. The diaphragm is a sheet of skeletal muscle that has to contract and relax for you to breathe day and night. If you recall from your study of the skeletal system and joints, body movement occurs around the joints in the body. The focus of this chapter is on skeletal muscle organization. The system to name skeletal muscles will be explained; in some cases, the muscle is named by its shape, and in other cases it is named by its location or attachments to the skeleton. If you understand the meaning of the name of the muscle, often it will help you remember its location and/or what it does. This chapter also will describe how skeletal muscles are arranged to accomplish movement, and how other muscles may assist, or be arranged on the skeleton to resist or carry out the opposite movement. The actions of the skeletal muscles will be covered in a regional manner, working from the head down to the toes.

## Interactions of Skeletal Muscles, Their Fascicle Arrangement, and Their Lever Systems

### Learning Objectives

- Compare and contrast agonist and antagonist muscles
- Describe how fascicles are arranged within a skeletal muscle
- Explain the major events of a skeletal muscle contraction within a muscle in generating force

To move the skeleton, the tension created by the contraction of the fibers in most skeletal muscles is transferred to the tendons. The tendons are strong bands of dense, regular connective tissue that connect muscles to bones. The bone connection is why this muscle tissue is called skeletal muscle.

### Interactions of Skeletal Muscles in the Body

To pull on a bone, that is, to change the angle at its synovial joint, which essentially moves the skeleton, a skeletal muscle must also be attached to a fixed part of the skeleton. The moveable end of the muscle that attaches to the bone being pulled is called the muscle's ***insertion***, and the end of the muscle attached to a fixed (stabilized) bone is called the ***origin***. During forearm ***flexion***—bending the elbow—the brachioradialis assists the brachialis.

Although a number of muscles may be involved in an action, the principal muscle involved is called the ***prime mover***, or ***agonist***. To lift a cup, a muscle called the biceps brachii is actually the prime mover; however, because it can be assisted by the brachialis,

the brachialis is called a ***synergist*** in this action (Figure 11.2). A synergist can also be a ***fixator*** that stabilizes the bone that is the attachment for the prime mover's origin.

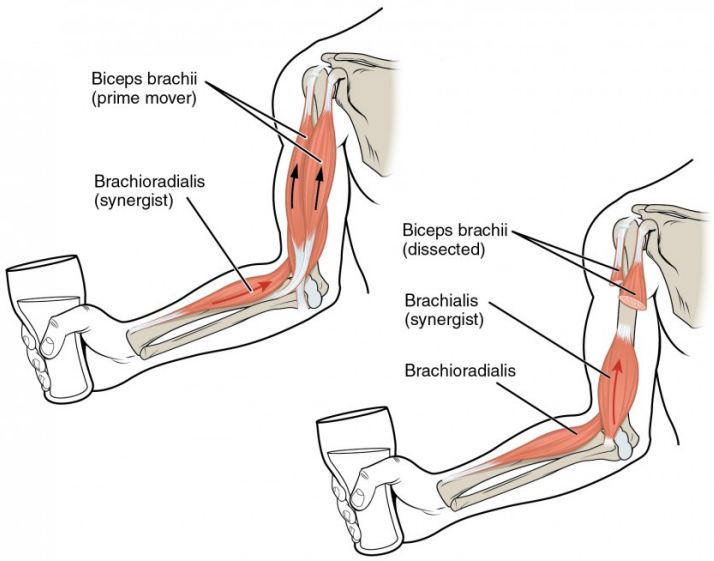



Figure 11.2. Prime Movers and Synergists The biceps brachii flex the lower arm. The brachoradialis, in the forearm, and brachialis, located deep to the biceps in the upper arm, are both synergists that aid in this motion.

A muscle with the opposite action of the prime mover is called an ***antagonist***. Antagonists play two important roles in muscle function: (1) they maintain body or limb position, such as holding the arm out or standing erect; and (2) they control rapid movement, as in shadow boxing without landing a punch or the ability to check the motion of a limb.

For example, to extend the knee, a group of four muscles called the quadriceps femoris in the anterior compartment of the thigh are activated (and would be called the agonists of knee extension). However, to flex the knee joint, an opposite or antagonistic set of muscles called the hamstrings is activated.

As you can see, these terms would also be reversed for the opposing action. If you consider the first action as the knee bending, the hamstrings would be called the agonists and the quadriceps femoris would then be called the antagonists. See Table 11.1 for a list of some agonists and antagonists.

Table 11.1.

| Agonist and Antagonist Skeletal Muscle Pairs | | |
|---|---|---|
| Agonist | Antagonist | Movement |
| Biceps brachii: in the anterior compartment of the arm | Triceps brachii: in the posterior compartment of the arm | The biceps brachii flexes the forearm, whereas the triceps brachii extends it. |
| Hamstrings: group of three muscles in the posterior compartment of the thigh | Quadriceps femoris: group of four muscles in the anterior compartment of the thigh | The hamstrings flex the leg, whereas the quadriceps femoris extend it. |
| Flexor digitorum superficialis and flexor digitorum profundus: in the anterior compartment of the forearm | Extensor digitorum: in the posterior compartment of the forearm | The flexor digitorum superficialis and flexor digitorum profundus flex the fingers and the hand at the wrist, whereas the extensor digitorum extends the fingers and the hand at the wrist. |

There are also skeletal muscles that do not pull against the skeleton for movements. For example, there are the muscles that produce facial expressions. The insertions and origins of facial muscles are in the skin, so that certain individual muscles contract to form a smile or frown, form sounds or words, and raise the eyebrows. There also are skeletal muscles in the tongue, and the external urinary and anal sphincters that allow for voluntary regulation of urination and defecation, respectively. In addition, the diaphragm contracts and relaxes to change the volume of the pleural cavities but it does not move the skeleton to do this.

## Everyday Connections: Exercise and Stretching

When exercising, it is important to first warm up the muscles. Stretching pulls on the muscle fibers and it also results in an increased blood flow to the muscles being worked. Without a proper warm-up, it is possible that you may either damage some of the muscle fibers or pull a tendon. A pulled tendon, regardless of location, results in pain, swelling, and diminished function; if it is moderate to severe, the injury could immobilize you for an extended period.

Recall the discussion about muscles crossing joints to create movement. Most of the joints you use during exercise are synovial joints, which have synovial fluid in the joint space between two bones. Exercise and stretching may also have a beneficial effect on synovial joints. Synovial fluid is a thin, but viscous film with the consistency of egg whites. When you first get up and start moving, your joints feel stiff for a number of reasons. After proper stretching and warm-up, the synovial fluid may become less viscous, allowing for better joint function.

## Patterns of Fascicle Organization

Skeletal muscle is enclosed in connective tissue scaffolding at three levels. Each muscle fiber (cell) is covered by endomysium and the entire muscle is covered by epimysium. When a group of muscle fibers is "bundled" as a unit within the whole muscle by an additional covering of a connective tissue called perimysium, that bundled group of muscle fibers is called a ***fascicle***. Fascicle arrangement by perimysia is correlated to the force generated by a muscle; it also affects the range of motion of the muscle. Based on the patterns of fascicle arrangement, skeletal muscles can be classified in several ways. What follows are the most common fascicle arrangements.

***Parallel*** muscles have fascicles that are arranged in the same direction as the long axis of the muscle (Figure 11.3). The majority of skeletal muscles in the body have this type of organization. Some parallel muscles are flat sheets that expand at the ends to make broad attachments. Other parallel muscles are rotund with tendons at one or both ends. Muscles that seem to be plump have a large mass of tissue located in the middle of the muscle, between the insertion and the origin, which is known as the central body. A more common name for this muscle is ***belly***. When a muscle contracts, the contractile fibers shorten it to an even larger bulge. For example, extend and then flex your biceps brachii muscle; the large, middle section is the belly (Figure 11.4). When a parallel muscle has a central, large belly that is spindle-shaped, meaning it tapers as it extends to its origin and insertion, it sometimes is called ***fusiform***.

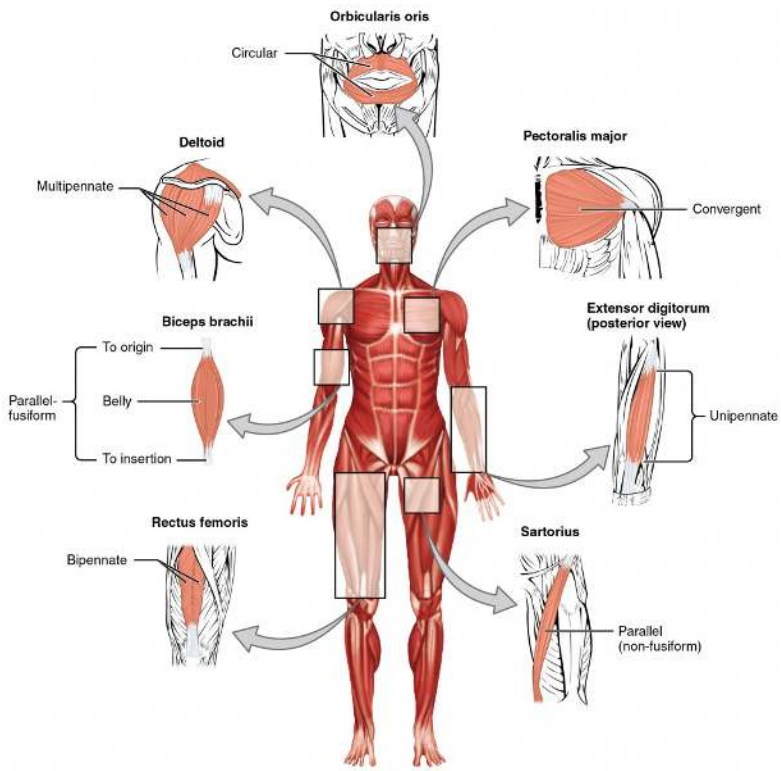



Figure 11.3. Muscle Shapes and Fiber Alignment The skeletal muscles of the body typically come in seven different general shapes.



*Figure 11.4. Biceps Brachii Muscle Contraction The large mass at the center of a muscle is called the belly. Tendons emerge from both ends of the belly and connect the muscle to the bones, allowing the skeleton to move. The tendons of the bicep connect to the upper arm and the forearm. (credit: Victoria Garcia)*

***Circular*** muscles are also called sphincters (see Figure 11.3). When they relax, the sphincters' concentrically arranged bundles of muscle fibers increase the size of the opening, and when they contract, the size of the opening shrinks to the point of closure. The orbicularis oris muscle is a circular muscle that goes around the mouth. When it contracts, the oral opening becomes smaller, as when puckering the lips for whistling. Another example is the orbicularis oculi, one of which surrounds each eye. Consider, for example, the names of the two orbicularis muscles (orbicularis oris and oribicularis oculi), where part of the first name of both muscles is the same. The first part of orbicularis, orb (orb = "circular"), is a reference to a round or circular structure; it may also make one think of orbit, such as the moon's path around the earth. The word oris (oris = "oral") refers to the oral cavity, or the mouth. The word oculi (ocular = "eye") refers to the eye.

There are other muscles throughout the body named by their shape or location. The deltoid is a large, triangular-shaped muscle that covers the shoulder. It is so-named because the Greek letter delta looks like a triangle. The rectus abdomis (rector = "straight") is the straight muscle in the anterior wall of the abdomen, while the rectus femoris is the straight muscle in the anterior compartment of the thigh.

When a muscle has a widespread expansion over a sizable area, but then the fascicles come to a single, common attachment point, the muscle is called ***convergent***. The attachment point for a convergent muscle could be a tendon, an aponeurosis (a flat, broad tendon), or a raphe (a very slender tendon). The large muscle on the chest, the pectoralis major, is an example of a convergent muscle because it converges on the greater tubercle of the humerus via a tendon. The temporalis muscle of the cranium is another.

***Pennate*** muscles (penna = "feathers") blend into a tendon that runs through the central region of the muscle for its whole length, somewhat like the quill of a feather with the muscle arranged similar to the feathers. Due to this design, the muscle fibers in a pennate muscle can only pull at an angle, and as a result, contracting pennate muscles do not move their tendons very far. However, because a pennate muscle generally can hold more muscle fibers within it, it can produce relatively more tension for its size. There are three subtypes of pennate muscles.

In a ***unipennate*** muscle, the fascicles are located on one side of the tendon. The extensor digitorum of the forearm is an example of a unipennate muscle. A ***bipennate*** muscle has fascicles on both sides of the tendon. In some pennate muscles, the muscle fibers wrap around the tendon, sometimes forming individual fascicles in the process. This arrangement is referred to as ***multipennate***. A common example is the deltoid muscle of the shoulder, which covers the shoulder but has a single tendon that inserts on the deltoid tuberosity of the humerus.

Because of fascicles, a portion of a multipennate muscle like the deltoid can be stimulated by the nervous system to change the direction of the pull. For example, when the deltoid muscle contracts, the arm abducts (moves away from midline in the sagittal plane), but when only the anterior fascicle is stimulated, the arm will ***abduct*** and flex (move anteriorly at the shoulder joint).

## The Lever System of Muscle and Bone Interactions

Skeletal muscles do not work by themselves. Muscles are arranged in pairs based on their functions. For muscles attached to the bones of the skeleton, the connection determines the force, speed, and range of movement. These characteristics depend on each other and can explain the general organization of the muscular and skeletal systems.

The skeleton and muscles act together to move the body. Have you ever used the back of a hammer to remove a nail from wood? The handle acts as a lever and the head of the hammer acts as a fulcrum, the fixed point that the force is applied to when you pull back or push down on the handle. The effort applied to this system is the pulling or pushing on the handle to remove the nail, which is the load, or "resistance" to the movement of the handle in the system. Our musculoskeletal system works in a similar manner,

with bones being stiff levers and the articular endings of the bones—encased in synovial joints—acting as fulcrums. The load would be an object being lifted or any resistance to a movement (your head is a load when you are lifting it), and the effort, or applied force, comes from contracting skeletal muscle.

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# 22.10: SELF-CHECK QUESTIONS- Interactions of Skeletal Muscles

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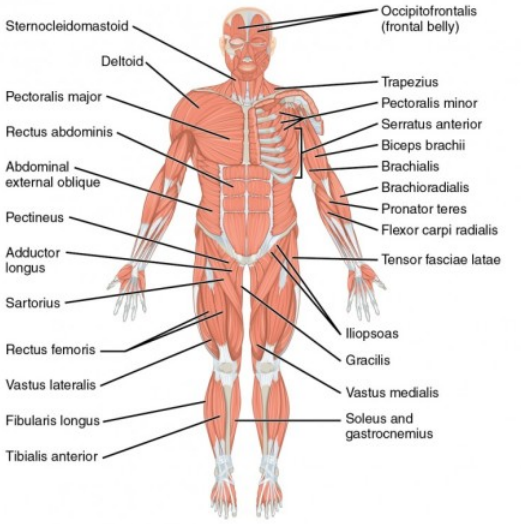
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# 22.11: Naming Skeletal Muscles

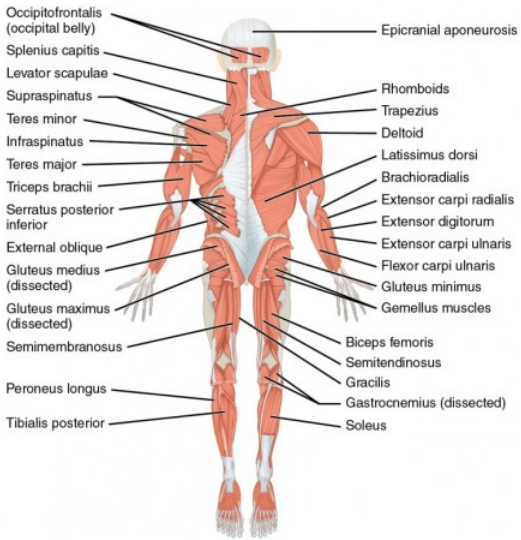
## Learning Objectives

- Describe the criteria used to name skeletal muscles
- Explain how understanding the muscle names helps describe shapes, location, and actions of various muscles

The Greeks and Romans conducted the first studies done on the human body in Western culture. The educated class of subsequent societies studied Latin and Greek, and therefore the early pioneers of anatomy continued to apply Latin and Greek terminology or roots when they named the skeletal muscles. The large number of muscles in the body and unfamiliar words can make learning the names of the muscles in the body seem daunting, but understanding the etymology can help. Etymology is the study of how the root of a particular word entered a language and how the use of the word evolved over time. Taking the time to learn the root of the words is crucial to understanding the vocabulary of anatomy and physiology. When you understand the names of muscles it will help you remember where the muscles are located and what they do (Figure 11.5, Figure 11.6, and Table 11.2). Pronunciation of words and terms will take a bit of time to master, but after you have some basic information; the correct names and pronunciations will become easier.




Major muscles of the body. Right side: superficial; left side: deep (anterior view)




Major muscles of the body. Right side: superficial; left side: deep (posterior view)

Figure 11.5. Overview of the Muscular System On the anterior and posterior views of the muscular system above, superficial muscles (those at the surface) are shown on the right side of the body while deep muscles (those underneath the superficial muscles) are shown on the left half of the body. For the legs, superficial muscles are shown in the anterior view while the posterior view shows both superficial and deep muscles.

| Example | Word | Latin Root 1 | Latin Root 2 | Meaning | Translation |
|---|---|---|---|---|---|
| abductor digiti minimi | abductor | ab = away from | duct = to move | a muscle that moves away from | A muscle that moves the little finger or toe away |
| | digiti | digitus = digit | | refers to a finger or toe | |
| | minimi | minimus = mini, tiny | | little | |
| adductor digiti minimi | adductor | ad = to, toward | duct = to move | a muscle that moves towards | A muscle that moves the little finger or toe toward |
| | digiti | digitus = digit | | refers to a finger or toe | |
| | minimi | minimus = mini, tiny | | little | |

Figure 11.6. Understanding a Muscle Name from the Latin

Table 11.2.

| Mnemonic Device for Latin Roots | | |
|---|---|---|
| Example | Latin or Greek Translation | Mnemonic Device |
| ad | to; toward | ADvance toward your goal |
| ab | away from | n/a |
| sub | under | SUBmarines move under water. |
| ductor | something that moves | A conDUCTOR makes a train move. |
| anti | against | If you are antisocial, you are against engaging in social activities. |
| epi | on top of | n/a |
| apo | to the side of | n/a |
| longissimus | longest | “Longissimus” is longer than the word “long.” |
| longus | long | long |
| brevis | short | brief |
| maximus | large | max |
| medius | medium | “Medius” and “medium” both begin with “med.” |
| minimus | tiny; little | mini |
| rectus | straight | To RECTify a situation is to straighten it out. |
| multi | many | If something is MULTIcolored, it has many colors. |
| uni | one | A UNIcorn has one horn. |
| bi/di | two | If a ring is DIcast, it is made of two metals. |
| tri | three | TRIple the amount of money is three times as much. |

| Mnemonic Device for Latin Roots | | |
|---|---|---|
| Example | Latin or Greek Translation | Mnemonic Device |
| quad | four | QUADruplets are four children born at one birth. |
| externus | outside | EXternal |
| internus | inside | INternal |

Anatomists name the skeletal muscles according to a number of criteria, each of which describes the muscle in some way. These include naming the muscle after its shape, its size compared to other muscles in the area, its location in the body or the location of its attachments to the skeleton, how many origins it has, or its action.

The skeletal muscle's anatomical location or its relationship to a particular bone often determines its name. For example, the frontalis muscle is located on top of the frontal bone of the skull. Similarly, the shapes of some muscles are very distinctive and the names, such as orbicularis, reflect the shape. For the buttocks, the size of the muscles influences the names: gluteus ***maximus*** (largest), gluteus ***medius*** (medium), and the gluteus ***minimus*** (smallest). Names were given to indicate length— ***brevis*** (short), ***longus*** (long)—and to identify position relative to the midline: ***lateralis*** (to the outside away from the midline), and ***medialis*** (toward the midline). The direction of the muscle fibers and fascicles are used to describe muscles relative to the midline, such as the ***rectus*** (straight) abdominis, or the ***oblique*** (at an angle) muscles of the abdomen.

Some muscle names indicate the number of muscles in a group. One example of this is the quadriceps, a group of four muscles located on the anterior (front) thigh. Other muscle names can provide information as to how many origins a particular muscle has, such as the biceps brachii. The prefix ***bi*** indicates that the muscle has two origins and ***tri*** indicates three origins.

The location of a muscle's attachment can also appear in its name. When the name of a muscle is based on the attachments, the origin is always named first. For instance, the sternocleidomastoid muscle of the neck has a dual origin on the sternum (sterno) and clavicle (cleido), and it inserts on the mastoid process of the temporal bone. The last feature by which to name a muscle is its action. When muscles are named for the movement they produce, one can find action words in their name. Some examples are ***flexor*** (decreases the angle at the joint), ***extensor*** (increases the angle at the joint), ***abductor*** (moves the bone away from the midline), or ***adductor*** (moves the bone toward the midline).

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# 22.12: Overview of Muscle Tissue Types

## The three types of muscle tissue are skeletal, smooth, and cardiac

### LEARNING OBJECTIVE

By the end of this section, you will be able to:

- Differentiate between the structure and location of skeletal, smooth, and cardiac muscles

### Key Points

- Skeletal muscles are attached to bones and allow voluntary movement of the body.
- Smooth muscles, which generate involuntary movement, form part of the walls of the esophagus, stomach, intestines, bronchi, uterus, urethra, bladder, and blood vessels, among other portions of the body.
- Cardiac muscle is involuntary and found only in the heart.
- Skeletal muscle is striated in regular, parallel bundles of sarcomeres.
- Cardiac muscle is striated, but the bundles are connected at branching, irregular angles called intercalated discs.
- Skeletal muscle tissue is about 15% denser than fat tissue.

### GLOSSARY

**cardiac muscle**: The striated and involuntary muscle of the vertebrate heart.

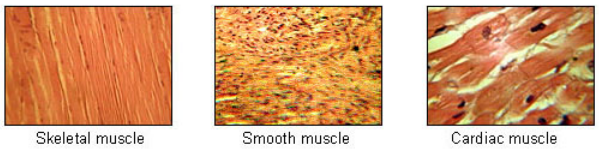
**skeletal muscle**: The voluntary muscle of vertebrates, which is striated and anchored by tendons to bone, is used to effect skeletal movement such as locomotion.

**smooth muscle**: Involuntary muscle which is found within the intestines, throat, uterus, and blood vessel walls.

**Example**: The girl is taking a walk, using her voluntary control of her skeletal muscles to move her body down the path. She decides to climb a hill and can feel the involuntary racing of her heart as she climbs the rugged slope. At the top of the hill, she takes a deep drink of water, which will eventually lead to an involuntary stretching of her bladder as she heads home.

## Different Types, Different Functions

Muscle tissue is a soft tissue, and is one of the four fundamental types of tissue present in animals. There are three types of muscle tissue recognized in vertebrates. *Skeletal muscle*, or *voluntary muscle*, is anchored to bone by tendons, or by aponeuroses at a few places, and is used to effect skeletal movement in activities such as locomotion and maintaining posture. Though this postural control is generally maintained as an unconscious reflex, the muscles responsible react to conscious control like non-postural muscles. An average adult male is made up of 42% of skeletal muscle and an average adult female is made up of 36%, expressed as a percentage of body mass.




Muscle Types
Cardiac and skeletal muscle are both striated in appearance, while smooth muscle is not. Both cardiac and smooth muscle are involuntary while skeletal muscle is voluntary.

*Smooth muscle*, or *involuntary muscle*, is found within the walls of organs and structures such as the esophagus, stomach, intestines, bronchi, uterus, urethra, bladder, blood vessels, and the arrector pili in the skin, in which it controls the erection of body hair. Unlike skeletal muscle, smooth muscle is not under conscious control. Cardiac muscle is also an involuntary muscle but is more akin in structure to skeletal muscle, and is found only in the heart.

Cardiac and skeletal muscles are *striated*, in that they contain sarcomeres and are packed into highly regular, repeating arrangements of bundles; smooth muscle has neither attribute. While skeletal muscles are arranged in regular, parallel bundles, cardiac muscle connects at branching, irregular angles, called *intercalated discs*. Striated muscle contracts and relaxes in short, intense bursts, whereas smooth muscle sustains longer or even near-permanent contractions.

The density of mammalian skeletal muscle tissue is about 1.06 kg/liter. This can be contrasted with the density of adipose tissue (fat), which is 0.9196 kg/liter. This makes muscle tissue approximately 15% denser than fat tissue.

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# 22.13: Overview of Muscle Functions

## The function of muscles is movement, but the types of movement elicited differ between skeletal, cardiac, and smooth muscle.

### LEARNING OBJECTIVE

By the end of this section, you will be able to:

- Differentiate among the actions of skeletal, smooth, and cardiac muscles

### KEY POINTS

- The origin and insertion points of skeletal muscles allow force to be exerted that allows movement of the skeleton.
- Skeletal movement is a form of lever mechanics with the position of origin and insertion of the muscle allowing for differences in force, velocity, and directionality.
- Smooth muscles act by involuntary peristalsis, moving food through the digestive system.
- Cardiac muscle contracts the heart without conscious thought, which is necessary for survival.

### GLOSSARY

**peristalsis**: The rhythmic, wave-like contraction of both longitudinal and circular smooth muscle fibers within the digestive tract that forces food through it.

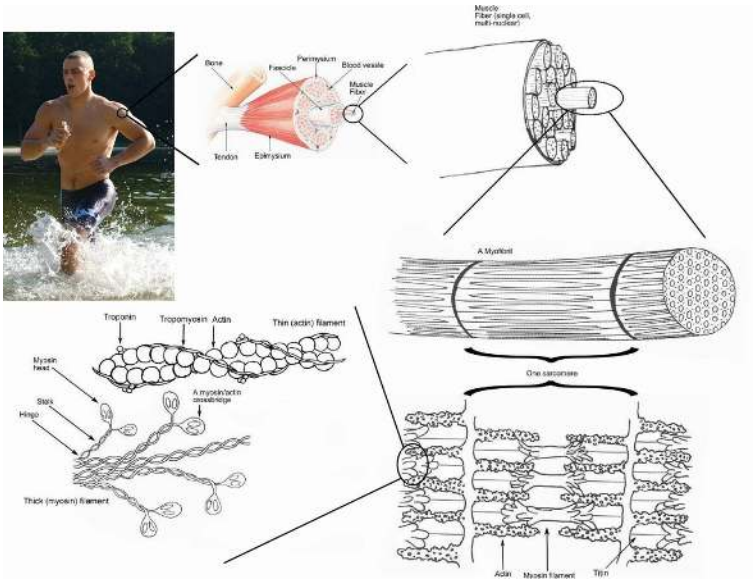
**insertion**: The distal end of attachment of a muscle to a bone that will be moved by the muscle when it contracts.

**origin**: The proximal end of attachment of a muscle to a bone that will not be moved by the action of that muscle.

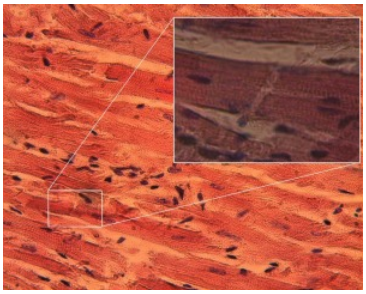
**Examples**:

- While cardiac muscle is considered involuntary, some individuals with yogic training have been shown to be able to voluntarily reduce their heart rate.
- Food poisoning can result in involuntary reversed peristalsis or vomiting.

Skeletal muscles are voluntary, striated muscles that allow movement of an organism by the deliberate generation of force . The action a skeletal muscle generates is determined by the origin and insertion locations. The cross-sectional area of a muscle (rather than volume or length) determines the amount of force it can generate by defining the number of sarcomeres which can operate in parallel. The amount of force applied to the external environment is determined by lever mechanics, specifically the ratio of in lever to out lever. For example, moving the insertion point of the biceps more distally on the radius (farther from the joint of rotation) would increase the force generated during flexion (and, as a result, the maximum weight lifted in this movement), but decrease the maximum speed of flexion. Moving the insertion point proximally (closer to the joint of rotation) would result in decreased force but increased velocity. This can be most easily seen by comparing the limb of a mole to a horse: In the former, the insertion point is positioned to maximize force (for digging), while in the latter, the insertion point is positioned to maximize speed (for running).




In addition to voluntary contractions of skeletal muscle, involuntary muscle also contracts in a similar fashion but does so involuntarily. Smooth muscle is responsible for movement of food through the digestive system via peristalsis and regulates the diameter of blood vessels, determining how much blood flows through the vessels. Cardiac muscle is responsible for contraction of the heart . The contraction of cardiac muscle of the heart is coordinated such that the entire heart beats in a controlled, uniform manner, ensuring blood is efficiently pumped from the chambers. Cardiac and smooth muscle contraction occurs without conscious thought and is necessary for survival.



Cardiac muscle is striated, similar to skeletal muscle, but beats involuntarily. The cells beat in unison as a result of unique gap junctions between the muscle cells.

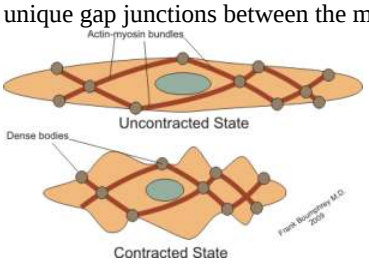



Diagram of contraction of smooth muscle fiber showing peristalsis

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# 22.14: Types of Skeletal Muscle Fibers

## Slow-twitch and fast-twitch skeletal muscle fibers can be characterized by their metabolic processes and corresponding physiological traits.

### LEARNING OBJECTIVE

By the end of this section, you will be able to:

- Differentiate between the types of skeletal muscle fibers

### KEY POINTS

- Oxidative fibers rely on aerobic respiration to fuel muscle contractions, and include slow-twitch fibers, which are characterized as muscles with long contraction duration, associated with endurance.
- Glycolytic fibers rely on glycolysis to fuel muscle contractions and include fast-twitch fibers, which are characterized by fast muscle contractions of short duration.
- The proportion of fast-twitch vs. slow-twitch muscles of an individual is partly genetic in nature. However, concentrated exercise that prioritizes one type of muscle fiber use over the other can improve an individual's ability to perform related physical activities.

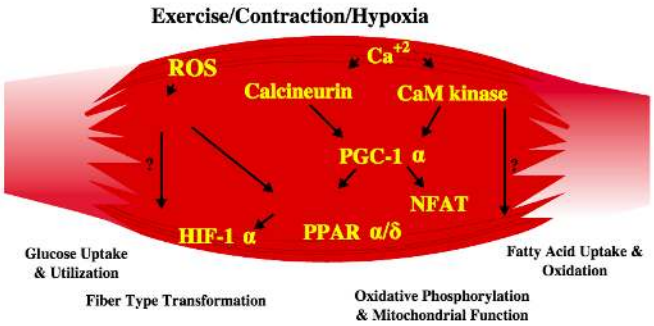
### GLOSSARY

**fast-twitch**: Type II fibers which are characterized by fast muscle contractions of short duration.

**slow-twitch**: Type I fibers characterized as muscles with long contraction duration, associated with endurance.

**glycolytic**: Of, pertaining to or producing glycolysis, which is the metabolic pathway that converts glucose into pyruvate.

Skeletal muscle fibers can be characterized by their metabolic processes and corresponding physiological traits.




Signaling Pathways that Regulate Skeletal Muscle Fiber-type Phenotype
Exercise-induced signaling pathways in skeletal muscle that determine specialized characteristics of slow-twitch and fast-twitch muscle fibers.

Oxidative fibers rely on aerobic respiration to fuel muscle contractions, and consist of slow-twitch (Type I) fibers, which are characterized as muscles with long contraction duration, associated with endurance. Slow-twitch fibers are used to maintain posture. They are usually found in red muscles, indicative of the large concentration of myoglobin providing a steady supply of oxygen to them. The red muscles use oxidative phosphorylation to obtain ATP. Oxidative phosphorylation occurs in the red muscles as the process requires a lot of oxygen, and the red muscles contain high amounts of myoglobin. The process is slower than glycolysis, but much more efficient, which is why slow-twitch muscles do not tire easily. Also, slow-twitch fibers contain less sarcoplasmic reticulum, facilitating a slower release of calcium, regulating muscle contraction at slower rates.

Glycolytic fibers rely on glycolysis to fuel muscle contractions and consist of fast-twitch (Type II) fibers, which are characterized by fast muscle contractions of short duration. Fast-twitch fibers are constituents of white muscles and have less myoglobin due to their primary reliance on glycolysis (anaerobic respiration) to fuel muscle contractions. Although glycolysis is very quick, it is also inefficient at producing ATP. Glycolysis produces lactic acid as a byproduct, which leads to fatigue. The use of the glycogen cycle is the reason why fast-twitch muscles tire out quickly.

There is some evidence that the proportion of fast-twitch versus slow-twitch muscles of an individual is partly genetic in nature. That is, we are born with a unique proportion of such muscles that suit us to particular types of physical activity. This is not without debate, however. Regardless, concentrated exercise that prioritizes one type of muscle fiber use over the other, can lead to muscle hypertrophy (increase in size), improving an individual's ability to perform related physical activities.

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# 22.15: Types of Muscle Contractions- Isotonic and Isometric

## Muscle contractions are defined by the changes in the length of the muscle during contraction.

### LEARNING OBJECTIVE

By the end of this section, you will be able to:

- Differentiate among the types of muscle contractions

### KEY POINTS

- Isotonic contractions generate force by changing the length of the muscle and can be concentric contractions or eccentric contractions.
- A concentric contraction causes muscles to shorten, thereby generating force.
- Eccentric contractions cause muscles to elongate in response to a greater opposing force.
- Isometric contractions generate force without changing the length of the muscle.

### GLOSSARY

**isometric**: Of or involving muscular contraction against resistance in which the length of the muscle remains the same.

**isotonic**: Of or involving muscular contraction against resistance in which the length of the muscle changes. Antonym is isometric. Isotonic movements are either concentric (working muscle shortens) or eccentric (working muscle lengthens).

**concentric**: (Of a motion), in the direction of contraction of a muscle. (E.g., extension of the lower arm via the elbow joint while contracting the triceps and other elbow extensor muscles.

**eccentric**: Against or in the opposite direction of contraction of a muscle. (E.g., flexion of the lower arm (bending of the elbow joint) by an external force while contracting the triceps and other elbow extensor muscles to control that movement.

**Example**:

- An example of this in the context of a bench press would be that a yielding isometric would be holding the bar at a given place even though it could be pressed higher, and an overcoming would be pressing the bar up into the safety guards of a squat cage that prevent pushing the bar any higher.

Muscle fiber generates tension through the action of actin and myosin cross-bridge cycling. While under tension, the muscle may lengthen, shorten, or remain the same. Although the term contraction implies shortening, when referring to the muscular system, it means muscle fibers generating tension with the help of motor neurons. Several types of muscle contractions occur and they are defined by the changes in the length of the muscle during contraction.

## Isotonic Contractions

Isotonic contractions maintain constant tension in the muscle as the muscle changes length. This can occur only when a muscle's maximal force of contraction exceeds the total load on the muscle. Isotonic muscle contractions can be either concentric (muscle shortens) or eccentric (muscle lengthens).

### Concentric Contractions

A concentric contraction is a type of muscle contraction in which the muscles shorten while generating force. This is typical of muscles that contract due to the sliding filament mechanism, and it occurs throughout the muscle. Such contractions also alter the angle of the joints to which the muscles are attached, as they are stimulated to contract according to the sliding filament mechanism.

This occurs throughout the length of the muscle, generating force at the musculo-tendinous junction; causing the muscle to shorten and the angle of the joint to change. For instance, a concentric contraction of the biceps would cause the arm to bend at the elbow as the hand moves from near to the leg to close to the shoulder (a biceps curl). A concentric contraction of the triceps would change the angle of the joint in the opposite direction, straightening the arm and moving the hand toward the leg.

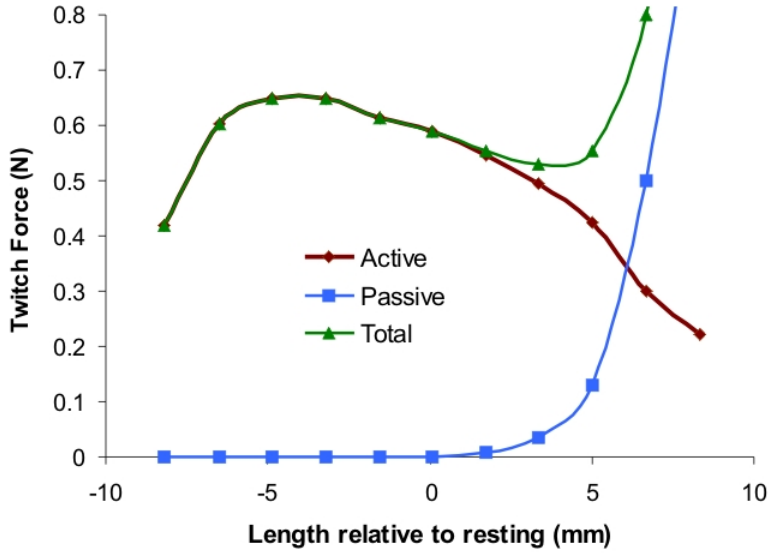
## Eccentric Contractions

An eccentric contraction results in the elongation of a muscle. Such contractions decelerate the muscle joints (acting as “brakes” to concentric contractions) and can alter the position of the load force. These contractions can be both voluntary and involuntary. During an eccentric contraction, the muscle elongates while under tension due to an opposing force which is greater than the force generated by the muscle. Rather than working to pull a joint in the direction of the muscle contraction, the muscle acts to decelerate the joint at the end of a movement or otherwise control the repositioning of a load.

This can occur involuntarily (when attempting to move a weight too heavy for the muscle to lift) or voluntarily (when the muscle is “smoothing out” a movement). Over the short-term, strength training involving both eccentric and concentric contractions appear to increase muscular strength more than training with concentric contractions alone.

## Isometric Contractions

In contrast to isotonic contractions, isometric contractions generate force without changing the length of the muscle . This is typical of muscles found in the hands and forearm: the muscles do not change length, and joints are not moved, so force for grip is sufficient. An example is when the muscles of the hand and forearm grip an object; the joints of the hand do not move, but muscles generate sufficient force to prevent the object from being dropped.




Force-length relationship in muscle: Muscle length versus isometric force.
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# 22.16: Effect of Exercise on Muscles

## Sustained, repeated overload of a group of muscles leads to muscle hypertrophy and strengthening of that muscle group.

### LEARNING OBJECTIVE

By the end of this section, you will be able to:

- Differentiate between the short-term and long-term effects of exercise on muscles

### KEY POINTS

- Aerobic exercise, or physical activity under conditions of high oxygen availability, involves extended periods of exercise at levels below maximal contraction strength, and uses a high percentage of Type I muscle fibers.
- Anaerobic respiration, or physical activity with a low availability of oxygen, involves high intensity muscle contractions for short periods of time, utilizing primarily Type II muscle fibers.
- Anaerobic exercise involves short, high-intensity bouts of exertion that utilize little or no oxygen and lead to increased levels of lactic acid.
- Muscle metabolism differs due to exercise type, primarily the availability (aerobic) or lack of availability (anaerobic) of oxygen. The rate at which energy is needed determines the relative contributions of these energy systems.
- Muscle metabolism differs due to exercise type, primarily the availability (aerobic) of lack of availability (anaerobic) of oxygen.

### GLOSSARY

**muscle hypertrophy:** Increase in muscle mass due to exercise, particularly weight training; a noticeable long-term effect of exercise.

**lactic acid**: Also known as milk acid, is a chemical compound that plays a role in various biochemical processes. During power exercises such as sprinting, when the rate of demand for energy is high, glucose is broken down and oxidized to pyruvate, and lactate is produced from the pyruvate faster than the tissues can remove it, so lactate concentration begins to rise.

**Type II muscle fibers:** Fast-twitch muscles fibers for short, high intensity contractions. Muscles prioritize the use of readily-available ATP, glucose and glycogen for these muscle contractions, which results in a build-up of lactic acid.

## The Effects of Exercise

Exercise involves a series of sustained muscle contractions, of either long or short duration, depending on the nature of the physical activity. Effects of exercise on muscles can be considered short-term or immediate, both during and shortly after exercise; as well as long-term, lasting effects.

### IMMEDIATE, SHORT-TERM EFFECTS

The effects of exercise on muscles varies with the type and duration of the activity.Aerobic exercise is typical of activities requiring endurance and sustained muscle contractions. Such activities rely mainly on Type I (slow-twitch muscles) which sustain maximal contraction for extensive periods of time. This use of slow-twitch muscles, and the availability of oxygen, prevents the buildup of lactic acid, and typically does not result in substantial muscle fatigue in the short-term. Sustained aerobic respiration tends to shift the metabolic pathways of muscle to favor the use of fat as the primary source of ATP, and glycogen is generally avoided.

Anaerobic respiration, typical of sprinting and weight lifting , prioritizes the use of Type II (fast-twitch) muscles fibers for short, high-intensity contractions. Muscles prioritize the use of readily-available ATP, glucose and glycogen for these contractions, which results in a build-up of lactic acid. Though traditionally viewed as the cause of muscle fatigue, recent research indicates ion shortages, particularly of calcium, during an aerobic exercise, causes such muscle fatigue. However, lactic acid inhibits further ATP production, indirectly causing fatigue.



Muscle Hypertrophy: Shoulder with deltoid and bicep hypertrophy

Muscle soreness, once thought to be due to lactic acid accumulation, has more recently been attributed to small tearing of the muscles fibers caused by eccentric contraction.

## LONG-TERM EFFECTS

Muscle hypertrophy, or the increase in muscle mass due to exercise , particularly weight training, is a noticeable long-term effect of exercise. Exercise of specific muscles can often result in hypertrophy in the opposite muscles as well, a phenomenon known as *cross education.*

Experts and professionals differ widely on the best approaches to specifically achieve muscle growth, as opposed to focusing on gaining strength, power, or endurance. It was generally considered that consistent anaerobic strength training will produce hypertrophy over the long term, in addition to its effects on muscular strength and endurance.

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# 22.17: Muscular Atrophy and Hypertrophy

## Muscle atrophy is a decrease in muscle mass; muscle hypertrophy is an increase in muscle mass due to an increase in muscle cell size.

### LEARNING OBJECTIVE

By the end of this section, you will be able to:

- Differentiate between muscular atrophy and hypertrophy

### KEY POINTS

- Muscle atrophy refers to the decrease in muscle mass leading to muscle weakness or a decrease in the ability to generate force.
- Atrophy has several causes including disease, starvation, and simple disuse.
- Muscle hypertrophy differs from muscle hyperplasia, which is the formation of new muscle cells.
- A range of stimuli can induce muscle cell hypertrophy, including strength training or anaerobic training.
- Biological factors such as age and nutrition can affect muscle hypertrophy.

### GLOSSARY

**atrophy**: To wither or waste away.

**dystrophy**: A wasting of body tissues, of genetic origin or due to inadequate or defective nutrition.

**sarcopenia**: Age-related loss of skeletal muscle, resulting in frailty. Often found together with osteoporosis, a loss of bone that is similarly associated with the aging process.

Muscle atrophy is the decrease in muscle strength due to a decrease in muscle mass, or the amount of muscle fibers. Atrophy can be partial or complete, varying in the extent of muscle weakness. Muscle atrophy is often a result of disease such as cancer, AIDS, congestive heart failure, chronic obstructive pulmonary disease, renal failure, and burns. Starvation can also result in muscle atrophy. Simple disuse of muscle, either due to a sedentary lifestyle, or because of bed rest, can also cause muscle atrophy.

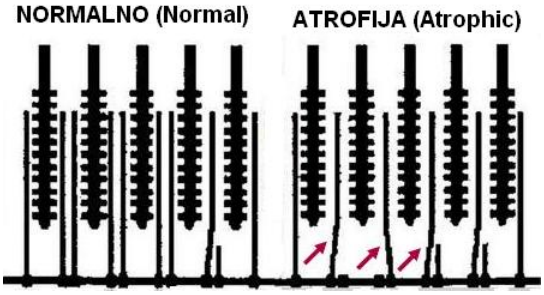
Muscle atrophy is typical to some extent during aging. Atrophy over time due to aging is known as sarcopenia. Though not completely clear, it is suspected that the cause of sarcopenia is a combination of the decline of satellite cells to regenerate cells of skeletal muscle fibers, as well as a decreased sensitivity or availability of hormonecues, including growth factors, that stimulate maintenance muscles through regeneration of muscle fiber cells from satellite cells.

Loss of muscle not due to atrophy or sarcopenia is indicative of diseases that result in structural defects of muscles (muscular dystrophy) or autoimmune responses that degrade muscle structure (myopathies).

Muscle hypertrophy is an increase in the size of a muscle through an increase in the size of its component cells. It differs from muscle hyperplasia, which is the formation of new muscle cells. Depending on the type of training, the hypertrophy can occur through increased sarcoplasmic volume or increased contractile proteins.

A range of stimuli can increase the volume of muscle cells, including strength training or anaerobic training. These changes occur as an adaptive response that serves to increase the ability to generate force or resist fatigue in anaerobic conditions.

Several biological factors such as age and nutrition can affect muscle hypertrophy. During puberty in males, hypertrophy occurs at an increased rate. Natural hypertrophy normally stops at full growth in the late teens. An adequate supply ofamino acids is essential to produce muscle hypertrophy. As testosterone is one of the body’s major growth hormones, on average, men find hypertrophy much easier to achieve than women. Taking additional testosterone, as in anabolic steroids, will increase results. It is also considered a performance-enhancing drug, the use of which can cause competitors to be suspended or banned from competitions. In addition, testosterone is also a medically regulated substance in most countries, making it illegal to possess it without a medical prescription.




Normal versus atrophied sarcomeres: Schematic of filament arrangement in normal, functional sarcomeres, versus atrophied sarcomeres following 17-day space flight
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# 22.18: Exercise-Induced Muscle Damage

## Exercise damages muscles due to eccentric and concentric muscle loading and often results in delayed onset muscle soreness (DOMS).

### LEARNING OBJECTIVE

By the end of this section, you will be able to:

- Detail the process of exercise-induced muscle damage

### KEY POINTS

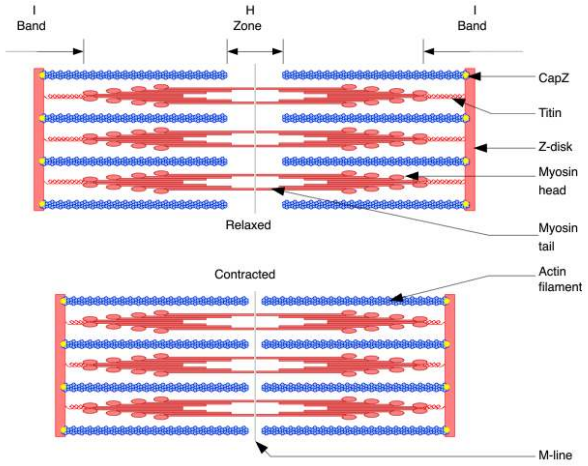
- Delayed onset muscle soreness is a result of damage in muscle sarcomeres during contractions.
- The acute but delayed nature of muscle soreness is indicative of an inflammatory immune response.
- This disruption of the muscle fibers triggers white blood cells to increase following the induced muscle soreness, leading to the inflammatory response observation from the induced muscle soreness.

### GLOSSARY

**eccentric contraction**: The elongation of a muscle while under tension due to an opposing force being greater than the force generated by the muscle.

**concentric contraction**: a type of muscle contraction in which the muscles shorten while generating force

Exercise damages muscles due to eccentric and concentric muscle loading. Resistance training, and particularly high loading during eccentric contractions, results in delayed onset muscle soreness (DOMS). Previously attributed to the accumulation of lactic acid during exercise, it is now understood that DOMS is due to structural damage in sarcomeres, particularly to the z-disks and contractile filaments. Z-disks provide the structural support for the contractile filaments of the sliding filament mechanism. Overloading of muscles damages these connections and the orientation of the contractile filaments.




The Sarcomere: Delayed onset muscle soreness is caused by structural damage to the Z disk and myosin and actin filaments.

Acute inflammation of the muscle cells, as understood in exercise physiology, can result after induced eccentric and concentric muscle training. Participation in eccentric training and conditioning, including resistance training and activities that emphasize eccentric lengthening of the muscle including downhill running on a moderate to high incline can result in considerable soreness within 24 to 48 hours, even though blood lactate levels, previously thought to cause muscle soreness, were much higher with level running. This has been noted especially in marathon runners whose muscle fibers revealed remarkable damage after both training and marathon competition. The onset and timing of this gradient damage to the muscle parallels the degree of muscle soreness experienced by the runners.

This disruption of the muscle fibers triggers white blood cells to increase following the induced muscle soreness, leading to the inflammatory response observation from the induced muscle soreness. Elevations in plasma enzymes, myoglobinemia, and abnormal muscle histology and ultrastructure are concluded to be associated with the inflammatory response. High tension in the

contractile-elastic system of muscle results in structural damage to the muscle fiber and plasmalemma and its epimysium, perimysium, and endomysium. The mysium damage disrupts calcium homeostasis in the injured fiber and fiber bundles, resulting in necrosis that peaks about 48 hours after exercise. The products of the macrophage activity and intracellular contents (such as histamines, kinins, and K+) accumulate outside the cells. These substances then stimulate the free nerve endings in the muscle; a process that appears accentuated by eccentric exercise, in which large forces are distributed over a relatively small cross-sectional area of the muscle.

The acute, and delayed nature of muscle soreness is indicative of an inflammatory immune response. Damage to the sarcomeres causes aninflux of white blood cells, leading to inflammation, which is itself associated with increased plasma enzyme concentration, myoglobinemia, and abnormal muscle structure and histology. A further response to sarcomere damage is necrosis following damage to the mysium, which peaks about 48 hours following exercise.

The muscle adapts rapidly to the structural damage caused by exercise, and further soreness and damage in later exercise events is mitigated.

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# 22.19: Aerobic Training versus Strength Training

## Aerobic activity relies on the availability of oxygen for energy production, whereas anaerobic activity utilizes primarily glycolysis.

### LEARNING OBJECTIVE

By the end of this section, you will be able to:

- Evaluate outcomes for aerobic training and strength training

### KEY POINTS

- Strength training is primarily a form of anaerobic exercise.
- Some aerobic respiration still occurs during strength training due to the energy system continuum of muscle activation, especially when muscles recruit more fibers to generate a higher force.
- Strength training primarily recruits Type II muscle fibers, compared to most aerobic exercise that prioritizes use of Type I fibers.

### GLOSSARY

**aerobic**: Occurring only in the presence of oxygen; aerobic exercise is typical of activities requiring endurance and sustained muscle contractions. Such activities rely mainly on Type I (slow-twitch muscles).

**HbA1c**: Glycosylated hemoglobin (hemoglobin A1c, HbA1c, A1C, or Hb1c; sometimes also HbA1c) is a form of hemoglobin that is measured primarily to identify the average plasma glucose concentration over prolonged periods of time.

**anaerobic**: Without oxygen; Anaerobic respiration, typical of sprinting and weight lifting, prioritizes the use of Type II (fast-twitch) muscles fibers

## Types of Muscle Fibers

There are two principal ways to categorize muscle fibers: the type of myosin (fast or slow) present, and the degree of oxidative phosphorylation that the fiber undergoes.Skeletal muscle can thus be broken down into two broad categories: Type I and Type II.

Type I fibers appear red due to the presence of the oxygen-binding protein myoglobin. These slow twitch fibers generate energy for ATP re-synthesis by means of a long-term system of aerobic energy transfer. They tend to have a low activity level of ATPase, a slower speed of contraction with a less well developed glycolytic capacity. They contain large and numerous mitochondria with high levels of myoglobin that gives them a red pigmentation. They have demonstrated a high concentration of mitochondrial enzymes, thus they are fatigue resistant. These fibers are suited for endurance activities and are slow to fatigue because they use oxidative metabolism to generate ATP.

Type II fibers are white due to the absence of myoglobin and a reliance on glycolytic enzymes. These fibers are efficient for short bursts of speed and power and use both oxidative and anaerobic metabolisms depending on the particular sub-type. However, fast twitch fibers also demonstrate a higher capability for electrochemical transmission of action potentials and a rapid level of calcium release and uptake by the sarcoplasmic reticulum. The fast twitch fibers rely on a well-developed, short term, glycolytic system for energy transfer and can contract and develop tension at 2-3 times the rate of slow twitch fibers. These fibers are quicker to fatigue.

## Exercise Examples

Exercise, depending on the type of activities involved, utilizes muscle fibers preferentially, depending on the availability of oxygen. Aerobic respiration, typical of long-distance running and other forms of exercise involving endurance, uses predominantly Type I fibers, which resist fatigue for long periods of time . With training, a higher level of effort can be sustained for extended periods, using oxygen and oxidative phosphorylation as the primary energy source. However, beyond a certain threshold of intensity, Type II fibers will be increasingly recruited, meeting the energy needs that the Type I fibers could not.



Marathon Runners: Running a marathon is emblematic of extended aerobic exercise that employs Type I (slow-twitch) muscles for extended endurance, and prioritizes aerobic metabolic pathways.

High intensity exercise, such as weight lifting, requires very large amounts of energy for very brief periods of time. In the case of a bout of weight lifting, aerobic energy production from Type I fibers would be insufficient to meet the energy demands of the muscles involved in the lifting exercise. Anaerobic exercise, as in this example, prioritizes the use of Type II fibers. However, at higher loads during anaerobic exercise, Type I fibers can also be recruited to generate a higher force from the muscle contraction. While Type II fibers are well suited for a superior rate of energy production, the duration over which this high level of energy production can be sustained is extremely finite.

## Health benefits

### Diabetes

A number of studies have examined the health benefits of aerobic and/or strength training in improving health and treating health issues. In diabetics, both resistance and aerobic exercise protocols appear to be effective in reducing pre- and post-exercise blood glucose levels and HbA1c levels, but resistance exercise produced a more significant reduction in HbA1c level as compared to treadmill exercise.

### Increased muscle mass

The body's basal metabolic rate increases with increases in muscle mass, which may promote long-term fat loss and help individuals increase basal caloric expenditure. Moreover, intense workouts elevate metabolism for several hours following the workout, which also promotes fat loss. Weight training has also been shown to benefit dieters as it inhibits lean body mass loss (as opposed to fat loss) when under a caloric deficit. Weight training also strengthens bones, helping to prevent bone loss and osteoporosis. By increasing muscular strength and improving balance, weight training can reduce falls by elderly persons as well.

### Recovery

For many people in rehabilitation or with an acquired disability, such as following stroke or orthopaedic surgery, strength training for weak muscles is a key factor to optimize recovery. For people with such a health condition, their strength training is likely to need to be designed by an appropriate health professional, such as a physiotherapist.One side-effect of any intense exercise is increased levels of dopamine, serotonin, and norepinephrine, neurotransmitters that can help to improve mood and counter feelings of depression.



Weight lifting is typical of anaerobic exercise: Weight lifting involves short, high intensity and high force muscle contractions that utilize anaerobic metabolic pathways to fuel muscle contractions, and prioritizes use of Type II (fast-twitch) muscle fibers.
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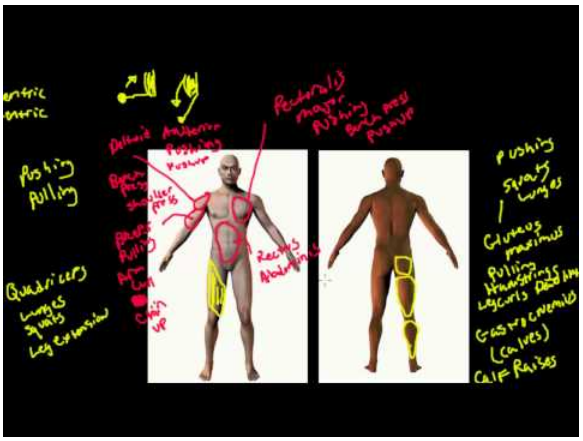
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# 22.20: Videos- Muscle Groups and Strength Training

## Major Muscle Groups and Associated Exercises

This video describes the major muscle groups and associated exercises.




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## Strength Training Exercises Playlist: 22 Videos



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# CHAPTER OVERVIEW

## 23: Lifetime Fitness and Wellness


23.1: Unit 4 Overview and Objectives
23.2: Lifetime Fitness and Wellness Reading
23.3: Discussion- Health Reform
23.4: Assessment- Post-Tests and Activity Logs


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# 23.1: Unit 4 Overview and Objectives

## Overview

And the winner is … You! Your fitness programs end and you have reached the finish line for the course. Give yourself a hearty pat on the back! Of course, to continue along the path to good health, you must “Keep Going!” long after this class ends. In this last unit, you will look back at your progress and forward at current events about health and how they might impact you.

## Learning Objectives

At the end of unit, you will be able to:

- Discuss your fitness progress based on assessment results and activity logs
- Evaluate your overall learning
- Discuss the impact of fitness and wellness in healthcare

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# 23.2: Lifetime Fitness and Wellness Reading

## Purpose

The readings will help you connect all the information covered during the course and and maintain lifelong wellness.

## Directions

- The term is almost over and you will no longer be required to exercise for a grade after this week. So what is your plan? I hope you learned a lot of helpful information and that you enjoyed your fitness program. The following hand-out will help you adhere to your new exercise program and understand the prevalence of obesity and current U.S. health objectives. Read pages 265-280 to review the stages of change and plan for potential lapses. You already read pages 270 to 272, but it's important to review them.
  - Lifestyle and weight management coach
- The American College of Sports Medicine (ACSM) has a wide variety of resources to help you remain physically active. Read the following short brochures to help you continue on with your active lifestyle in a safe and effective way:
  - ACSM Selecting a fitness facility
  - ACSM Selecting a personal trainer
  - ACSM Sprains, strains, and tears
- The ACSM also provides newsletters with expert advice on exercise, nutrition, and health. As you know, there are many barriers that keep people from being active and eating right on a regular basis. The following newsletters cover topics that will help you make fitness and wellness part of your permanent lifestyle. They cover topics ranging from how to create your own home exercise program and how to adhere to your program (remember the maintenance state of the transtheoretical model?), to overcoming plateaus and bad habits.
  - DYI Exercise
  - Behavior change and exercise adherence
  - Breaking plateaus
- In the beginning of this course, we learned about the general benefits of exercise on health. Now we go into more details about the effects of healthy lifestyle on chronic conditions. As you read the information below, reflect on your own health and family history and how healthy lifestyles may affect other segments of society.
  - Metabolic syndrome: click on the right arrow at the end of the page to read every page of this article
  - Exercise and nutrition for the heart
  - Exercise and chronic disease
  - Cancer and exercise
  - Exercise, menopause, and osteoporosis
  - Fitness assessment and injury prevention

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# 23.3: Discussion- Health Reform

## Directions

Health Care reform is here! It took more than 75 years to bring changes … political bickering … Supreme Court involvement … what a long process! This term, you participated in your own health reform and brought changes a lot faster. Now that you know how easy it can be, how do you think society should handle individual responsibility for health care? **Answer question #1 and any one of the policy questions; then respond to two of your classmates' policy threads**. One response should be to someone with whom you agree, and the other response should be to someone with whom you disagree. If you do not disagree with anyone, pretend that you do and provide points that someone with that opinion would provide. Remember, it is possible to disagree without being disagreeable. Show the politicians that it is possible to debate the issues without being hostile. Netiquette is a must here.

Questions to address:

1. How has this course affected your fitness and wellness understanding? Do you feel that you know more now than you did at the beginning of the semester? If you already knew a lot about fitness and wellness, did the course reinforce what you knew? What is the most important information you will remember from the course?
2. Should people who do not exercise and eat nutritiously pay more for health insurance? What about people who smoke cigarettes? Should people who exercise and eat nutritiously receive discounts on health insurance?
3. Do you think health care should be free for everyone, including people who do not practice preventive health? Should there be a minimal charge for everyone?
4. Should there be a "health tax" on soft drinks and fast food?

## Grading

This assignment is **worth 15 points maximum.** Your work will be assessed using the Health Care Grading Rubric:

| Criteria |
|---|

Novice

Competent

Proficient

Original entry: questions #1

0 points 2 points

Up to 2 points if submitted late, missing answers to some questions listed in the assignment instructions, or answer less than 3 sentences long.

3.5 points

Thorough entry addressing all parts of question #1 and submitted by the deadline. Answer should be at least 3 sentences long.

Original entry: policy question

0 points 2 points

Up to 2 points if submitted late, missing answers to some questions listed in the assignment instructions, or answer less than 3 sentences long.

3.5 points

Thorough entry addressing all parts of selected question and submitted by the deadline. Posting should be at least 3 sentences long.

Response to two classmates

0 points

1 point

Up to 1 point if late or response to one classmate only

2 points

Well-constructed responses to two classmates addressing each classmate original posting and submitted by the deadline.

Grammar and organization

0 points 0 points 1 point

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# 23.4: Assessment- Post-Tests and Activity Logs

## Purpose

Now that you have completed your fitness program, it is time to evaluate your progress for the last time. Again, your CR posttest must be the same as your CR pretest.

## Directions

- Click the President's Challenge Fitness Test link to take the tests.
- See "Fitness Test Instructions" at the beginning of Unit Two for directions to submit the assignment
- When you submit the posttests, also submit your pretest report (you do not need to submit the midsemester updates).
- Write a brief reflection and compare your pretest scores with your posttest scores.
- For your physical activity logs, go to the Super Tracker website and click on "My Reports" then "History Charts" at the top of the page.
- Select "Physical Activity" on the left side of the page, enter your time period and dates (weekly), select chart type (bar or line graph), then create your report.
- Export or save the report as a PDF file. If your computer will not allow you to do this, copy and paste the chart **(only the chart, not the entire page)** into a document and save.
- This assignment will have two documents: your posttest report (submit as a Word document) and your physical activity report. Upload both directly into the course as one submission.

## Grading

This assignment is **worth 15 points maximum.** Your work will be assessed using the Post-Test and Activity Logs Grading

### Rubric:

| Criteria | Absent | Present |
|---|---|---|
| Post-tests | 0 points | 3 points<br>Must include results for aerobic endurance, flexibility, muscular endurance (half sit-ups and push-ups), BMI, and waist circumference. |
| Pre-tests | 0 points | 3 points<br>Must include results for aerobic endurance, flexibility, muscular endurance (half sit-ups and push-ups), BMI, and waist circumference. |
| Reflection | 0 points | 4 points<br>Well-constructed reflection comparing your pre-test scored with your post-test scores and submitted by the deadline. Posting must be at least 2 sentences long. |
| Activity tracker report | 0 points | 5 points<br>Physical activity report including 8 weeks of exercise program |

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# CHAPTER OVERVIEW

## 24: Stress

24.1: What is Stress
24.2: Stressors

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# 24.1: What is Stress

## What Is Stress?

### LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Differentiate between stimulus-based and response-based definitions of stress
- Define stress as a process
- Differentiate between good stress and bad stress
- Describe the early contributions of Walter Cannon and Hans Selye to the stress research field
- Understand the physiological basis of stress and describe the general adaptation syndrome

The term stress as it relates to the human condition first emerged in scientific literature in the 1930s, but it did not enter the popular vernacular until the 1970s (Lyon, 2012). Today, we often use the term loosely in describing a variety of unpleasant feeling states; for example, we often say we are stressed out when we feel frustrated, angry, conflicted, overwhelmed, or fatigued. Despite the widespread use of the term, stress is a fairly vague concept that is difficult to define with precision.

Researchers have had a difficult time agreeing on an acceptable definition of stress. Some have conceptualized stress as a demanding or threatening event or situation (e.g., a high-stress job, overcrowding, and long commutes to work). Such conceptualizations are known as stimulus-based definitions because they characterize stress as a stimulus that causes certain reactions. Stimulus-based definitions of stress are problematic, however, because they fail to recognize that people differ in how they view and react to challenging life events and situations. For example, a conscientious student who has studied diligently all semester would likely experience less stress during final exams week than would a less responsible, unprepared student.

Others have conceptualized stress in ways that emphasize the physiological responses that occur when faced with demanding or threatening situations (e.g., increased arousal). These conceptualizations are referred to as response-based definitions because they describe stress as a response to environmental conditions. For example, the endocrinologist Hans Selye, a famous stress researcher, once defined stress as the “response of the body to any demand, whether it is caused by, or results in, pleasant or unpleasant conditions” (Selye, 1976, p. 74). Selye’s definition of stress is response-based in that it conceptualizes stress chiefly in terms of the body’s physiological reaction to any demand that is placed on it. Neither stimulus-based nor response-based definitions provide a complete definition of stress. Many of the physiological reactions that occur when faced with demanding situations (e.g., accelerated heart rate) can also occur in response to things that most people would not consider to be genuinely stressful, such as receiving unanticipated good news: an unexpected promotion or raise.

A useful way to conceptualize stress is to view it as a process whereby an individual perceives and responds to events that he appraises as overwhelming or threatening to his well-being (Lazarus & Folkman, 1984). A critical element of this definition is that it emphasizes the importance of how we appraise—that is, judge—demanding or threatening events (often referred to as stressors); these appraisals, in turn, influence our reactions to such events. Two kinds of appraisals of a stressor are especially important in this regard: primary and secondary appraisals. A primary appraisal involves judgment about the degree of potential harm or threat to well-being that a stressor might entail. A stressor would likely be appraised as a threat if one anticipates that it could lead to some kind of harm, loss, or other negative consequence; conversely, a stressor would likely be appraised as a challenge if one believes that it carries the potential for gain or personal growth. For example, an employee who is promoted to a leadership position would likely perceive the promotion as a much greater threat if she believed the promotion would lead to excessive work demands than if she viewed it as an opportunity to gain new skills and grow professionally. Similarly, a college student on the cusp of graduation may face the change as a threat or a challenge ([link]).



Graduating from college and entering the workforce can be viewed as either a threat (loss of financial support) or a challenge (opportunity for independence and growth). (credit: Timothy Zanker)

The perception of a threat triggers a secondary appraisal: judgment of the options available to cope with a stressor, as well as perceptions of how effective such options will be (Lyon, 2012) ([link]). As you may recall from what you learned about self-efficacy, an individual's belief in his ability to complete a task is important (Bandura, 1994). A threat tends to be viewed as less catastrophic if one believes something can be done about it (Lazarus & Folkman, 1984). Imagine that two middle-aged women, Robin and Maria, perform breast self-examinations one morning and each woman notices a lump on the lower region of her left breast. Although both women view the breast lump as a potential threat (primary appraisal), their secondary appraisals differ considerably. In considering the breast lump, some of the thoughts racing through Robin's mind are, "Oh my God, I could have breast cancer! What if the cancer has spread to the rest of my body and I cannot recover? What if I have to go through chemotherapy? I've heard that experience is awful! What if I have to quit my job? My husband and I won't have enough money to pay the mortgage. Oh, this is just horrible…I can't deal with it!" On the other hand, Maria thinks, "Hmm, this may not be good. Although most times these things turn out to be benign, I need to have it checked out. If it turns out to be breast cancer, there are doctors who can take care of it because the medical technology today is quite advanced. I'll have a lot of different options, and I'll be just fine." Clearly, Robin and Maria have different outlooks on what might turn out to be a very serious situation: Robin seems to think that little could be done about it, whereas Maria believes that, worst case scenario, a number of options that are likely to be effective would be available. As such, Robin would clearly experience greater stress than would Maria.



When encountering a stressor, a person judges its potential threat (primary appraisal) and then determines if effective options are available to manage the situation. Stress is likely to result if a stressor is perceived as extremely threatening or threatening with few or no effective coping options available.

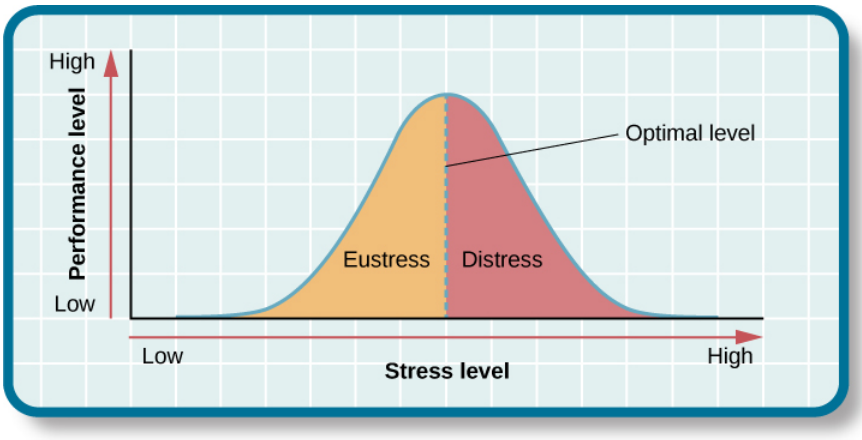
To be sure, some stressors are inherently more stressful than others in that they are more threatening and leave less potential for variation in cognitive appraisals (e.g., objective threats to one's health or safety). Nevertheless, appraisal will still play a role in augmenting or diminishing our reactions to such events (Everly & Lating, 2002).

If a person appraises an event as harmful and believes that the demands imposed by the event exceed the available resources to manage or adapt to it, the person will subjectively experience a state of stress. In contrast, if one does not appraise the same event as harmful or threatening, she is unlikely to experience stress. According to this definition, environmental events trigger stress reactions by the way they are interpreted and the meanings they are assigned. In short, stress is largely in the eye of the beholder: it's not so much what happens to you as it is how you respond (Selye, 1976).

## GOOD STRESS?

Although stress carries a negative connotation, at times it may be of some benefit. Stress can motivate us to do things in our best interests, such as study for exams, visit the doctor regularly, exercise, and perform to the best of our ability at work. Indeed, Selye (1974) pointed out that not all stress is harmful. He argued that stress can sometimes be a positive, motivating force that can improve the quality of our lives. This kind of stress, which Selye called eustress (from the Greek *eu* = "good"), is a good kind of stress associated with positive feelings, optimal health, and performance. A moderate amount of stress can be beneficial in challenging situations. For example, athletes may be motivated and energized by pregame stress, and students may experience similar beneficial stress before a major exam. Indeed, research shows that moderate stress can enhance both immediate and delayed recall of educational material. Male participants in one study who memorized a scientific text passage showed improved memory of the passage immediately after exposure to a mild stressor as well as one day following exposure to the stressor (Hupbach & Fieman, 2012).

Increasing one's level of stress will cause performance to change in a predictable way. As shown in [link], as stress increases, so do performance and general well-being (eustress); when stress levels reach an optimal level (the highest point of the curve), performance reaches its peak. A person at this stress level is colloquially at the top of his game, meaning he feels fully energized, focused, and can work with minimal effort and maximum efficiency. But when stress exceeds this optimal level, it is no longer a positive force—it becomes excessive and debilitating, or what Selye termed distress (from the Latin *dis* = "bad"). People who reach this level of stress feel burned out; they are fatigued, exhausted, and their performance begins to decline. If the stress remains excessive, health may begin to erode as well (Everly & Lating, 2002).

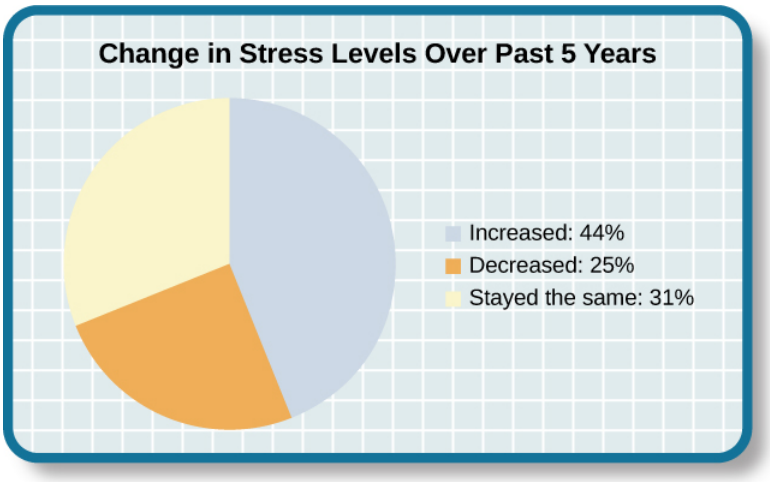



As the stress level increases from low to moderate, so does performance (eustress). At the optimal level (the peak of the curve), performance has reached its peak. If stress exceeds the optimal level, it will reach the distress region, where it will become excessive and debilitating, and performance will decline (Everly & Lating, 2002).

## THE PREVALENCE OF STRESS

Stress is everywhere and, as shown in [link], it has been on the rise over the last several years. Each of us is acquainted with stress—some are more familiar than others. In many ways, stress feels like a load you just can't carry—a feeling you experience when, for example, you have to drive somewhere in a crippling blizzard, when you wake up late the morning of an important job

interview, when you run out of money before the next pay period, and before taking an important exam for which you realize you are not fully prepared.

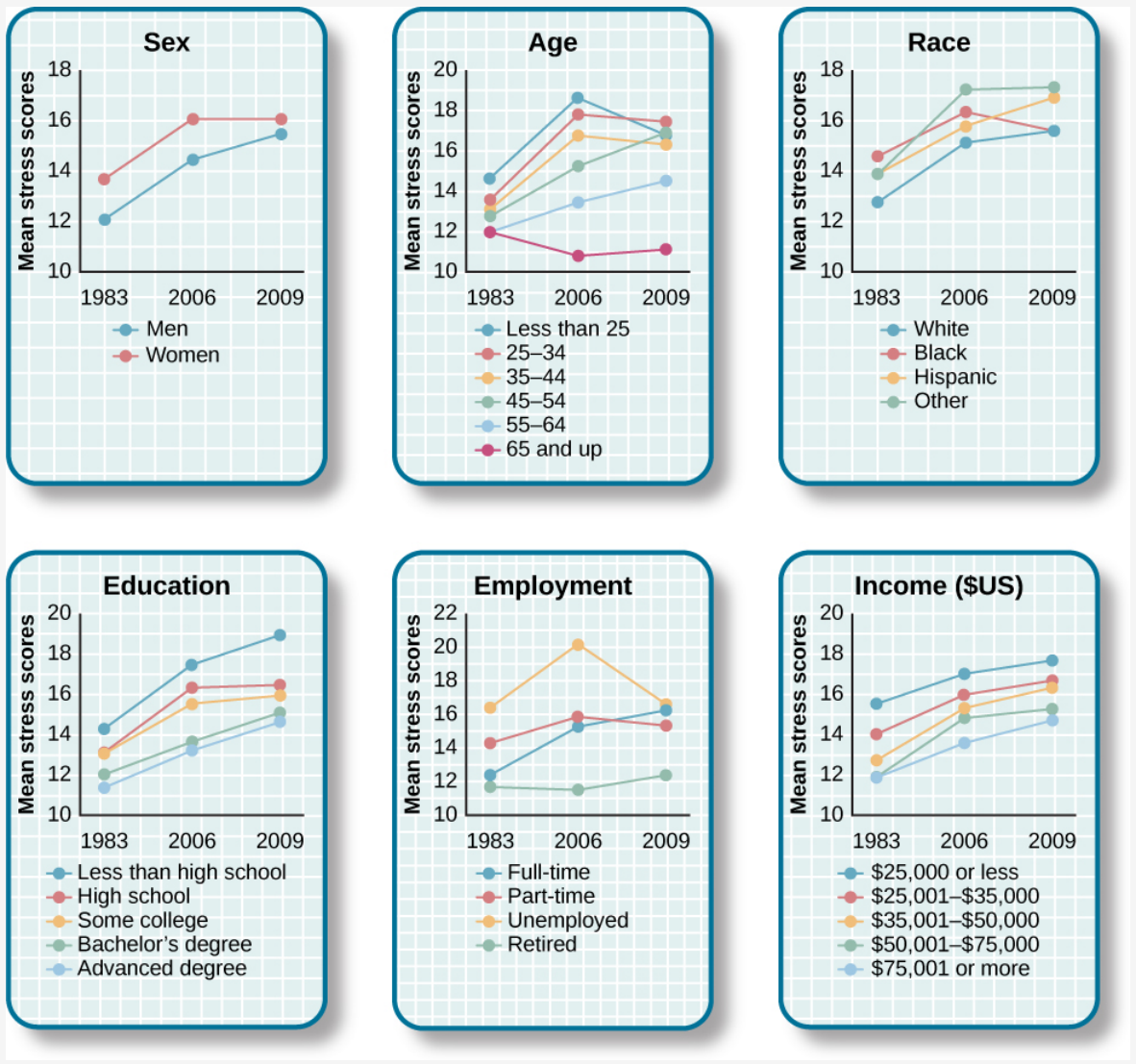



Nearly half of U.S. adults indicated that their stress levels have increased over the last five years (Neelakantan, 2013).

Stress is an experience that evokes a variety of responses, including those that are physiological (e.g., accelerated heart rate, headaches, or gastrointestinal problems), cognitive (e.g., difficulty concentrating or making decisions), and behavioral (e.g., drinking alcohol, smoking, or taking actions directed at eliminating the cause of the stress). Although stress can be positive at times, it can have deleterious health implications, contributing to the onset and progression of a variety of physical illnesses and diseases (Cohen & Herbert, 1996).

The scientific study of how stress and other psychological factors impact health falls within the realm of health psychology, a subfield of psychology devoted to understanding the importance of psychological influences on health, illness, and how people respond when they become ill (Taylor, 1999). Health psychology emerged as a discipline in the 1970s, a time during which there was increasing awareness of the role behavioral and lifestyle factors play in the development of illnesses and diseases (Straub, 2007). In addition to studying the connection between stress and illness, health psychologists investigate issues such as why people make certain lifestyle choices (e.g., smoking or eating unhealthy food despite knowing the potential adverse health implications of such behaviors). Health psychologists also design and investigate the effectiveness of interventions aimed at changing unhealthy behaviors. Perhaps one of the more fundamental tasks of health psychologists is to identify which groups of people are especially at risk for negative health outcomes, based on psychological or behavioral factors. For example, measuring differences in stress levels among demographic groups and how these levels change over time can help identify populations who may have an increased risk for illness or disease.

[link] depicts the results of three national surveys in which several thousand individuals from different demographic groups completed a brief stress questionnaire; the surveys were administered in 1983, 2006, and 2009 (Cohen & Janicki-Deverts, 2012). All three surveys demonstrated higher stress in women than in men. Unemployed individuals reported high levels of stress in all three surveys, as did those with less education and income; retired persons reported the lowest stress levels. However, from 2006 to 2009 the greatest increase in stress levels occurred among men, Whites, people aged 45–64, college graduates, and those with full-time employment. One interpretation of these findings is that concerns surrounding the 2008–2009 economic downturn (e.g., threat of or actual job loss and substantial loss of retirement savings) may have been especially stressful to White, college-educated, employed men with limited time remaining in their working careers.




The charts above, adapted from Cohen & Janicki-Deverts (2012), depict the mean stress level scores among different demographic groups during the years 1983, 2006, and 2009. Across categories of sex, age, race, education level, employment status, and income, stress levels generally show a marked increase over this quarter-century time span.

## EARLY CONTRIBUTIONS TO THE STUDY OF STRESS

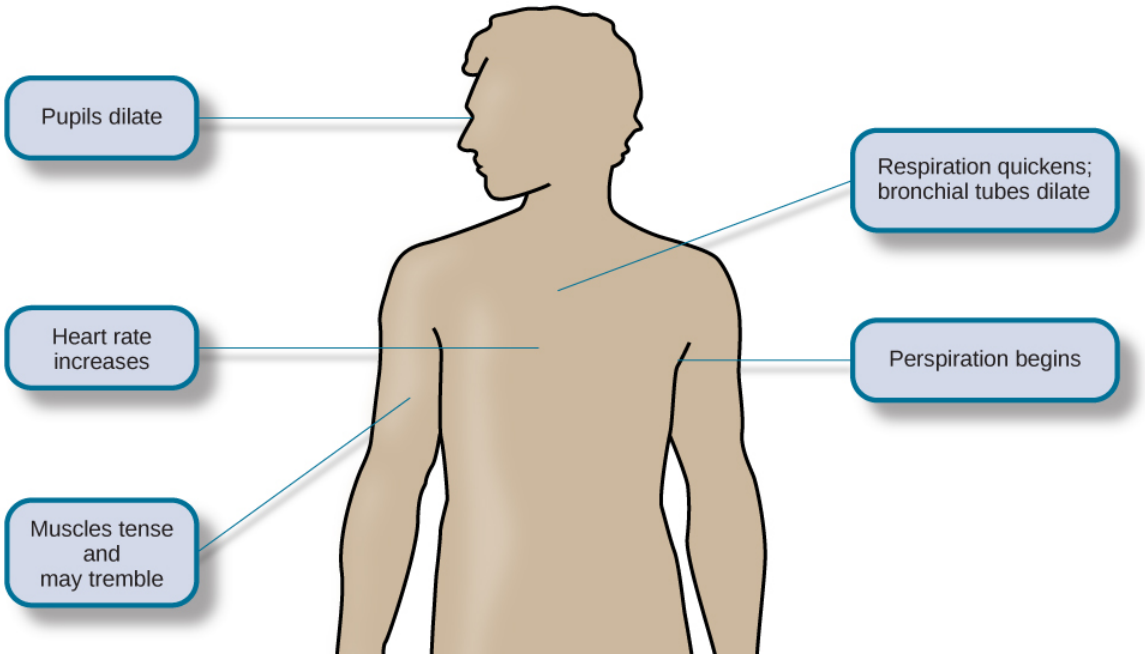
As previously stated, scientific interest in stress goes back nearly a century. One of the early pioneers in the study of stress was Walter Cannon, an eminent American physiologist at Harvard Medical School ([link]). In the early part of the 20th century, Cannon was the first to identify the body's physiological reactions to stress.



Harvard physiologist Walter Cannon first articulated and named the fight-or-flight response, the nervous system's sympathetic response to a significant stressor.

## Cannon and the Fight-or-Flight Response

Imagine that you are hiking in the beautiful mountains of Colorado on a warm and sunny spring day. At one point during your hike, a large, frightening-looking black bear appears from behind a stand of trees and sits about 50 yards from you. The bear notices you, sits up, and begins to lumber in your direction. In addition to thinking, "This is definitely not good," a constellation of physiological reactions begins to take place inside you. Prompted by a deluge of epinephrine (adrenaline) and norepinephrine (noradrenaline) from your adrenal glands, your pupils begin to dilate. Your heart starts to pound and speeds up, you begin to breathe heavily and perspire, you get butterflies in your stomach, and your muscles become tense, preparing you to take some kind of direct action. Cannon proposed that this reaction, which he called the fight-or-flight response, occurs when a person experiences very strong emotions—especially those associated with a perceived threat (Cannon, 1932). During the fight-or-flight response, the body is rapidly aroused by activation of both the sympathetic nervous system and the endocrine system ([link]). This arousal helps prepare the person to either fight or flee from a perceived threat.




Fight or flight is a physiological response to a stressor.

According to Cannon, the fight-or-flight response is a built-in mechanism that assists in maintaining homeostasis—an internal environment in which physiological variables such as blood pressure, respiration, digestion, and temperature are stabilized at levels optimal for survival. Thus, Cannon viewed the fight-or-flight response as adaptive because it enables us to adjust internally and externally to changes in our surroundings, which is helpful in species survival.

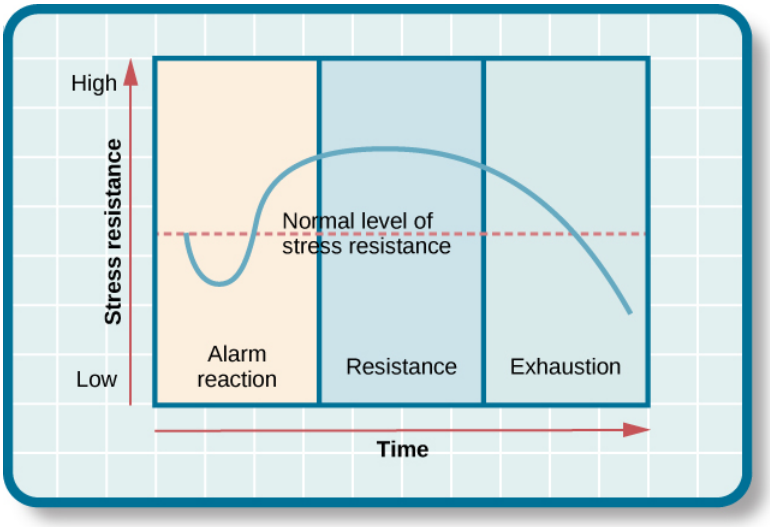
## Selye and the General Adaptation Syndrome

Another important early contributor to the stress field was Hans Selye, mentioned earlier. He would eventually become one of the world's foremost experts in the study of stress ([link]). As a young assistant in the biochemistry department at McGill University in the 1930s, Selye was engaged in research involving sex hormones in rats. Although he was unable to find an answer for what he was initially researching, he incidentally discovered that when exposed to prolonged negative stimulation (stressors)—such as extreme cold, surgical injury, excessive muscular exercise, and shock—the rats showed signs of adrenal enlargement, thymus and lymph node shrinkage, and stomach ulceration. Selye realized that these responses were triggered by a coordinated series of physiological reactions that unfold over time during continued exposure to a stressor. These physiological reactions were nonspecific, which means that regardless of the type of stressor, the same pattern of reactions would occur. What Selye discovered was the general adaptation syndrome, the body's nonspecific physiological response to stress.




Hans Selye specialized in research about stress. In 2009, his native Hungary honored his work with this stamp, released in conjunction with the 2nd annual World Conference on Stress.

The general adaptation syndrome, shown in [link], consists of three stages: (1) alarm reaction, (2) stage of resistance, and (3) stage of exhaustion (Selye, 1936; 1976). Alarm reaction describes the body's immediate reaction upon facing a threatening situation or emergency, and it is roughly analogous to the fight-or-flight response described by Cannon. During an alarm reaction, you are alerted to a stressor, and your body alarms you with a cascade of physiological reactions that provide you with the energy to manage the situation. A person who wakes up in the middle of the night to discover her house is on fire, for example, is experiencing an alarm reaction.




The three stages of Selye's general adaptation syndrome are shown in this graph. Prolonged stress ultimately results in exhaustion.

If exposure to a stressor is prolonged, the organism will enter the stage of resistance. During this stage, the initial shock of alarm reaction has worn off and the body has adapted to the stressor. Nevertheless, the body also remains on alert and is prepared to respond as it did during the alarm reaction, although with less intensity. For example, suppose a child who went missing is still missing 72 hours later. Although the parents would obviously remain extremely disturbed, the magnitude of physiological reactions would likely have diminished over the 72 intervening hours due to some adaptation to this event.

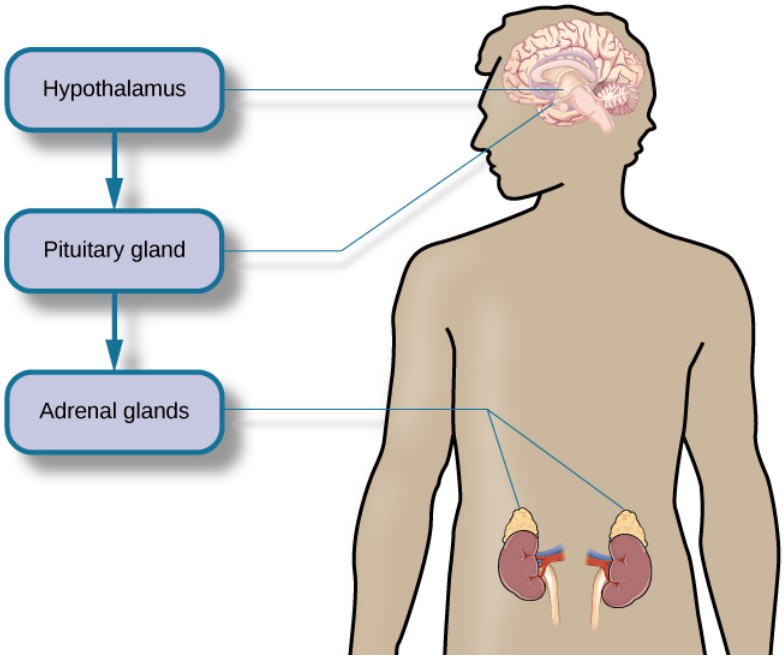
If exposure to a stressor continues over a longer period of time, the stage of exhaustion ensues. At this stage, the person is no longer able to adapt to the stressor: the body's ability to resist becomes depleted as physical wear takes its toll on the body's tissues

and organs. As a result, illness, disease, and other permanent damage to the body—even death—may occur. If a missing child still remained missing after three months, the long-term stress associated with this situation may cause a parent to literally faint with exhaustion at some point or even to develop a serious and irreversible illness.

In short, Selye's general adaptation syndrome suggests that stressors tax the body via a three-phase process—an initial jolt, subsequent readjustment, and a later depletion of all physical resources—that ultimately lays the groundwork for serious health problems and even death. It should be pointed out, however, that this model is a response-based conceptualization of stress, focusing exclusively on the body's physical responses while largely ignoring psychological factors such as appraisal and interpretation of threats. Nevertheless, Selye's model has had an enormous impact on the field of stress because it offers a general explanation for how stress can lead to physical damage and, thus, disease. As we shall discuss later, prolonged or repeated stress has been implicated in development of a number of disorders such as hypertension and coronary artery disease.

## THE PHYSIOLOGICAL BASIS OF STRESS

What goes on inside our bodies when we experience stress? The physiological mechanisms of stress are extremely complex, but they generally involve the work of two systems—the sympathetic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis. When a person first perceives something as stressful (Selye's alarm reaction), the sympathetic nervous system triggers arousal via the release of adrenaline from the adrenal glands. Release of these hormones activates the fight-or-flight responses to stress, such as accelerated heart rate and respiration. At the same time, the HPA axis, which is primarily endocrine in nature, becomes especially active, although it works much more slowly than the sympathetic nervous system. In response to stress, the hypothalamus (one of the limbic structures in the brain) releases corticotrophin-releasing factor, a hormone that causes the pituitary gland to release adrenocorticotropic hormone (ACTH) ([link]). The ACTH then activates the adrenal glands to secrete a number of hormones into the bloodstream; an important one is cortisol, which can affect virtually every organ within the body. Cortisol is commonly known as a stress hormone and helps provide that boost of energy when we first encounter a stressor, preparing us to run away or fight. However, sustained elevated levels of cortisol weaken the immune system.




This diagram shows the functioning of the hypothalamic-pituitary-adrenal (HPA) axis. The hypothalamus activates the pituitary gland, which in turn activates the adrenal glands, increasing their secretion of cortisol.

In short bursts, this process can have some favorable effects, such as providing extra energy, improving immune system functioning temporarily, and decreasing pain sensitivity. However, extended release of cortisol—as would happen with prolonged or chronic stress—often comes at a high price. High levels of cortisol have been shown to produce a number of harmful effects. For example, increases in cortisol can significantly weaken our immune system (Glaser & Kiecolt-Glaser, 2005), and high levels are frequently observed among depressed individuals (Geoffroy, Hertzman, Li, & Power, 2013). In summary, a stressful event causes a variety of

physiological reactions that activate the adrenal glands, which in turn release epinephrine, norepinephrine, and cortisol. These hormones affect a number of bodily processes in ways that prepare the stressed person to take direct action, but also in ways that may heighten the potential for illness.

When stress is extreme or chronic, it can have profoundly negative consequences. For example, stress often contributes to the development of certain psychological disorders, including post-traumatic stress disorder, major depressive disorder, and other serious psychiatric conditions. Additionally, we noted earlier that stress is linked to the development and progression of a variety of physical illnesses and diseases. For example, researchers in one study found that people injured during the September 11, 2001, World Trade Center disaster or who developed post-traumatic stress symptoms afterward later suffered significantly elevated rates of heart disease (Jordan, Miller-Archie, Cone, Morabia, & Stellman, 2011). Another investigation yielded that self-reported stress symptoms among aging and retired Finnish food industry workers were associated with morbidity 11 years later. This study also predicted the onset of musculoskeletal, nervous system, and endocrine and metabolic disorders (Salonen, Arola, Nygård, & Huhtala, 2008). Another study reported that male South Korean manufacturing employees who reported high levels of work-related stress were more likely to catch the common cold over the next several months than were those employees who reported lower work-related stress levels (Park et al., 2011). Later, you will explore the mechanisms through which stress can produce physical illness and disease.

## Summary

Stress is a process whereby an individual perceives and responds to events appraised as overwhelming or threatening to one's well-being. The scientific study of how stress and emotional factors impact health and well-being is called health psychology, a field devoted to studying the general impact of psychological factors on health. The body's primary physiological response during stress, the fight-or-flight response, was first identified in the early 20th century by Walter Cannon. The fight-or-flight response involves the coordinated activity of both the sympathetic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis. Hans Selye, a noted endocrinologist, referred to these physiological reactions to stress as part of general adaptation syndrome, which occurs in three stages: alarm reaction (fight-or-flight reactions begin), resistance (the body begins to adapt to continuing stress), and exhaustion (adaptive energy is depleted, and stress begins to take a physical toll).

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## SELF CHECK QUESTIONS

### *Critical Thinking Questions*

1. Provide an example (other than the one described earlier) of a situation or event that could be appraised as either threatening or challenging.

2. Provide an example of a stressful situation that may cause a person to become seriously ill. How would Selye's general adaptation syndrome explain this occurrence?

### *Personal Application Question*

3. Think of a time in which you and others you know (family members, friends, and classmates) experienced an event that some viewed as threatening and others viewed as challenging. What were some of the differences in the reactions of those who experienced the event as threatening compared to those who viewed the event as challenging? Why do you think there were differences in how these individuals judged the same event?

## AnswerS

1. Answers will vary. One example is divorce. People may perceive a divorce as a threat if they believe it will result in loneliness, change of lifestyle (due to loss of additional income), or humiliation in the eyes of their family. However, divorce may be perceived as a challenge if they view it as an opportunity to find somebody more compatible, and if they consider the process of finding a new partner a pleasant one, perhaps involving mystery and excitement.

2. Answers will vary. One example is when somebody's spouse dies or is unexpectedly diagnosed with a fatal disease. In both cases, the stress experienced by the surviving spouse would be intense, continuous, and—according the general adaptation syndrome—would eventually increase vulnerability to illness or disease (exhaustion stage).

## GLOSSARY

**alarm reaction**

first stage of the general adaptation syndrome; characterized as the body's immediate physiological reaction to a threatening situation or some other emergency; analogous to the fight-or-flight response

**cortisol**

stress hormone released by the adrenal glands when encountering a stressor; helps to provide a boost of energy, thereby preparing the individual to take action

**distress**

bad form of stress; usually high in intensity; often leads to exhaustion, fatigue, feeling burned out; associated with erosions in performance and health

**eustress** good form of stress; low to moderate in intensity; associated with positive feelings, as well as optimal health and performance

**fight-or-flight response** set of physiological reactions (increases in blood pressure, heart rate, respiration rate, and sweat) that occur when an individual encounters a perceived threat; these reactions are produced by activation of the sympathetic nervous system and the endocrine system

**general adaptation syndrome** Hans Selye's three-stage model of the body's physiological reactions to stress and the process of stress adaptation: alarm reaction, stage of resistance, and stage of exhaustion

**health psychology** subfield of psychology devoted to studying psychological influences on health, illness, and how people respond when they become ill

**hypothalamic-pituitary-adrenal (HPA) axis** set of structures found in both the limbic system (hypothalamus) and the endocrine system (pituitary gland and adrenal glands) that regulate many of the body's physiological reactions to stress through the release of hormones

**primary appraisal** judgment about the degree of potential harm or threat to well-being that a stressor might entail

**secondary appraisal** judgment of options available to cope with a stressor and their potential effectiveness

**stage of exhaustion** third stage of the general adaptation syndrome; the body's ability to resist stress becomes depleted; illness, disease, and even death may occur

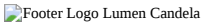
**stage of resistance** second stage of the general adaptation syndrome; the body adapts to a stressor for a period of time

**stress** process whereby an individual perceives and responds to events that one appraises as overwhelming or threatening to one's well-being

**stressors** environmental events that may be judged as threatening or demanding; stimuli that initiate the stress process

LICENSES AND ATTRIBUTIONS

Previous Next




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# 24.2: Stressors

## Stressors

### LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe different types of possible stressors
- Explain the importance of life changes as potential stressors
- Describe the Social Readjustment Rating Scale
- Understand the concepts of job strain and job burnout

For an individual to experience stress, he must first encounter a potential stressor. In general, stressors can be placed into one of two broad categories: chronic and acute. Chronic stressors include events that persist over an extended period of time, such as caring for a parent with dementia, long-term unemployment, or imprisonment. Acute stressors involve brief focal events that sometimes continue to be experienced as overwhelming well after the event has ended, such as falling on an icy sidewalk and breaking your leg (Cohen, Janicki-Deverts, & Miller, 2007). Whether chronic or acute, potential stressors come in many shapes and sizes. They can include major traumatic events, significant life changes, daily hassles, as well as other situations in which a person is regularly exposed to threat, challenge, or danger.

### TRAUMATIC EVENTS

Some stressors involve traumatic events or situations in which a person is exposed to actual or threatened death or serious injury. Stressors in this category include exposure to military combat, threatened or actual physical assaults (e.g., physical attacks, sexual assault, robbery, childhood abuse), terrorist attacks, natural disasters (e.g., earthquakes, floods, hurricanes), and automobile accidents. Men, non-Whites, and individuals in lower socioeconomic status (SES) groups report experiencing a greater number of traumatic events than do women, Whites, and individuals in higher SES groups (Hatch & Dohrenwend, 2007). Some individuals who are exposed to stressors of extreme magnitude develop post-traumatic stress disorder (PTSD): a chronic stress reaction characterized by experiences and behaviors that may include intrusive and painful memories of the stressor event, jumpiness, persistent negative emotional states, detachment from others, angry outbursts, and avoidance of reminders of the event (American Psychiatric Association [APA], 2013).

### LIFE CHANGES

Most stressors that we encounter are not nearly as intense as the ones described above. Many potential stressors we face involve events or situations that require us to make changes in our ongoing lives and require time as we adjust to those changes. Examples include death of a close family member, marriage, divorce, and moving ([link]).



Some fairly typical life events, such as moving, can be significant stressors. Even when the move is intentional and positive, the amount of resulting change in daily life can cause stress. (credit: “Jellaluna”/Flickr)

In the 1960s, psychiatrists Thomas Holmes and Richard Rahe wanted to examine the link between life stressors and physical illness, based on the hypothesis that life events requiring significant changes in a person’s normal life routines are stressful, whether these events are desirable or undesirable. They developed the Social Readjustment Rating Scale (SRRS), consisting of 43 life events that require varying degrees of personal readjustment (Holmes & Rahe, 1967). Many life events that most people would

consider pleasant (e.g., holidays, retirement, marriage) are among those listed on the SRRS; these are examples of eustress. Holmes and Rahe also proposed that life events can add up over time, and that experiencing a cluster of stressful events increases one's risk of developing physical illnesses.

In developing their scale, Holmes and Rahe asked 394 participants to provide a numerical estimate for each of the 43 items; each estimate corresponded to how much readjustment participants felt each event would require. These estimates resulted in mean value scores for each event—often called life change units (LCUs) (Rahe, McKeen, & Arthur, 1967). The numerical scores ranged from 11 to 100, representing the perceived magnitude of life change each event entails. Death of a spouse ranked highest on the scale with 100 LCUs, and divorce ranked second highest with 73 LCUs. In addition, personal injury or illness, marriage, and job termination also ranked highly on the scale with 53, 50, and 47 LCUs, respectively. Conversely, change in residence (20 LCUs), change in eating habits (15 LCUs), and vacation (13 LCUs) ranked low on the scale ([link]). Minor violations of the law ranked the lowest with 11 LCUs. To complete the scale, participants checked yes for events experienced within the last 12 months. LCUs for each checked item are totaled for a score quantifying the amount of life change. Agreement on the amount of adjustment required by the various life events on the SRRS is highly consistent, even cross-culturally (Holmes & Masuda, 1974).

Some Stressors on the Social Readjustment Rating Scale (Holmes & Rahe, 1967)

| Life event | Life change units |
|---|---|
| Death of a close family member | 63 |
| Personal injury or illness | 53 |
| Dismissal from work | 47 |
| Change in financial state | 38 |
| Change to different line of work | 36 |
| Outstanding personal achievement | 28 |
| Beginning or ending school | 26 |
| Change in living conditions | 25 |
| Change in working hours or conditions | 20 |
| Change in residence | 20 |
| Change in schools | 20 |
| Change in social activities | 18 |
| Change in sleeping habits | 16 |
| Change in eating habits | 15 |
| Minor violation of the law | 11 |

Extensive research has demonstrated that accumulating a high number of life change units within a brief period of time (one or two years) is related to a wide range of physical illnesses (even accidents and athletic injuries) and mental health problems (Monat & Lazarus, 1991; Scully, Tosi, & Banning, 2000). In an early demonstration, researchers obtained LCU scores for U.S. and Norwegian Navy personnel who were about to embark on a six-month voyage. A later examination of medical records revealed positive (but small) correlations between LCU scores prior to the voyage and subsequent illness symptoms during the ensuing six-month journey (Rahe, 1974). In addition, people tend to experience more physical symptoms, such as backache, upset stomach, diarrhea, and acne, on specific days in which self-reported LCU values are considerably higher than normal, such as the day of a family member's wedding (Holmes & Holmes, 1970).

The Social Readjustment Rating Scale (SRRS) provides researchers a simple, easy-to-administer way of assessing the amount of stress in people's lives, and it has been used in hundreds of studies (Thoits, 2010). Despite its widespread use, the scale has been subject to criticism. First, many of the items on the SRRS are vague; for example, death of a close friend could involve the death of a long-absent childhood friend that requires little social readjustment (Dohrenwend, 2006). In addition, some have challenged its assumption that undesirable life events are no more stressful than desirable ones (Derogatis & Coons, 1993). However, most of the

available evidence suggests that, at least as far as mental health is concerned, undesirable or negative events are more strongly associated with poor outcomes (such as depression) than are desirable, positive events (Hatch & Dohrenwend, 2007). Perhaps the most serious criticism is that the scale does not take into consideration respondents' appraisals of the life events it contains. As you recall, appraisal of a stressor is a key element in the conceptualization and overall experience of stress. Being fired from work may be devastating to some but a welcome opportunity to obtain a better job for others. The SRRS remains one of the most well-known instruments in the study of stress, and it is a useful tool for identifying potential stress-related health outcomes (Scully et al., 2000).

### *Link to Learning*

Go to this site to complete the SRRS scale and determine the total number of LCUs you have experienced over the last year.

## Connect the Concepts: Correlational Research

The Holmes and Rahe Social Readjustment Rating Scale (SRRS) uses the correlational research method to identify the connection between stress and health. That is, respondents' LCU scores are correlated with the number or frequency of self-reported symptoms indicating health problems. These correlations are typically positive—as LCU scores increase, the number of symptoms increase. Consider all the thousands of studies that have used this scale to correlate stress and illness symptoms: If you were to assign an average correlation coefficient to this body of research, what would be your best guess? How strong do you think the correlation coefficient would be? Why can't the SRRS show a causal relationship between stress and illness? If it were possible to show causation, do you think stress causes illness or illness causes stress?

## HASSLES

Potential stressors do not always involve major life events. Daily hassles—the minor irritations and annoyances that are part of our everyday lives (e.g., rush hour traffic, lost keys, obnoxious coworkers, inclement weather, arguments with friends or family)—can build on one another and leave us just as stressed as life change events ([link]) (Kanner, Coyne, Schaefer, & Lazarus, 1981).



(a)



(b)

Daily commutes, whether (a) on the road or (b) via public transportation, can be hassles that contribute to our feelings of everyday stress. (credit a: modification of work by Jeff Turner; credit b: modification of work by "epSos.de"/Flickr)

Researchers have demonstrated that the frequency of daily hassles is actually a better predictor of both physical and psychological health than are life change units. In a well-known study of San Francisco residents, the frequency of daily hassles was found to be more strongly associated with physical health problems than were life change events (DeLongis, Coyne, Dakof, Folkman, & Lazarus, 1982). In addition, daily minor hassles, especially interpersonal conflicts, often lead to negative and distressed mood states (Bolger, DeLongis, Kessler, & Schilling, 1989). Cyber hassles that occur on social media may represent a new source of stress. In one investigation, undergraduates who, over a 10-week period, reported greater Facebook-induced stress (e.g., guilt or discomfort over rejecting friend requests and anger or sadness over being unfriended by another) experienced increased rates of upper respiratory infections, especially if they had larger social networks (Campisi et al., 2012). Clearly, daily hassles can add up and take a toll on us both emotionally and physically.

## OTHER STRESSORS

Stressors can include situations in which one is frequently exposed to challenging and unpleasant events, such as difficult, demanding, or unsafe working conditions. Although most jobs and occupations can at times be demanding, some are clearly more stressful than others ([link]). For example, most people would likely agree that a firefighter's work is inherently more stressful than that of a florist. Equally likely, most would agree that jobs containing various unpleasant elements, such as those requiring exposure to loud noise (heavy equipment operator), constant harassment and threats of physical violence (prison guard), perpetual frustration (bus driver in a major city), or those mandating that an employee work alternating day and night shifts (hotel desk

clerk), are much more demanding—and thus, more stressful—than those that do not contain such elements. [link] lists several occupations and some of the specific stressors associated with those occupations (Sulsky & Smith, 2005).



(a)



(b)

(a) Police officers and (b) firefighters hold high stress occupations. (credit a: modification of work by Australian Civil-Military Centre; credit b: modification of work by Andrew Magill)

Occupations and Their Related Stressors

| Occupation | Stressors Specific to Occupation (Sulsky & Smith, 2005) |
|---|---|
| Police officer | physical dangers, excessive paperwork, red tape, dealing with court system, coworker and supervisor conflict, lack of support from the public |
| Firefighter | uncertainty over whether a serious fire or hazard awaits after an alarm |
| Social worker | little positive feedback from jobs or from the public, unsafe work environments, frustration in dealing with bureaucracy, excessive paperwork, sense of personal responsibility for clients, work overload |
| Teacher | Excessive paperwork, lack of adequate supplies or facilities, work overload, lack of positive feedback, vandalism, threat of physical violence |
| Nurse | Work overload, heavy physical work, patient concerns (dealing with death and medical concerns), interpersonal problems with other medical staff (especially physicians) |
| Emergency medical worker | Unpredictable and extreme nature of the job, inexperience |
| Air traffic controller | Little control over potential crisis situations and workload, fear of causing an accident, peak traffic situations, general work environment |
| Clerical and secretarial work | Little control over job mobility, unsupportive supervisors, work overload, lack of perceived control |
| Managerial work | Work overload, conflict and ambiguity in defining the managerial role, difficult work relationships |

Although the specific stressors for these occupations are diverse, they seem to share two common denominators: heavy workload and uncertainty about and lack of control over certain aspects of a job. Both of these factors contribute to job strain, a work situation that combines excessive job demands and workload with little discretion in decision making or job control (Karasek & Theorell, 1990). Clearly, many occupations other than the ones listed in [link] involve at least a moderate amount of job strain in that they often involve heavy workloads and little job control (e.g., inability to decide when to take breaks). Such jobs are often low-status and include those of factory workers, postal clerks, supermarket cashiers, taxi drivers, and short-order cooks. Job strain can have adverse consequences on both physical and mental health; it has been shown to be associated with increased risk of hypertension (Schnall & Landsbergis, 1994), heart attacks (Theorell et al., 1998), recurrence of heart disease after a first heart

attack (Aboa-Éboulé et al., 2007), significant weight loss or gain (Kivimäki et al., 2006), and major depressive disorder (Stansfeld, Shipley, Head, & Fuhrer, 2012). A longitudinal study of over 10,000 British civil servants reported that workers under 50 years old who earlier had reported high job strain were 68% more likely to later develop heart disease than were those workers under 50 years old who reported little job strain (Chandola et al., 2008).

Some people who are exposed to chronically stressful work conditions can experience job burnout, which is a general sense of emotional exhaustion and cynicism in relation to one's job (Maslach & Jackson, 1981). Job burnout occurs frequently among those in human service jobs (e.g., social workers, teachers, therapists, and police officers). Job burnout consists of three dimensions. The first dimension is exhaustion—a sense that one's emotional resources are drained or that one is at the end of her rope and has nothing more to give at a psychological level. Second, job burnout is characterized by depersonalization: a sense of emotional detachment between the worker and the recipients of his services, often resulting in callous, cynical, or indifferent attitudes toward these individuals. Third, job burnout is characterized by diminished personal accomplishment, which is the tendency to evaluate one's work negatively by, for example, experiencing dissatisfaction with one's job-related accomplishments or feeling as though one has categorically failed to influence others' lives through one's work.

Job strain appears to be one of the greatest risk factors leading to job burnout, which is most commonly observed in workers who are older (ages 55–64), unmarried, and whose jobs involve manual labor. Heavy alcohol consumption, physical inactivity, being overweight, and having a physical or lifetime mental disorder are also associated with job burnout (Ahola, et al., 2006). In addition, depression often co-occurs with job burnout. One large-scale study of over 3,000 Finnish employees reported that half of the participants with severe job burnout had some form of depressive disorder (Ahola et al., 2005). Job burnout is often precipitated by feelings of having invested considerable energy, effort, and time into one's work while receiving little in return (e.g., little respect or support from others or low pay) (Tatris, Peeters, Le Blanc, Schreurs, & Schaufeli, 2001).

As an illustration, consider CharlieAnn, a nursing assistant who worked in a nursing home. CharlieAnn worked long hours for little pay in a difficult facility. Her supervisor was domineering, unpleasant, and unsupportive; he was disrespectful of CharlieAnn's personal time, frequently informing her at the last minute she must work several additional hours after her shift ended or that she must report to work on weekends. CharlieAnn had very little autonomy at her job. She had little say in her day-to-day duties and how to perform them, and she was not permitted to take breaks unless her supervisor explicitly told her that she could. CharlieAnn did not feel as though her hard work was appreciated, either by supervisory staff or by the residents of the home. She was very unhappy over her low pay, and she felt that many of the residents treated her disrespectfully.

After several years, CharlieAnn began to hate her job. She dreaded going to work in the morning, and she gradually developed a callous, hostile attitude toward many of the residents. Eventually, she began to feel as though she could no longer help the nursing home residents. CharlieAnn's absenteeism from work increased, and one day she decided that she had had enough and quit. She now has a job in sales, vowing never to work in nursing again.

***Link to Learning***

A humorous example illustrating lack of supervisory support can be found in the 1999 comedy *Office Space*. Follow this link to view a brief excerpt in which a sympathetic character's insufferable boss makes a last-minute demand that he "go ahead and come in" to the office on both Saturday and Sunday.

Finally, our close relationships with friends and family—particularly the negative aspects of these relationships—can be a potent source of stress. Negative aspects of close relationships can include adverse exchanges and conflicts, lack of emotional support or confiding, and lack of reciprocity. All of these can be overwhelming, threatening to the relationship, and thus stressful. Such stressors can take a toll both emotionally and physically. A longitudinal investigation of over 9,000 British civil servants found that those who at one point had reported the highest levels of negative interactions in their closest relationship were 34% more likely to experience serious heart problems (fatal or nonfatal heart attacks) over a 13–15 year period, compared to those who experienced the lowest levels of negative interaction (De Vogli, Chandola & Marmot, 2007).

## Summary

Stressors can be chronic (long term) or acute (short term), and can include traumatic events, significant life changes, daily hassles, and situations in which people are frequently exposed to challenging and unpleasant events. Many potential stressors include events or situations that require us to make changes in our lives, such as a divorce or moving to a new residence. Thomas Holmes and Richard Rahe developed the Social Readjustment Rating Scale (SRRS) to measure stress by assigning a number of life change units to life events that typically require some adjustment, including positive events. Although the SRRS has been criticized on a

number of grounds, extensive research has shown that the accumulation of many LCUs is associated with increased risk of illness. Many potential stressors also include daily hassles, which are minor irritations and annoyances that can build up over time. In addition, jobs that are especially demanding, offer little control over one's working environment, or involve unfavorable working conditions can lead to job strain, thereby setting the stage for job burnout.

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## SELF CHECK QUESTIONS

### *Critical Thinking Questions*

1. Review the items on the Social Readjustment Rating Scale. Select one of the items and discuss how it might bring about distress and eustress.

2. Job burnout tends to be high in people who work in human service jobs. Considering the three dimensions of job burnout, explain how various job aspects unique to being a police officer might lead to job burnout in that line of work.

### *Personal Application Question*

3. Suppose you want to design a study to examine the relationship between stress and illness, but you cannot use the Social Readjustment Rating Scale. How would you go about measuring stress? How would you measure illness? What would you need to do in order to tell if there is a cause-effect relationship between stress and illness?

## AnswerS

1. Answers will vary. For example, many people look forward to celebrating the Christmas holiday, but it can be stressful in that it requires some degree of readjustment. Getting together with family may bring eustress, while the schedule and travel demands of may bring distress. Giving gifts to others and seeing their enjoyment may bring eustress, but the financial burden associated with buying presents could produce distress. Each of these things requires making some minor adjustments to one's life, and thus is considered somewhat stressful.

2. Answers will vary. Many calls that police officers make can be emotionally draining (e.g., tragic deaths, suicides, and children who live in squalid conditions), which might eventually lead to feelings of exhaustion that one can no longer deal with such things. Depersonalization may occur if a police officer works in an environment in which she feels disrespected and unappreciated, which may lead to cynical and callous feelings toward the public. Constant disrespect from others may diminish a police officer's sense of personal accomplishment.

## GLOSSARY

**daily hassles** minor irritations and annoyances that are part of our everyday lives and are capable of producing stress
**job burnout** general sense of emotional exhaustion and cynicism in relation to one's job; consists of three dimensions: exhaustion, depersonalization, and sense of diminished personal accomplishment
**job strain** work situation involving the combination of excessive job demands and workload with little decision making latitude or job control
**Social Readjustment Rating Scale (SRRS)** popular scale designed to measure stress; consists of 43 potentially stressful events, each of which has a numerical value quantifying how much readjustment is associated with the event

LICENSES AND ATTRIBUTIONS

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# CHAPTER OVERVIEW

## 25: Substance Use and Abuse

25.1: Substance Use and Abuse
25.2: Attributions

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# 25.1: Substance Use and Abuse

## Substance Use and Abuse

### LEARNING OBJECTIVES

By the end of this section, you will be able to:

- Describe the diagnostic criteria for substance use disorders
- Identify the neurotransmitter systems affected by various categories of drugs
- Describe how different categories of drugs effect behavior and experience

While we all experience altered states of consciousness in the form of sleep on a regular basis, some people use drugs and other substances that result in altered states of consciousness as well. This section will present information relating to the use of various psychoactive drugs and problems associated with such use. This will be followed by brief descriptions of the effects of some of the more well-known drugs commonly used today.

### SUBSTANCE USE DISORDERS

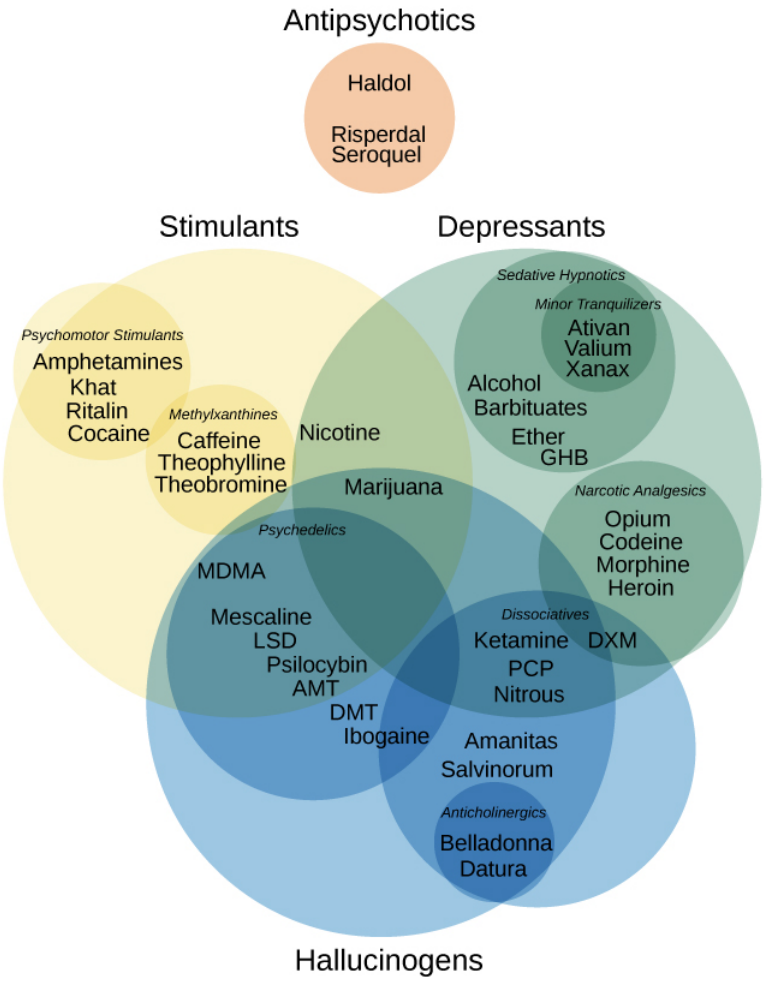
The fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders*, *Fifth Edition* (DSM-5) is used by clinicians to diagnose individuals suffering from various psychological disorders. Drug use disorders are addictive disorders, and the criteria for specific substance (drug) use disorders are described in DSM-5. A person who has a substance use disorder often uses more of the substance than they originally intended to and continues to use that substance despite experiencing significant adverse consequences. In individuals diagnosed with a substance use disorder, there is a compulsive pattern of drug use that is often associated with both physical and psychological dependence.

Physical dependence involves changes in normal bodily functions—the user will experience withdrawal from the drug upon cessation of use. In contrast, a person who has psychological dependence has an emotional, rather than physical, need for the drug and may use the drug to relieve psychological distress. Tolerance is linked to physiological dependence, and it occurs when a person requires more and more drug to achieve effects previously experienced at lower doses. Tolerance can cause the user to increase the amount of drug used to a dangerous level—even to the point of overdose and death.

Drug withdrawal includes a variety of negative symptoms experienced when drug use is discontinued. These symptoms usually are opposite of the effects of the drug. For example, withdrawal from sedative drugs often produces unpleasant arousal and agitation. In addition to withdrawal, many individuals who are diagnosed with substance use disorders will also develop tolerance to these substances. Psychological dependence, or drug craving, is a recent addition to the diagnostic criteria for substance use disorder in DSM-5. This is an important factor because we can develop tolerance and experience withdrawal from any number of drugs that we do not abuse. In other words, physical dependence in and of itself is of limited utility in determining whether or not someone has a substance use disorder.

### DRUG CATEGORIES

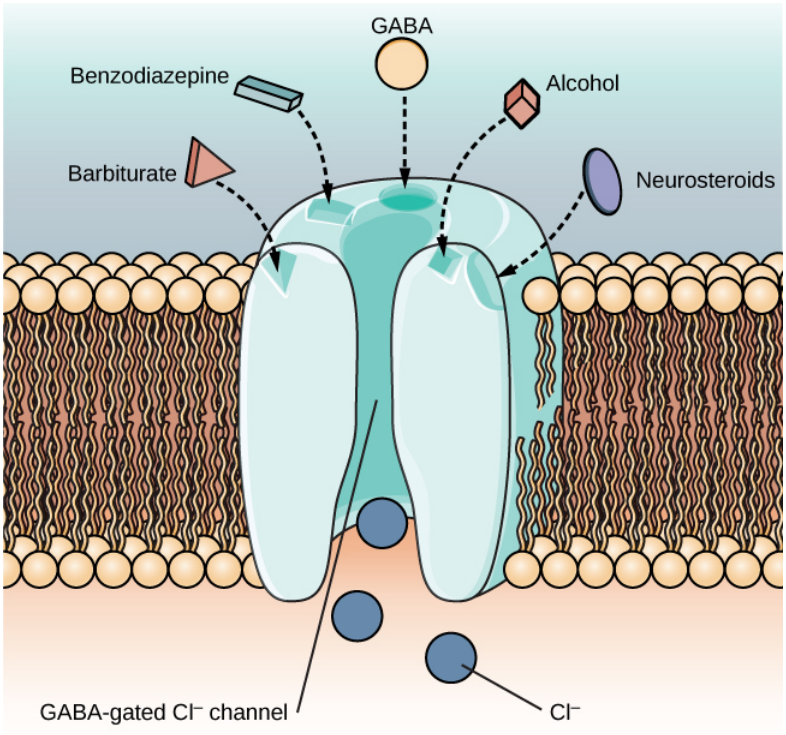
The effects of all psychoactive drugs occur through their interactions with our endogenous neurotransmitter systems. Many of these drugs, and their relationships, are shown in [link]. As you have learned, drugs can act as agonists or antagonists of a given neurotransmitter system. An agonist facilitates the activity of a neurotransmitter system, and antagonists impede neurotransmitter activity.




This figure illustrates various drug categories and overlap among them. (credit: modification of work by Derrick Snider)

## Alcohol and Other Depressants

Ethanol, which we commonly refer to as alcohol, is in a class of psychoactive drugs known as depressants ([link]). A depressant is a drug that tends to suppress central nervous system activity. Other depressants include barbiturates and benzodiazepines. These drugs share in common their ability to serve as agonists of the gamma-Aminobutyric acid (GABA) neurotransmitter system. Because GABA has a quieting effect on the brain, GABA agonists also have a quieting effect; these types of drugs are often prescribed to treat both anxiety and insomnia.




The GABA-gated chloride (Cl-) channel is embedded in the cell membrane of certain neurons. The channel has multiple receptor sites where alcohol, barbiturates, and benzodiazepines bind to exert their effects. The binding of these molecules opens the chloride channel, allowing negatively-charged chloride ions (Cl-) into the neuron's cell body. Changing its charge in a negative direction pushes the neuron away from firing; thus, activating a GABA neuron has a quieting effect on the brain.

Acute alcohol administration results in a variety of changes to consciousness. At rather low doses, alcohol use is associated with feelings of euphoria. As the dose increases, people report feeling sedated. Generally, alcohol is associated with decreases in reaction time and visual acuity, lowered levels of alertness, and reduction in behavioral control. With excessive alcohol use, a person might experience a complete loss of consciousness and/or difficulty remembering events that occurred during a period of intoxication (McKim & Hancock, 2013). In addition, if a pregnant woman consumes alcohol, her infant may be born with a cluster of birth defects and symptoms collectively called fetal alcohol spectrum disorder (FASD) or fetal alcohol syndrome (FAS).

With repeated use of many central nervous system depressants, such as alcohol, a person becomes physically dependent upon the substance and will exhibit signs of both tolerance and withdrawal. Psychological dependence on these drugs is also possible. Therefore, the abuse potential of central nervous system depressants is relatively high.

Drug withdrawal is usually an aversive experience, and it can be a life-threatening process in individuals who have a long history of very high doses of alcohol and/or barbiturates. This is of such concern that people who are trying to overcome addiction to these substances should only do so under medical supervision.

## Stimulants

Stimulants are drugs that tend to increase overall levels of neural activity. Many of these drugs act as agonists of the dopamine neurotransmitter system. Dopamine activity is often associated with reward and craving; therefore, drugs that affect dopamine neurotransmission often have abuse liability. Drugs in this category include cocaine, amphetamines (including methamphetamine), cathinones (i.e., bath salts), MDMA (ecstasy), nicotine, and caffeine.

Cocaine can be taken in multiple ways. While many users snort cocaine, intravenous injection and ingestion are also common. The freebase version of cocaine, known as crack, is a potent, smokable version of the drug. Like many other stimulants, cocaine agonizes the dopamine neurotransmitter system by blocking the reuptake of dopamine in the neuronal synapse.

## Dig Deeper: Crack Cocaine

Crack ([link]) is often considered to be more addictive than cocaine itself because it is smokable and reaches the brain very quickly. Crack is often less expensive than other forms of cocaine; therefore, it tends to be a more accessible drug for individuals from impoverished segments of society. During the 1980s, many drug laws were rewritten to punish crack users more severely than cocaine users. This led to discriminatory sentencing with low-income, inner-city minority populations receiving the harshest punishments. The wisdom of these laws has recently been called into question, especially given research that suggests crack may not be more addictive than other forms of cocaine, as previously thought (Haasen & Krausz, 2001; Reinerman, 2007).

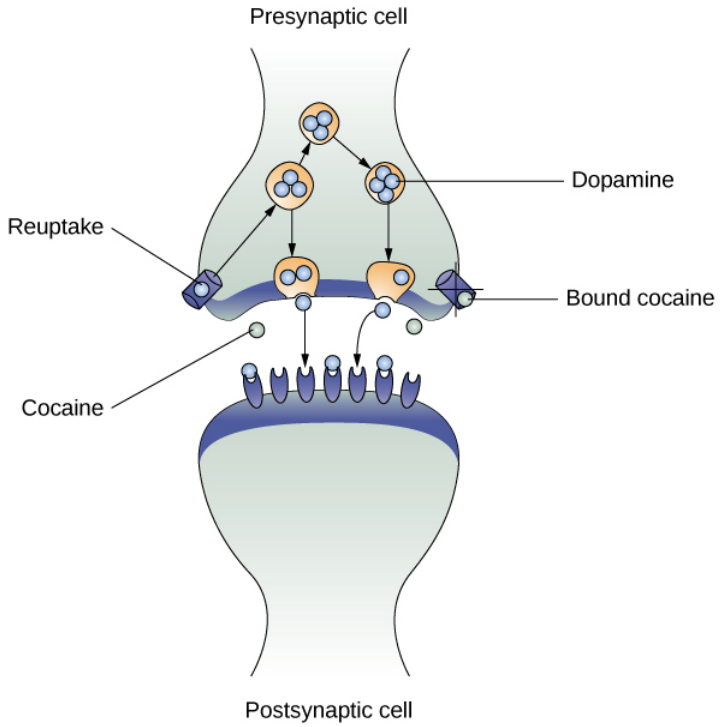


Crack rocks like these are smoked to achieve a high. Compared with other routes of administration, smoking a drug allows it to enter the brain more rapidly, which can often enhance the user's experience. (credit: modification of work by U.S. Department of Justice)

### *Link to Learning*

Read this interesting newspaper article describing myths about crack cocaine.

Amphetamines have a mechanism of action quite similar to cocaine in that they block the reuptake of dopamine in addition to stimulating its release ([link]). While amphetamines are often abused, they are also commonly prescribed to children diagnosed with attention deficit hyperactivity disorder (ADHD). It may seem counterintuitive that stimulant medications are prescribed to treat a disorder that involves hyperactivity, but the therapeutic effect comes from increases in neurotransmitter activity within certain areas of the brain associated with impulse control.




As one of their mechanisms of action, cocaine and amphetamines block the reuptake of dopamine from the synapse into the presynaptic cell.

In recent years, methamphetamine (meth) use has become increasingly widespread. Methamphetamine is a type of amphetamine that can be made from ingredients that are readily available (e.g., medications containing pseudoephedrine, a compound found in many over-the-counter cold and flu remedies). Despite recent changes in laws designed to make obtaining pseudoephedrine more difficult, methamphetamine continues to be an easily accessible and relatively inexpensive drug option (Shukla, Crump, & Chrisco, 2012).

The cocaine, amphetamine, cathinones, and MDMA users seek a euphoric high, feelings of intense elation and pleasure, especially in those users who take the drug via intravenous injection or smoking. Repeated use of these stimulants can have significant adverse consequences. Users can experience physical symptoms that include nausea, elevated blood pressure, and increased heart rate. In addition, these drugs can cause feelings of anxiety, hallucinations, and paranoia (Fiorentini et al., 2011). Normal brain functioning is altered after repeated use of these drugs. For example, repeated use can lead to overall depletion among the monoamine neurotransmitters (dopamine, norepinephrine, and serotonin). People may engage in compulsive use of these stimulant substances in part to try to reestablish normal levels of these neurotransmitters (Jayanthi & Ramamoorthy, 2005; Rothman, Blough, & Baumann, 2007).

Caffeine is another stimulant drug. While it is probably the most commonly used drug in the world, the potency of this particular drug pales in comparison to the other stimulant drugs described in this section. Generally, people use caffeine to maintain increased levels of alertness and arousal. Caffeine is found in many common medicines (such as weight loss drugs), beverages, foods, and even cosmetics (Herman & Herman, 2013). While caffeine may have some indirect effects on dopamine neurotransmission, its primary mechanism of action involves antagonizing adenosine activity (Porkka-Heiskanen, 2011).

While caffeine is generally considered a relatively safe drug, high blood levels of caffeine can result in insomnia, agitation, muscle twitching, nausea, irregular heartbeat, and even death (Reissig, Strain, & Griffiths, 2009; Wolt, Ganetsky, & Babu, 2012). In 2012, Kromann and Nielson reported on a case study of a 40-year-old woman who suffered significant ill effects from her use of caffeine. The woman used caffeine in the past to boost her mood and to provide energy, but over the course of several years, she increased her caffeine consumption to the point that she was consuming three liters of soda each day. Although she had been taking a prescription antidepressant, her symptoms of depression continued to worsen and she began to suffer physically, displaying significant warning signs of cardiovascular disease and diabetes. Upon admission to an outpatient clinic for treatment of mood disorders, she met all of the diagnostic criteria for substance dependence and was advised to dramatically limit her caffeine intake. Once she was able to limit her use to less than 12 ounces of soda a day, both her mental and physical health gradually improved.

Despite the prevalence of caffeine use and the large number of people who confess to suffering from caffeine addiction, this was the first published description of soda dependence appearing in scientific literature.

Nicotine is highly addictive, and the use of tobacco products is associated with increased risks of heart disease, stroke, and a variety of cancers. Nicotine exerts its effects through its interaction with acetylcholine receptors. Acetylcholine functions as a neurotransmitter in motor neurons. In the central nervous system, it plays a role in arousal and reward mechanisms. Nicotine is most commonly used in the form of tobacco products like cigarettes or chewing tobacco; therefore, there is a tremendous interest in developing effective smoking cessation techniques. To date, people have used a variety of nicotine replacement therapies in addition to various psychotherapeutic options in an attempt to discontinue their use of tobacco products. In general, smoking cessation programs may be effective in the short term, but it is unclear whether these effects persist (Cropley, Theadom, Pravettoni, & Webb, 2008; Levitt, Shaw, Wong, & Kaczorowski, 2007; Smedslund, Fisher, Boles, & Lichtenstein, 2004).

## Opioids

An opioid is one of a category of drugs that includes heroin, morphine, methadone, and codeine. Opioids have analgesic properties; that is, they decrease pain. Humans have an endogenous opioid neurotransmitter system—the body makes small quantities of opioid compounds that bind to opioid receptors reducing pain and producing euphoria. Thus, opioid drugs, which mimic this endogenous painkilling mechanism, have an extremely high potential for abuse. Natural opioids, called opiates, are derivatives of opium, which is a naturally occurring compound found in the poppy plant. There are now several synthetic versions of opiate drugs (correctly called opioids) that have very potent painkilling effects, and they are often abused. For example, the National Institutes of Drug Abuse has sponsored research that suggests the misuse and abuse of the prescription pain killers hydrocodone and oxycodone are significant public health concerns (Maxwell, 2006). In 2013, the U.S. Food and Drug Administration recommended tighter controls on their medical use.

Historically, heroin has been a major opioid drug of abuse ([link]). Heroin can be snorted, smoked, or injected intravenously. Like the stimulants described earlier, the use of heroin is associated with an initial feeling of euphoria followed by periods of agitation. Because heroin is often administered via intravenous injection, users often bear needle track marks on their arms and, like all abusers of intravenous drugs, have an increased risk for contraction of both tuberculosis and HIV.



(a)



(b)

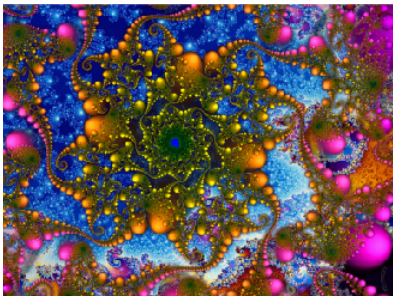
(a) Common paraphernalia for heroin preparation and use are shown here in a needle exchange kit. (b) Heroin is cooked on a spoon over a candle. (credit a: modification of work by Todd Huffman)

Aside from their utility as analgesic drugs, opioid-like compounds are often found in cough suppressants, anti-nausea, and anti-diarrhea medications. Given that withdrawal from a drug often involves an experience opposite to the effect of the drug, it should be no surprise that opioid withdrawal resembles a severe case of the flu. While opioid withdrawal can be extremely unpleasant, it is not life-threatening (Julien, 2005). Still, people experiencing opioid withdrawal may be given methadone to make withdrawal from the drug less difficult. Methadone is a synthetic opioid that is less euphorigenic than heroin and similar drugs. Methadone clinics help people who previously struggled with opioid addiction manage withdrawal symptoms through the use of methadone. Other drugs, including the opioid buprenorphine, have also been used to alleviate symptoms of opiate withdrawal.

Codeine is an opioid with relatively low potency. It is often prescribed for minor pain, and it is available over-the-counter in some other countries. Like all opioids, codeine does have abuse potential. In fact, abuse of prescription opioid medications is becoming a major concern worldwide (Aquina, Marques-Baptista, Bridgeman, & Merlin, 2009; Casati, Sedefov, & Pfeiffer-Gerschel, 2012).

## Hallucinogens

A hallucinogen is one of a class of drugs that results in profound alterations in sensory and perceptual experiences ([link]). In some cases, users experience vivid visual hallucinations. It is also common for these types of drugs to cause hallucinations of body sensations (e.g., feeling as if you are a giant) and a skewed perception of the passage of time.



Psychedelic images like this are often associated with hallucinogenic compounds. (credit: modification of work by “new 1lluminati”/Flickr)

As a group, hallucinogens are incredibly varied in terms of the neurotransmitter systems they affect. Mescaline and LSD are serotonin agonists, and PCP (angel dust) and ketamine (an animal anesthetic) act as antagonists of the NMDA glutamate receptor. In general, these drugs are not thought to possess the same sort of abuse potential as other classes of drugs discussed in this section.

***Link to Learning***

To learn more about some of the most commonly abused prescription and street drugs, check out the Commonly Abused Drugs Chart and the Commonly Abused Prescription Drugs Chart from the National Institute on Drug Abuse.

## Dig Deeper: Medical Marijuana

While the possession and use of marijuana is illegal in most states, it is now legal in Washington and Colorado to possess limited quantities of marijuana for recreational use ([link]). In contrast, medical marijuana use is now legal in nearly half of the United States and in the District of Columbia. Medical marijuana is marijuana that is prescribed by a doctor for the treatment of a health condition. For example, people who undergo chemotherapy will often be prescribed marijuana to stimulate their appetites and prevent excessive weight loss resulting from the side effects of chemotherapy treatment. Marijuana may also have some promise in the treatment of a variety of medical conditions (Mather, Rauwendaal, Moxham-Hall, & Wodak, 2013; Robson, 2014; Schicho & Storr, 2014).




Medical marijuana shops are becoming more and more common in the United States. (credit: Laurie Avocado)

While medical marijuana laws have been passed on a state-by-state basis, federal laws still classify this as an illicit substance, making conducting research on the potentially beneficial medicinal uses of marijuana problematic. There is quite a bit of controversy within the scientific community as to the extent to which marijuana might have medicinal benefits due to a lack of large-scale, controlled research (Bostwick, 2012). As a result, many scientists have urged the federal government to allow for relaxation of current marijuana laws and classifications in order to facilitate a more widespread study of the drug’s effects (Aggarwal et al., 2009; Bostwick, 2012; Kogan & Mechoulam, 2007).

Until recently, the United States Department of Justice routinely arrested people involved and seized marijuana used in medicinal settings. In the latter part of 2013, however, the United States Department of Justice issued statements indicating that they would not continue to challenge state medical marijuana laws. This shift in policy may be in response to the scientific community’s recommendations and/or reflect changing public opinion regarding marijuana.

## Summary

Substance use disorder is defined in DSM-5 as a compulsive pattern of drug use despite negative consequences. Both physical and psychological dependence are important parts of this disorder. Alcohol, barbiturates, and benzodiazepines are central nervous system depressants that affect GABA neurotransmission. Cocaine, amphetamine, cathinones, and MDMA are all central nervous stimulants that agonize dopamine neurotransmission, while nicotine and caffeine affect acetylcholine and adenosine, respectively. Opiate drugs serve as powerful analgesics through their effects on the endogenous opioid neurotransmitter system, and hallucinogenic drugs cause pronounced changes in sensory and perceptual experiences. The hallucinogens are variable with regards to the specific neurotransmitter systems they affect.

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## SELF CHECK QUESTIONS

### *Critical Thinking Questions*

1. The negative health consequences of both alcohol and tobacco products are well-documented. A drug like marijuana, on the other hand, is generally considered to be as safe, if not safer than these legal drugs. Why do you think marijuana use continues to be illegal in many parts of the United States?

2. Why are programs designed to educate people about the dangers of using tobacco products just as important as developing tobacco cessation programs?

***Personal Application Question***

3. Many people experiment with some sort of psychoactive substance at some point in their lives. Why do you think people are motivated to use substances that alter consciousness?

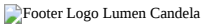
## AnswerS

1. One possibility involves the cultural acceptance and long history of alcohol and tobacco use in our society. No doubt, money comes into play as well. Growing tobacco and producing alcohol on a large scale is a well-regulated and taxed process. Given that marijuana is essentially a weed that requires little care to grow, it would be much more difficult to regulate its production. Recent events suggest that cultural attitudes regarding marijuana are changing, and it is quite likely that its illicit status will be adapted accordingly.

2. Given that currently available programs designed to help people quit using tobacco products are not necessarily effective in the long term, programs designed to prevent people from using these products in the first place may be the best hope for dealing with the enormous public health concerns associated with tobacco use.

## GLOSSARY

**codeine** opiate with relatively low potency often prescribed for minor pain
**depressant** drug that tends to suppress central nervous system activity
**euphoric high** feelings of intense elation and pleasure from drug use
**hallucinogen** one of a class of drugs that results in profound alterations in sensory and perceptual experiences, often with vivid hallucinations
**methadone** synthetic opioid that is less euphorogenic than heroin and similar drugs; used to manage withdrawal symptoms in opiate users
**methadone clinic** uses methadone to treat withdrawal symptoms in opiate users
**methamphetamine** type of amphetamine that can be made from pseudoephedrine, an over-the-counter drug; widely manufactured and abused
**opiate/opioid** one of a category of drugs that has strong analgesic properties; opiates are produced from the resin of the opium poppy; includes heroin, morphine, methadone, and codeine
**physical dependence** changes in normal bodily functions that cause a drug user to experience withdrawal symptoms upon cessation of use
**psychological dependence** emotional, rather than a physical, need for a drug which may be used to relieve psychological distress
**stimulant** drug that tends to increase overall levels of neural activity; includes caffeine, nicotine, amphetamines, and cocaine
**tolerance** state of requiring increasing quantities of the drug to gain the desired effect
**withdrawal** variety of negative symptoms experienced when drug use is discontinued




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# 25.2: Attributions

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# CHAPTER OVERVIEW

## 26: Instructor Resources


26.1: Test #1
26.2: Test #2
26.3: Test #3
26.4: Test #4
26.5: Test #5
26.6: Additional Assessments


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# 26.1: Test #1

**Note: This test may need to be updated and/or revised to accurately reflect current statistics, research findings, and health trends.**

1. What does the term “risk factor” refer to?

    a. health outcomes resulting from a disease

    b. symptoms of a disease that occur

    c. attributes that increase disease probability

    d. probability of disease mortality

2. Approximately which percentage of American adults are overweight or obese?

    a. 28%

    b. 88%

    c. 38%

    d. 68%

3. In the United States, what is the leading cause of death?

    a. cancer

    b. heart disease

    c. stroke

    d. AIDS

4. Which source below would be most likely to offer reliable and accurate information about the topic of cholesterol?

    a. a health blog on cholesterol written by a health and fitness enthusiast

    b. a cholesterol article on a web site that is sponsored by a pharmaceutical company

    c. a cholesterol article on a web site that is sponsored by a medical institution

    d. all of the above

5. What is the leading contributing cause of preventable disease and death in the United States?

    a. unprotected sex

    b. obesity

    c. tobacco use

    d. poor diet

6. Which stage of the transtheoretical model involves recognizing that a problem exists, and having intentions to make a behavior change within 6 months?

    a. precontemplation

    b. contemplation

    c. preparation

    d. action

7. Current physical activity guidelines indicate that adults need at least how many minutes of moderate-intensity aerobic activity per week?

    a. 75

    b. 120

c. 150

d. 200

8. In using music therapy for relaxation, why is listening to instrumental music recommended?

a. it activates the left hemisphere of the brain to promote deeper relaxation

b. it activates the right hemisphere of the brain to promote deeper relaxation

c. it deactivates the right hemisphere of the brain

d. it deactivates the creative function of the brain

9. According to the Yerkes-Dodson law, stress…?

a. decreases performance at all levels

b. increases performance at all levels

c. increases performance to a certain point

d. has no effect on performance

10. Progressive muscular relaxation, a technique used to increase physical neuromuscular awareness, is accomplished by:

a. contracting and relaxing muscles

b. relaxing muscles ONLY

c. stretching muscles

d. massaging muscles

11. Stress increases cardiovascular disease risk through which of the following?

a. prolonged elevation of heart rate and blood pressure

b. reduced heart rate and blood pressure

c. reparation of damaged vessel lining

d. uninhibited blood flow

12. For EACH dimension of wellness, briefly explain your (personal) current level of progress and potential areas in need of improvement:

physical –

emotional –

intellectual –

interpersonal –

cultural –

spiritual –

environmental –

financial –

occupational –

13. Take a look at the following advertisement for the weight reduction pill, “Beta-Slim.” Circle ***four*** statements or claims in the ad that should make consumers cautious about the product, **ANDexplain** why it might be a red flag (on the next page):

**Lose up to 10, 20, 50 even 100 lbs. or more with Beta-Slim™**

Beta-Slim™ is a unique, all natural weight reduction formula that is guaranteed to get you to your weight loss goal, without restrictive dieting, strenuous workouts or failure. This method is easy, safe and scientifically proven to get quick, noticeable results for anyone needing to shed unwanted pounds and inches. Backed by years of in-depth research and testing conducted at state-of-

the-art laboratories, Beta-Slim™ will prove to be the solution that you've been waiting for! Never before has there been such a simple way to slim down.

**Safe & Effective Fat Absorber**

Beta-Slim is a small, easy to swallow capsule, proven safe and effective, with no side effects. It contains a natural fat absorber – a unique amino-polysaccharide (inert carbohydrate) which comes from lab-controlled cultures – grown in the USA. This natural fat absorber has the amazing propensity to target and remove fat from the system, slimming you down in record time…. now you can lose up to 10 pounds of fat each week, guaranteed! And because Beta-Slim™ works to absorb the bad fats from the foods you eat, you will never be forced to give up the foods you love. Just eat as you normally would and let Beta-Slim™ do the rest! If you need to lose from as little as 5 pounds to as much as 100 pounds or more, Beta-Slim™ will work for you, changing your life forever!

Scientific breakthrough will help you DROP POUNDS & TRIM INCHES…

►Without changing your diet

►Without hard exercise

►Without trying

**Lose Pounds and Inches!**

You can get the slim, sexy body that you've always wanted… without the disappointment of starting and stopping one diet after another… without feeling guilty every time you eat your favorite foods… without having to do another boring exercise… without having to tell another person you failed at your diet… yet again!

With Beta-Slim™, you will have total control of your weight… and your life. This amazing new formula is perfect for anyone who wants to lose pounds and inches without frustration. Regardless of how much weight you need to lose, Beta-Slim™ will get you the results you want!

**Lose up to 10 lbs. a week & up to 40 lbs. a month**

Beta-Slim™ is an extremely potent, pharmaceutical-grade fat absorber that has proven itself, again and again, to bring significant, visible results for everyone-regardless of how much weight needs to be lost. This thoroughly tested, safe fat absorber promotes the loss of up to 5-10 pounds each week and up to 40 pounds each month, guaranteed! Now, you will finally be able to succeed with your weight-loss mission and attain the body of your dreams. You will be amazed at how quickly and efficiently Beta-Slim works to trim inches and melt pounds away.

Watch as years of accumulated fat disappear effortlessly. Even if you feel that losing weight is impossible, now, thanks to Beta-Slim™, you will finally be able to lose all the weight that you need to, without diets, exercise or disappointments!

> *"I went from a size 14 to a size 7 with Beta-Slim and it was so easy. I love to eat and with Beta-Slim, I didn't have to change any of my eating habits. Thanks a million!" – Brenda H.*
>
> *"Beta Slim is incredible. I lost 48 lbs. without having to diet or exercise. If I can do it… anyone can!" – Donna M.*
>
> *"This product really helped me. I had been overweight since high school and I was never able to get the weight off. With Beta Slim, I lost 37 pounds and I look and feel fantastic!" – Tanya B.*
>
> **Red Flag Explanations:**
>
> **1.**
>
> **2.**
>
> **3.**
>
> **4.**

14. Explain what a "target heart rate zone" means, and discuss its potential cardiovascular health benefits. Your response should be at least 50 words in length.

15. A condition in which the body has an excessive and unhealthy amount of fat (BMI 30 or >) is known as…?

a. hypertrophy

b. overweight

c. obesity

d. embolus

16. Which of the following is a standard that correlates body weight with the risk of developing chronic health conditions associated with excess body fat?

a. body composition

b. body mass index

c. metabolism

d. metabolic rate

17. In setting health behavior change goals, using the "SMART" criteria increases the effectiveness and chances of potential success. Identify and explain what each letter of the "SMART" acronym stands for:

S =

M =

A =

R =

T =

18. One pound of body fat is equal to approximately how many calories?

a. 150

b. 350

c. 1,500

d. 3,500

19. Several factors can be attributed to weight gain, overweight and obesity. For **EACH** of the four factors listed below, explain how it potentially contributes to the process of gaining too much weight:

**BIOLOGICAL:**

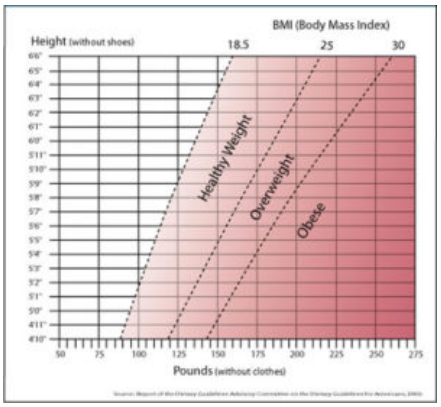
- Explain the "Set Point Theory":

**PSYCHOLOGICAL:**

**SOCIAL:**

**ENVIRONMENTAL:**

20. Locate your **Body Mass Index (BMI)** on the chart below by finding where your height and weight meet up, then answer the question on the next page:




Whether you are currently at a healthy weight, overweight, or obese; what steps can you take to maintain and/or achieve a BMI that will lend itself to a healthy lifestyle? Be sure to include ***specific*** information about diet and exercise. Your response should be at least 75 words in length.

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- Body Mass Index chart. **Authored by**: HealthAliciousNess. **Located at**: https://www.flickr.com/photos/healthaliciousness/20547962728. **License**: *CC BY: Attribution*

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# 26.2: Test #2

**Note: This test may need to be updated and/or revised to accurately reflect current statistics, research findings, and health trends.**

1. The CDC (Centers for Disease Control and Prevention) estimates that approximately how many new cases of STIs occur each year in the United States?

    a. 2 million

    b. 12 million

    c. 20 million

    d. 40 million

2. It is estimated that there are more than how many total STIs among men and women in the U.S.?

    a. 75 million

    b. 110 million

    c. 150 million

    d. 210 million

3. Which of the following STIs cannot be cured?

    a. chlamydia

    b. syphilis

    c. herpes

    d. gonorrhea

4. Which statement below is false regarding STI testing?

    a. There are separate tests for different STIs.

    b. You must request that an STI test be performed.

    c. If you do not have any symptoms, it is not necessary to get tested.

    d. STI tests are relatively easy to get.

5. Antibiotic treatment can be used for which STI?

    a. herpes

    b. HPV

    c. chlamydia

    d. HIV

6. If a condom is used during intercourse, there is no risk for getting an STI.

    a. True

    b. False

7. About one out of _____ adults in the U.S. has genital herpes, but as many as 90% of those infected don't know it.

    a. 2

    b. 4

    c. 6

    d. 8

8. If you are trying to protect yourself from getting genital herpes, oral sex is a safe alternative to vaginal sex.

a. True

b. False

9. Which four bodily fluids can transmit HIV to others?

a. semen, saliva, urine, vaginal secretions

b. semen, vaginal secretions, sweat, saliva

c. semen, saliva, blood, vaginal secretions

d. semen, vaginal secretions, breast milk, blood

10. A diagnosis of AIDS ensues when an HIV-infected person's CD4 cell count drops below…?

a. 700 cells/uL

b. 500 cells/uL

c. 200 cells/uL

d. 1000 cells/uL

11. The most effective way to protect yourself against STIs EACH time you have a new sexual partner (and ***before*** you first engage in any sexual activity with that person) is…?

a. to determine how many previous sexual partners he/she has been with

b. to ask if he/she has any STIs

c. to go get tested for STIs together and see each other's results

d. to rely on the effectiveness of using a condom when you decide to have sex

12. Hepatitis can severely damage which organ?

a. kidney

b. colon

c. liver

d. spleen

13. Most sexually active men and women will get HPV at some point in their lives.

a. True

b. False

14. The HPV vaccines for females and males are most effective when all doses are…?

a. given within a 1 month time period

b. given before a person first has sexual contact

c. given at the time the infection first occurs

d. given directly after sexual contact has occurred

15. Explain why "I" statements are generally a more effective approach to communication than "you" statements, and provide at least one example that demonstrates the difference between the two:

16. **Directions:** For each scenario below, circle the choice that most closely resembles how you would likely respond to the situation, and then answer the question that follows:

a. Your roommate/significant other/family member rarely, if ever, cleans up anything in your dorm room/apartment/house. You…

i. don't say anything and just clean up after them

ii. talk to them about a plan/schedule for taking turns cleaning shared spaces

iii. start placing clutter and dirty dishes in the person's space

iv. call them a slob, yell at them, and/or threaten to kick them out

b. Your classmate is not pulling his/her weight on your assigned group project. You…

i. pick up the slack for that person without addressing the issue

ii. discuss with that person/the whole group how to best proceed/divide tasks

iii. rip the person apart/call them lazy and useless

c. Your friend says something that hurts your feelings. You…

i. say nothing and hope it doesn't happen again

ii. tell your friend that what he/she said hurt your feelings

iii. get even with your friend by saying something hurtful too

d. Your friend borrows your watch/jewelry/piece of clothing without returning it. You…

i. let them keep it even though it is one of your favorites

ii. ask your friend to return the item

iii. get even by taking something that belongs to them

iv. accuse your friend of trying to steal from you

**Question**: In addition to the previous scenarios, take a moment to reflect on how you typically respond to various situations in your life. Do you have a difficult time speaking up? Or, do you tend to lash out at others very quickly (e.g. name-calling, raised voice, etc.)? If you chose "ii" for most of the scenarios, then you are probably on the "right" track to communicating effectively. Briefly (and honestly!) discuss how satisfied or dissatisfied you are with your current level of communication with others, as well as areas that could potentially use improvement. Keep in mind, communicating effectively involves respecting others as well as yourself.

Your response should be at least 75 words in length:

17. What are the 3 key elements of Sternberg's Triangular Theory of Love (write them below)?

a.

b.

c.

18. HPV can cause cancer in both men and women.

a. True

b. False

19. People who have an STI are more likely to become infected with HIV.

a. True

b. False

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# 26.3: Test #3

**Note: This test may need to be updated and/or revised to accurately reflect current statistics, research findings, and health trends.**

1. A myocardial infarction is also known as…?

    a. arrhythmia

    b. claudication

    c. heart attack

    d. stroke

2. Place a check mark next to EACH factor below that is a **risk factor** for cardiovascular disease:

    _____ high LDL cholesterol

    _____ consuming unsaturated fats

    _____ diabetes

    _____ obesity

    _____ total cholesterol below 200

    _____ family history of heart disease

3. When a plaque forms on the artery wall due to the build up of fatty material, this is known as…?

    a. angioplasty

    b. angiogenesis

    c. angina

    d. atherosclerosis

4. If you think you, or someone else, may be having a heart attack, you should…?

    a. wait at least five minutes to assess the severity of symptoms

    b. take an aspirin first, then determine how you feel within an hour

    c. call 911 within five minutes of experiencing the symptoms

    d. drive yourself to the emergency room

5. What does the acronym FAST stand for regarding the signs of a stroke?

    a. Fecal release, Artery constriction, Standing upright, Telling time

    b. Fever escalation, Abdominal pain, Severe nausea, Temperature increase

    c. Facial weakness, Arm weakness, Speech difficulties, Time is of the essence

    d. Fast breathing, Abnormal heart rate, Selective memory, Total loss of bowel control

6. Foods rich in what nutrient have been shown to potentially help lower “bad” cholesterol levels?

    a. soluble fiber

    b. insoluble fiber

    c. protein

    d. vitamin C

7. Consuming which of the following has the greatest affect on increasing “bad” cholesterol levels?

    a. cholesterol

    b. unsaturated fat

c. sodium

d. saturated fat

8. Generally, your total cholesterol should be kept below…?

a. 100 mg/dL

b. 150 mg/dL

c. 200 mg/dL

d. 250 mg/dL

9. The relatively new cholesterol management guidelines state that if a person's long-term risk for having a heart attack or stroke is low, then there is probably no need for statins (medication) unless…?

a. LDL cholesterol is above 100 mg/dL

b. LDL cholesterol is below 100 mg/dL

c. LDL cholesterol is above 190 mg/dL

d. LDL cholesterol is below 190 mg/dL

10. For a diagnosis of metabolic syndrome, a person would have 3 or more of the following risks (**fill in all of the blanks for each one**):

a. Abdominal obesity equating to a waist measurement of more than _____inches in men, and _____inches in women

b. Triglycerides greater than _____mg/dl; HDL cholesterol of less than _____mg/dl in men, and less than _____mg/dl in women

c. Blood pressure greater than _____/_____

d. Fasting blood glucose greater than _____mg/dl

11. Identify (state what each letter stands for) and explain the ABCDEs of melanoma:

A =

B =

C =

D =

E =

12. Which term describes the ability of cancer cells to spread from where they develop to another part of the body?

a. sarcoma

b. metastasis

c. biopsy

d. synthesis

13. What are cancer-causing substances called?

a. antigens

b. pathogens

c. carcinogens

d. toxins

14. Tobacco use can be attributed to which percentage of **ALL** cancer deaths?

a. 10%

b. 30%

c. 50%

d. 80%

15. Which cancer kills more men and women than any other type?

a. liver

b. kidney

c. stomach

d. lung

16. To reduce the risk of melanoma and other skin cancers, exposure to the sun should be avoided, especially during which times of the day when UV radiation is highest?

a. 7 a.m. – 1 p.m.

b. 8 a.m. – 2 p.m.

c. 10 a.m. – 4 p.m.

d. 1 p.m. – 7 p.m.

17. Women with multiple sexual partners have a greater chance of developing cervical cancer due to an increased risk of becoming infected with which of the following viruses?

a. HIV

b. Hepatitis B

c. Hepatitis C

d. HPV

18. Which ingredient found in most processed meats has the potential to contribute to the formation of cancer?

a. carrageenan

b. sodium nitrite

c. citric acid

d. dextrose

19. Cooking foods in certain ways can create chemicals that have been shown to be cancer causing. Below, explain how this occurs for both HCAs and PAHs:

HCA:

PAH:

20. Are you putting yourself at risk for developing cancer or heart disease? Place a check mark next to each risk factor below that applies to you (Please note—this is not a complete list of all risk factors):

| | |
|---|---|
| _____ | smoking (including exposure to secondhand smoke) |
| _____ | smokeless tobacco use (chewing, snuff, etc.) |
| _____ | physical inactivity |
| _____ | dietary factors (eating too many saturated fats, processed meats, etc.) |
| _____ | overweight/obesity |
| _____ | UV radiation exposure (sun and/or indoor tanning) |
| _____ | excessive alcohol consumption (>1 drink/day for women; >2 drinks/day for men; and/or binge drinking) |

| | |
|---|---|
| _____ | stress (that is not being managed or offset by relaxation strategies) |
| _____ | unprotected sex (and/or multiple partners) |
| _____ | family history of cancer or heart disease (non-modifiable, but important to know for screening) |

Discuss all of your current (and past) behaviors that are known risk factors for cancer and/or heart disease, and identify what changes you need to make (or that you already have made) to reduce your risk:

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# 26.4: Test #4

**Note: This test may need to be updated and/or revised to accurately reflect current statistics, research findings, and health trends.**

1. In New York State, a blood alcohol concentration (BAC) of how much constitutes Driving While Intoxicated (DWI), with the exception of commercial motor vehicle drivers?

   a. .02

   b. .04

   c. .06

   d. .08

2. Which of the following can make you sober?

   a. drinking coffee

   b. taking a cold shower

   c. time

   d. all of the above

3. Which statement is most accurate regarding how BAC is affected by certain factors?

   a. a person with a higher percentage of body fat will have a lower BAC than a leaner person of the same weight

   b. women metabolize less alcohol in the stomach than men do, resulting in a higher BAC

   c. men metabolize less alcohol in the stomach than women do, resulting in a higher BAC

   d. a person with a lower percentage of body fat will have a higher BAC than a person of the same weight with more body fat

4. Every year, approximately how many people die in the United States as a result of using tobacco products?

   a. 143,000

   b. 14,000

   c. 443,000

   d. 44,000

5. Which of the following statements about secondhand smoke is **false**?

   a. It contributes to over 3,000 lung cancer deaths each year among U.S. non-smokers.

   b. There are less than 25 toxic chemicals found in secondhand tobacco smoke.

   c. It may increase the risk of heart disease by 25-30 percent.

   d. 46,000 heart disease deaths are likely due to secondhand smoke each year in the U.S.

6. Tobacco use is responsible for about ____% of all cancer deaths annually in the U.S.

   a. 15

   b. 30

   c. 50

   d. 65

7. Place a check mark next to EACH statement that is correct regarding the use of e-cigarettes:

   _____ They are FDA approved as a quit-smoking aid

   _____ Extensive research shows they are safe

   _____ Carcinogens may be associated with its use

_____ Nicotine addiction is still a factor

8. Which type of cancer kills more men and women than any other kind?

a. stomach

b. liver

c. lung

d. colon

9. What are three conditions or diseases that can affect a person's liver due to excessive alcohol consumption (list them below)?

a. _____

b. _____

c. _____

10. Marijuana use may increase the risk of having a heart attack.

a. True

b. False

11. Which statement below regarding prescription drugs, herbal supplements, and other available products that people consume is most accurate?

a. Herbal products are strictly regulated and approved for safety.

b. Medications are only prescribed if there is no risk for addiction.

c. Herbal and synthetic products are available that have not been regulated.

d. The FDA ensures that all products are safe before they can be sold.

12. OxyContin, a prescription drug, is most closely associated with which of the following illicit drugs?

a. cocaine

b. heroin

c. methamphetamine

d. ecstasy

13. Based on the concept of synergism, which drug combination below would be most apt to result in a severe reduction in respiration, decreased heart rate, coma, or even death if consumed together?

a. meth and cocaine

b. Ritalin and alcohol

c. Valium and alcohol

d. meth and marijuana

14. **Addiction to Technology?**

The popularity of the internet continues to grow because of the many ways users can interact, be entertained, informed, contacted, and occupied. Users connect through virtual worlds, blogs, games, subscription services and social networking sites. Technology gives users the ability to stay connected and contactable 24 hours a day.

However, being connected 24 hours can lead to excessive internet use, which can have a negative impact on the well-being of the user and his/her friends and family.

**Do you show signs of possible excessive technology use? Circle "Yes" or "No" for each of the following questions (and be honest!). Are you…**

- experiencing a decline in work/study performance as a result of time spent online? Yes No
- feeling tired as a result of late night online activity? Yes No

- missing meals or eating while online so that you can stay connected? Yes No
- lying awake at night with your mind on what's happening online or waking up in the middle of the night to check online updates and messages (including text messages)? Yes No
- using your smart phone at inappropriate times and places such as in a movie theater or while driving? Yes No
- misleading family members about the extent of time spent on the internet? Yes No
- preferring to spend time online rather than with your family and friends? Yes No
- spending time on the internet because it's more fun than the 'real' world? Yes No
- unsuccessfully trying to cut back on internet use (including social media, gaming, etc.)? Yes No

Answering yes to more than a few of these questions may mean there is a potential problem with excessive internet use. Left unchecked, this can have a negative impact on your overall well-being, relationships, and may also affect work/study performance.

It is important to strike a balance between online and offline activity!

Reflect on the previous questions and take an honest look at the amount of time you spend on electronic devices (smart phone, laptop, tablet, etc.). Discuss how you feel this affects the quality of your life (including your relationships, self-esteem, mood, time management, etc.), and whether or not this interferes with a "healthy" balance in your life. Your total response should be at least 75 words in length.

15. What is the strongest risk factor for transmitting violent behavior from one generation to the next?

a. Living with parents/caretakers who did not graduate from high school

b. Having family members who are afflicted with alcoholism and/or drug abuse

c. Witnessing violence between one's parents/caretakers

d. Watching disproportionate amounts of violence on television

16. Approximately how many women will experience domestic violence in their lifetime?

a. 1 out of 2

b. 1 out of 3

c. 1 out of 4

d. 1 out of 10

17. Abuse that occurs in domestic violence situations tends to subside or lessen as time goes on.

a. True

b. False

18. Besides physical abuse, explain two other types of abuse that someone might use to exert power and control over his/her partner. Be sure to provide an example for each type of abuse.

19. Which statement regarding how meth use affects the brain is most accurate?

a. meth initially releases a surge of dopamine, causing a sense of euphoria

b. over time, meth destroys dopamine receptors, making it impossible to feel the same pleasure

c. both a & b

d. none of the above

20. Prescription drugs do not have the potential for dangerous outcomes (such as addiction or death) unless they are mixed with illegal drugs.

a. True

b. False

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# 26.5: Test #5

**Note: This test may need to be updated and/or revised to accurately reflect current statistics, research findings, and health trends.**

1. What is a potential benefit of replacing “unhealthy fats” with “healthy fats” in your diet?

    a. It may increase your LDL cholesterol levels.

    b. It may reduce your LDL cholesterol levels.

    c. It may increase your blood glucose levels.

    d. It has no effect on your cholesterol levels.

2. Place a check mark beside EACH “healthy” fat below:

    _____ trans fat

    _____ monounsaturated fat

    _____ polyunsaturated fat

    _____ saturated fat

    _____ omega-3

    _____ unsaturated fat

3. Olive oil is a good choice to consider when trying to incorporate more “healthy fats” into your diet.

    a. True

    b. False

4. Which type of fiber has been shown to potentially help lower “bad” cholesterol levels?

    a. insoluble

    b. high density

    c. low density

    d. soluble

5. Which nutrient would be the most helpful in promoting regularity (i.e. relieving constipation)?

    a. protein

    b. calcium

    c. soluble fiber

    d. insoluble fiber

6. Explain what type 2 diabetes is (i.e. what happens in the body), and discuss how/why it can damage the body over time:

7. Anxiety disorders affect approximately how many American adults in a given year?

    a. 10 million

    b. 20 million

    c. 40 million

    d. 80 million

8. List **five** symptoms of depression:

    a.

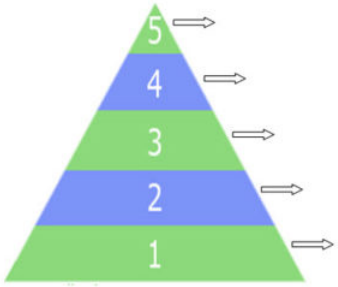
    b.

    c.

d.

e.

9. Identify and briefly explain each stage of Maslow's Hierarchy of Needs in the correct order below:




10. Choose ONE of the following defense mechanisms, and explain what it is:

- Repression
- Denial
- Rationalization
- Projection
- Displacement
- Regression
- Sublimation

11. Which eating disorder best describes behaviors that involve periods of overeating, followed by purging?

a. anorexia nervosa

b. bulimia nervosa

c. binge-eating

d. all of the above

12. Generalized Anxiety Disorder (GAD) is diagnosed when a person worries excessively about a variety of everyday problems for…?

a. at least 2 weeks

b. at least 1 month

c. at least 6 months

d. at least 1 year

13. Agoraphobia can best be described as a fear of…?

a. public places

b. farms

c. horror films

d. math

14. A treatment approach in which a person gradually encounters the object or situation that is feared, perhaps at first only through pictures or videos, then later face-to-face, is known as…?

a. aversion therapy

b. psychoanalysis

c. existential therapy

d. exposure-based therapy

15. Major depression is an episode of sadness or apathy along with other symptoms that lasts at least _____ and is severe enough to interrupt daily activities.

a. 2 consecutive weeks

b. 2 consecutive months

c. 6 consecutive weeks

d. 6 consecutive months

16. Long-term milder symptoms, lasting 2 years or longer, that prevent normal functioning or feeling well, is best described as which condition?

a. major depression

b. panic disorder

c. dysthymia

d. bipolar disorder

17. The FDA has placed a “black box” warning label on all antidepressant medications to alert the public about the potential increased risk of…?

a. dangerous interactions that may occur with over-the-counter (OTC) products

b. elevating blood pressure levels

c. suicidal thinking or attempts in children, adolescents, and young adults

d. suffering from a heart attack

18. Place a check mark beside EACH fat-soluble vitamin below:

_____ Vitamin C

_____ Vitamin D

_____ Thiamin

_____ Vitamin A

_____ Vitamin E

_____ Vitamin B-12

19. What is found in certain foods that can help protect the body from damage by free radicals?

a. psyllium

b. amino acids

c. antioxidants

d. none of the above

20. The words “organic” and “natural” mean the same thing on food labeling, and must adhere to the same standards.

a. True

b. False

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# 26.6: Additional Assessments

## Reflection:

1. Which health topics (choose at least two) are you most interested in, and why?

2. What health issues have affected you and/or your family/friends, and how has that influenced your attitude towards health?

## Essay:

1. On a scale of 1-10, with 10 being the highest, how motivated are you to make a healthy behavior change at this point in time, and WHY?

2. How will you maintain or increase your motivation for making healthy behavior changes?

After completing the questions above, choose one health-related behavior that you will work to change throughout the duration of this course and beyond. Include all of the following information:

Behavior Change Contract:

3. My behavior change goal will be (use the "SMART" criteria to set your goal):

4. What type of prevention (i.e. primary, secondary, or tertiary) would your behavior change be considered, and why?

5. Explain whether you have an External or Internal Locus of Control, and how this may affect your ability to attain this goal.

6. Explain how the constructs of the Health Belief Model apply to your situation and how this may affect your goal.

7. Explain what stage of the Transtheoretical Model you are currently in regarding this goal.

8. Discuss strategies and steps you will try to incorporate to support your efforts to change.

## Reflection:

1. What stressors in your life would you like to deal with more effectively – briefly discuss them?

2. How do you typically deal with stress (include all ways that you can think of and be honest!)?

3. What positive characteristics or strengths do you have that will help you deal with stress better (explain how it will help)?

4. What are some of the traits you have that might obstruct your ability to handle stress effectively (explain how/why)?

5. Choose at least two relaxation techniques/strategies that you think might help you to manage stress more effectively, and briefly discuss how/when you would realistically try to incorporate them into your life.

## Research Summary:

Choose any **TWO** of the following cancer risk topics to focus on:

- Obesity
- Alcohol
- Physical Inactivity
- Tanning
- HPV
- Chewing Tobacco

Based on the research provided from the National Cancer Institute via https://www.cancer.gov/, develop a summary for EACH topic that you choose by discussing important aspects associated with the selected cancer risk. Be sure to include sufficient information about the selected risk factor itself and how it potentially contributes to cancer, the types of cancers in particular that are identified in conjunction with the risk factor and why, any recommendations for prevention or how to reduce risk, and your overall reaction to the research findings (e.g., perhaps you were unaware of certain cancers being associated with a particular risk factor, etc.).

EACH summary should be at least **500 words in length (= a total of at least 1,000 words)**, and MUST be written **using your own words**! You cannot simply copy and paste information into your summary as this is considered plagiarism and will result in a

failing grade. If you use additional sources (other than the National Cancer Institute) to obtain further research, you must cite those sources within your summary.

## Discussion Forum/Essay:

It's your turn to research and present information for all of us to learn from! You will decide which topic to focus on (below), and ultimately provide a summary/essay of your research findings for the class to review and discuss. Remember, your summary must be written in your own words – you cannot simply copy/paste information from another source into your summary/post. At the end of your summary, include a reference list of all sources used (APA style citation is preferred). You must use and cite at least three sources.

Choose ONE of the following options to research, and be sure to address all related questions. Your initial summary/post should be approximately **250-300 words in length**. Submit your initial post no later than Wednesday, and then submit at least two replies on a subsequent day after reading through your classmates' posts. Your replies need to be more substantial than just, "I agree" or "That's interesting." You need to expand upon your thoughts and offer additional insight and/or cite research to back your statements. Keep the discussion going throughout the week! As always, the quality of your writing matters (i.e. spelling, grammar, etc.), as does the reliability of the sources you use!

**Option 1: Synthetic drugs**

- Explain what synthetic drugs are, and give at least two specific examples/names of these drugs.
- What are some of the potential health risks associated with synthetic drugs? How/where are these drugs purchased? Discuss any current legislation regarding the sale of such drugs.
- Do you know someone, or have heard about someone (in the news, etc.), who has abused synthetic drugs? Briefly discuss the abuse, and what happened as a result. Based on your research, what would your message be to other people about the potential dangers of synthetic drugs?

-OR-

**Option 2: Electronic cigarettes**

- Explain how electronic cigarettes are used, and how this differs from smoking cigarettes.
- What are the potential health risks/concerns associated with vaping, and why does additional research need to be conducted on this topic?
- Based on your overall research, what seems to be the initial message about its safety, as well as its utilization as a quit smoking method? Do you know someone who uses e-cigarettes? If so, briefly discuss why they are vaping (e.g. just for "fun", to relax, to help quit smoking, etc.), and whether or not smoking cigarettes has been, or still is, a part of their life.

## Final Paper/Analysis:

All questions must be answered thoroughly and completely to reflect your level of understanding (and sufficient time and effort) in correlating the concepts learned from this course to your behavior change analysis. **Note:** Your grade will not be based on whether or not you reached your goal, but rather on the experience of setting and working toward a health behavior change goal, the learning that took place, and the quality of your related responses for this analysis.

1. Restate your initial behavior change goal and the specific strategies you had initially planned for making this change. Include any modifications that you made to your goal along the way, and explain why changes were made.

2. Discuss the progress that you have made toward your goal from the beginning of this course until now. Be specific in stating measurable outcomes (e.g. If your goal was to quit smoking, state how many cigarettes you used to smoke per day as compared to how many you currently smoke per day, etc.). Include specific barriers and challenges that you faced and how you addressed them.

3. Refer back to the Health Belief Model and discuss what, if any, changes occurred during this process in relation to your perceived seriousness and perceived susceptibility to potential health problems, as well as any cues to action that may have affected you.

4. Refer back to the Transtheoretical Model and discuss which stage you are currently in, and whether or not you have moved forward from where you started at the beginning of the course.

5. Realistically, how motivated are you to maintain and/or improve upon your health-related goals for the future? If you are not very motivated, what will potentially happen if you do not make any changes (be specific in discussing health related issues)?

6. Discuss the areas in your life that you most need to address and continue working on to improve your overall health (e.g. managing stress, quitting smoking, improving your communication skills, exercising more frequently, etc.).

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# CHAPTER OVERVIEW

## 27: Complementary and Integrative Health


27.1: Definition of Terms

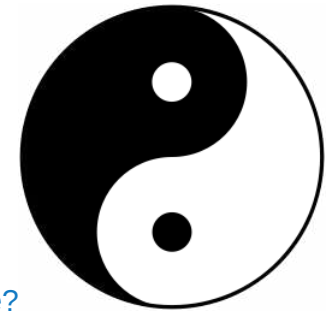
27.2: Types of Complementary Health Approaches

27.3: Dietary Supplements


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# 27.1: Definition of Terms



## Complementary, Alternative, or Integrative Health: What's In a Name?

We've all seen the words "complementary," "alternative," and "*integrative*," but what do they really mean?

Note: Also has been referred to as "complementary and alternative medicine," or "CAM" as an abbreviation.

## Complementary Versus Alternative

Many Americans—more than 30 percent of adults and about 12 percent of children—use health care approaches developed outside of mainstream Western, or conventional, medicine. When describing these approaches, people often use "alternative" and "complementary" interchangeably, but the two terms refer to different concepts:

- If a non-mainstream practice is used **together with** *conventional medicine*, it's considered "complementary."
- If a non-mainstream practice is used **in place of** conventional medicine, it's considered "alternative."

True alternative medicine is uncommon. Most people who use non-mainstream approaches use them along with conventional treatments.

## Integrative Medicine

There are many definitions of "integrative" health care, but all involve bringing conventional and complementary approaches together in a coordinated way. The use of integrative approaches to health and wellness has grown within care settings across the United States. Researchers are currently exploring the potential benefits of integrative health in a variety of situations, including pain management for military personnel and veterans, relief of symptoms in cancer patients and survivors, and programs to promote healthy behaviors.

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# 27.2: Types of Complementary Health Approaches

Most complementary health approaches fall into one of two subgroups—natural products or mind and body practices.

To learn more about specific products, practices, and approaches, click on each underlined item below.

## Natural Products

This group includes a variety of products, such as **herbs** (also known as botanicals), **vitamins and minerals**, and **probiotics**. They are widely marketed, readily available to consumers, and often sold as dietary supplements.

According to the 2012 National Health Interview Survey (NHIS), which included a comprehensive survey on the use of complementary health approaches by Americans, 17.7 percent of American adults had used a dietary supplement other than vitamins and minerals in the past year. These products were the most popular complementary health approach in the survey. The most commonly used natural product was fish oil.

Researchers have done large, rigorous studies on a few natural products, but the results often showed that the products didn't work. Research on others is in progress. While there are indications that some may be helpful, more needs to be learned about the effects of these products in the human body and about their safety and potential interactions with medicines and other natural products.

## Mind and Body Practices

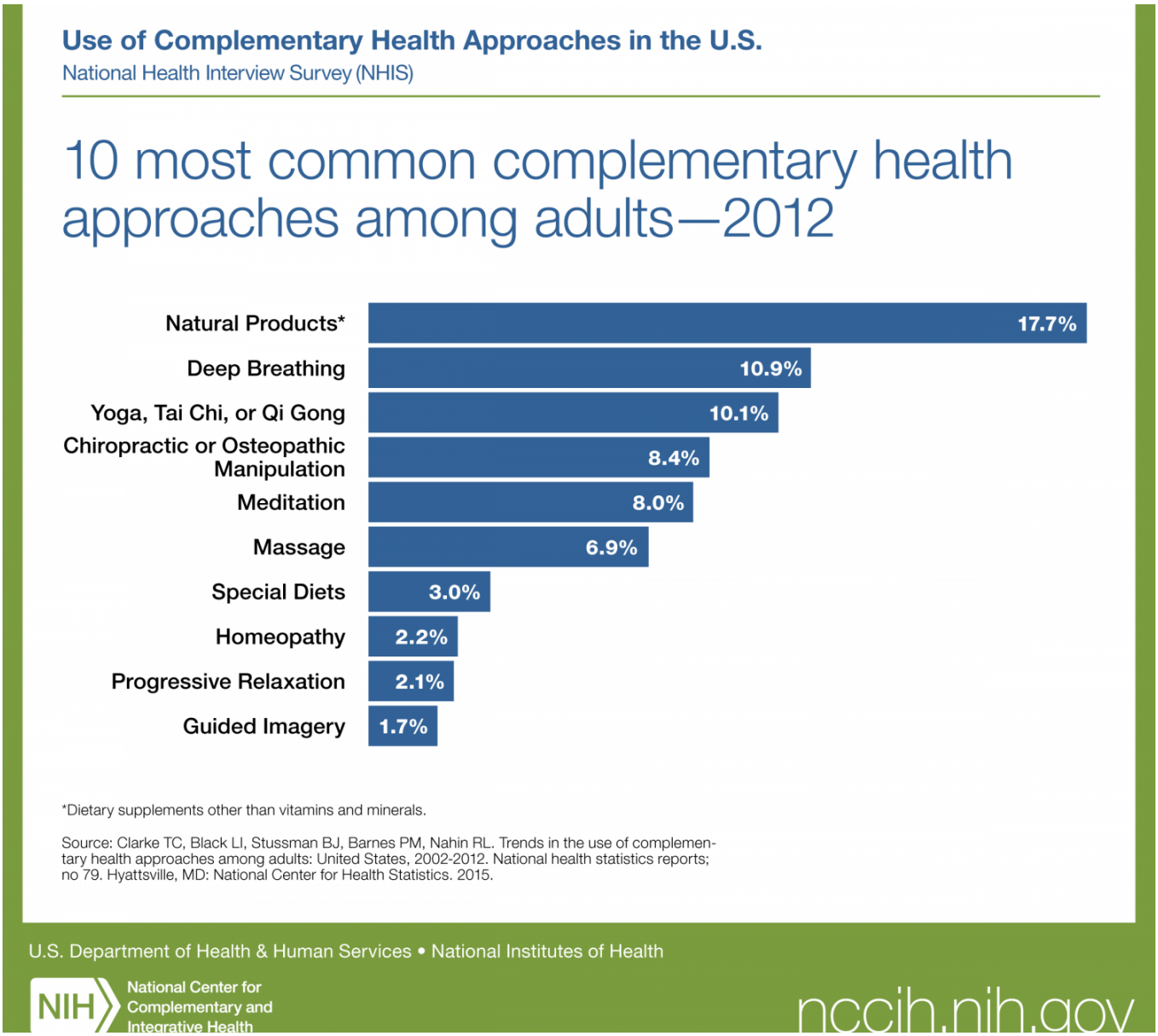
Mind and body practices include a large and diverse group of procedures or techniques administered or taught by a trained practitioner or teacher. The 2012 NHIS showed that **yoga**, **chiropractic and osteopathic manipulation**, **meditation**, and **massage therapy** are among the most popular mind and body practices used by adults. The popularity of yoga has grown dramatically in recent years, with almost twice as many U.S. adults practicing yoga in 2012 as in 2002.

Other mind and body practices include **acupuncture**, **relaxation techniques** (such as breathing exercises, guided imagery, and progressive muscle relaxation), **tai chi**, **qi gong**, **healing touch**, **hypnotherapy**, and **movement therapies** (such as Feldenkrais method, Alexander technique, Pilates, Rolfing Structural Integration, and Trager psychophysical integration).

The amount of research on mind and body approaches varies widely depending on the practice. For example, researchers have done many studies on acupuncture, yoga, spinal manipulation, and meditation, but there have been fewer studies on some other practices.

## Other Complementary Health Approaches

The two broad areas discussed above—natural products and mind and body practices—capture most complementary health approaches. However, some approaches may not neatly fit into either of these groups—for example, the practices of **traditional healers**, **Ayurvedic medicine**, **traditional Chinese medicine**, **homeopathy**, and **naturopathy**.




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# 27.3: Dietary Supplements

Like many Americans, you may take dietary supplements in an effort to stay healthy. With so many dietary supplements available and so many claims made about their health benefits, how can you decide whether a supplement is safe or useful? This fact sheet provides a general overview of dietary supplements, discusses safety considerations, and suggests sources for additional information.

### Key Points

- Dietary supplements contain a variety of ingredients, such as vitamins, minerals, amino acids, and herbs or other botanicals. Research has confirmed health benefits of some dietary supplements but not others.
- To use dietary supplements safely, read and follow the label instructions, and recognize that "natural" does not always mean "safe." Be aware that an *herbal supplement* may contain dozens of compounds and that all of its ingredients may not be known.
- Some dietary supplements may interact with medications or pose risks if you have medical problems or are going to have surgery. Most dietary supplements have not been tested in pregnant women, nursing mothers, or children.
- The U.S. Food and Drug Administration (FDA) regulates dietary supplements, but the regulations for dietary supplements are different and less strict than those for prescription or over-the-counter drugs.
- Tell all your health care providers about any complementary health approaches you use. Give them a full picture of what you do to manage your health. This will help ensure coordinated and safe care.

## Federal Regulation of Dietary Supplements

The Federal Government regulates dietary supplements through the FDA. The regulations for dietary supplements are not the same as those for prescription or over-the-counter drugs.

- Manufacturers of dietary supplements are responsible for ensuring that their products are safe and that the label information is truthful and not misleading. However, a manufacturer of a dietary supplement does not have to provide the FDA with data that demonstrate the safety of the product before it is marketed.[1] In contrast, manufacturers of drugs have to provide the FDA with evidence that their products are both safe and effective before the drugs can be sold.
- Manufacturers may make three types of claims for their dietary supplements: health claims, structure/function claims, and nutrient content claims. Some of these claims describe the link between a food substance and a disease or health-related condition; the intended benefits of using the product; or the amount of a nutrient or dietary substance in a product. Different requirements apply to each type of claim. If a dietary supplement manufacturer makes a claim about a product's effects, the manufacturer must have data to support the claim. Claims about how a supplement affects the structure or function of the body must be followed by the words "This statement has not been evaluated by the U.S. Food and Drug Administration (FDA). This product is not intended to diagnose, treat, cure, or prevent any disease."
- Manufacturers must follow "current good manufacturing practices" for dietary supplements to ensure that these products are processed, labeled, and packaged consistently and meet quality standards.
- Once a dietary supplement is on the market, the FDA evaluates safety by doing research and keeping track of any side effects reported by consumers, health care providers, and supplement companies. If the FDA finds a product to be unsafe, it can take action against the manufacturer and/or distributor, and may issue a warning or require that the product be removed from the marketplace.

## Sources of Science-Based Information

It's important to look for reliable sources of information on dietary supplements so you can evaluate the claims that are made about them. The most reliable information on dietary supplements is based on the results of rigorous scientific testing.

To get reliable information on a particular dietary supplement:

- Ask your health care providers. Even if they don't know about a specific dietary supplement, they may be able to access the latest medical guidance about its uses and risks.
- Look for scientific research findings on the dietary supplement. The National Center for Complementary and Integrative Health (NCCIH) and the National Institutes of Health (NIH) Office of Dietary Supplements (ODS), as well as other Federal agencies, have free publications, clearinghouses, and information on their Web sites.

## Safety Considerations

If you're thinking about or currently using a dietary supplement, here are some points to keep in mind.

- **Tell all your health care providers** about any complementary health approaches you use. Give them a full picture of what you do to manage your health. This will help ensure coordinated and safe care.
- It's especially important to talk to your health care providers if you:
  - Take any medications (whether prescription or over-the-counter). Some dietary supplements have been found to interact with medications. For example, the herbal supplement St. John's wort interacts with many medications, making them less effective.
  - Are thinking about replacing your regular medication with one or more dietary supplements.
  - Expect to have surgery. Certain dietary supplements may increase the risk of bleeding or affect the response to anesthesia.
  - Are pregnant, nursing a baby, attempting to become pregnant, or considering giving a child a dietary supplement. Most dietary supplements have not been tested in pregnant women, nursing mothers, or children.
  - Have any medical conditions. Some dietary supplements may harm you if you have particular medical conditions. For example, by taking supplements that contain iron, people with hemochromatosis, a hereditary disease in which too much iron accumulates in the body, could further increase their iron levels and therefore their risk of complications such as liver disease.
- If you're taking a dietary supplement, **follow the label instructions**. Talk to your health care provider if you have any questions, particularly about the best dosage for you to take. If you experience any side effects that concern you, stop taking the dietary supplement, and contact your health care provider. You can report serious problems suspected with dietary supplements to the U.S. Food and Drug Administration and the National Institutes of Health through the Safety Reporting Portal.
- Keep in mind that although many dietary supplements (and some prescription drugs) come from natural sources, **"natural" does not always mean "safe."** For example, the herbs comfrey and kava can cause serious harm to the liver. Also, a manufacturer's use of the term "standardized" (or "verified" or "certified") does not necessarily guarantee product quality or consistency.
- Be aware that **an herbal supplement may contain dozens of compounds** and that all of its ingredients may not be known. Researchers are studying many of these products in an effort to identify what ingredients may be active and understand their effects in the body. Also consider the possibility that what's on the label may not be what's in the bottle. Analyses of dietary supplements sometimes find differences between labeled and actual ingredients. For example:
  - An herbal supplement may not contain the correct plant species.
  - The amounts of the ingredients may be lower or higher than the label states. That means you may be taking less—or more—of the dietary supplement than you realize.
  - The dietary supplement may be contaminated with other herbs, pesticides, or metals, or even adulterated with unlabeled, illegal ingredients such as prescription drugs.

For current information from the Federal Government on the safety of particular dietary supplements, check the "Dietary Supplement Alerts and Safety Information" section of the FDA Web site or the "Alerts and Advisories" section of the NCCIH Web site.

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# CHAPTER OVERVIEW

## 28: Consumer Health

28.1: Finding Reliable Health Information
28.2: Health Fraud
28.3: Quick Tips for Evaluating Health Websites

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# 28.1: Finding Reliable Health Information

Millions of consumers get health information from magazines, TV or the Internet. Some of the information is reliable and up to date; some is not. How can you tell the good from the bad?

First, consider the source. If you use the Web, look for an “about us” page. Check to see who runs the site: Is it a branch of the government, a university, a health organization, a hospital or a business? Focus on quality. Does the site have an editorial board? Is the information reviewed before it is posted? Be skeptical. Things that sound too good to be true often are. You want current, unbiased information based on research.

## Consider the source–Use recognized authorities

Know who is responsible for the content.

- Look for an “about us” page. Check to see who runs the site: is it a branch of the Federal Government, a non-profit institution, a professional organization, a health system, a commercial organization or an individual.
- There is a big difference between a site that says, “I developed this site after my heart attack” and one that says, “This page on heart attack was developed by health professionals at the American Heart Association.”
- Web sites should have a way to contact the organization or webmaster. If the site provides no contact information, or if you can’t easily find out who runs the site, use caution.

## Focus on quality–All Web sites are not created equal

Does the site have an editorial board? Is the information reviewed before it is posted?

- This information is often on the “about us” page, or it may be under the organization’s mission statement, or part of the annual report.
- See if the board members are experts in the subject of the site. For example, a site on osteoporosis whose medical advisory board is composed of attorneys and accountants is not medically authoritative.
- Look for a description of the process of selecting or approving information on the site. It is usually in the “about us” section and may be called “editorial policy” or “selection policy” or “review policy.”
- Sometimes the site will have information “about our writers” or “about our authors” instead of an editorial policy. Review this section to find out who has written the information.

## Be a cyberskeptic–Quackery abounds on the Web

Does the site make health claims that seem too good to be true? Does the information use deliberately obscure, “scientific” sounding language? Does it promise quick, dramatic, miraculous results? Is this the only site making these claims?

- Beware of claims that one remedy will cure a variety of illnesses, that it is a “breakthrough,” or that it relies on a “secret ingredient.”
- Use caution if the site uses a sensational writing style (lots of exclamation points, for example.)
- A health Web site for consumers should use simple language, not technical jargon.
- Get a second opinion! Check more than one site.

https://youtu.be/augrvuHd1OM

## Look for the evidence–Rely on medical research, not opinion

Does the site identify the author? Does it rely on testimonials?

- Look for the author of the information, either an individual or an organization. Good examples are “Written by Jane Smith, R.N.,” or “Copyright 2013, American Cancer Society.”
- If there are case histories or testimonials on the Web site, look for contact information such as an email address or telephone number. If the testimonials are anonymous or hard to track down (“Jane from California”), use caution.

## Check for currency–Look for the latest information

Is the information current?

- Look for dates on documents. A document on coping with the loss of a loved one doesn't need to be current, but a document on the latest treatment of AIDS needs to be current.
- Click on a few links on the site. If there are a lot of broken links, the site may not be kept up-to-date.

## Beware of bias–What is the purpose? Who is providing the funding?

Who pays for the site?

- Check to see if the site is supported by public funds, donations or by commercial advertising.
- Advertisements should be labeled. They should say "Advertisement" or "From our Sponsor."
- Look at a page on the site, and see if it is clear when content is coming from a non-commercial source and when an advertiser provides it. For example, if a page about treatment of depression recommends one drug by name, see if you can tell if the company that manufactures the drug provides that information. If it does, you should consult other sources to see what they say about the same drug.

## Protect your privacy–Health information should be confidential

Does the site have a privacy policy and tell you what information they collect?

- There should be a link saying "Privacy" or "Privacy Policy." Read the privacy policy to see if your privacy is really being protected. For example, if the site says "We share information with companies that can provide you with useful products," then your information isn't private.
- If there is a registration form, notice what types of questions you must answer before you can view content. If you must provide personal information (such as name, address, date of birth, gender, mother's maiden name, credit card number) you should refer to their privacy policy to see what they can do with your information.

## Consult with your health professional–Patient/provider partnerships lead to the best medical decisions.

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# 28.2: Health Fraud

## 6 Tip-offs to Rip-offs: Don’t Fall for Health Fraud Scams

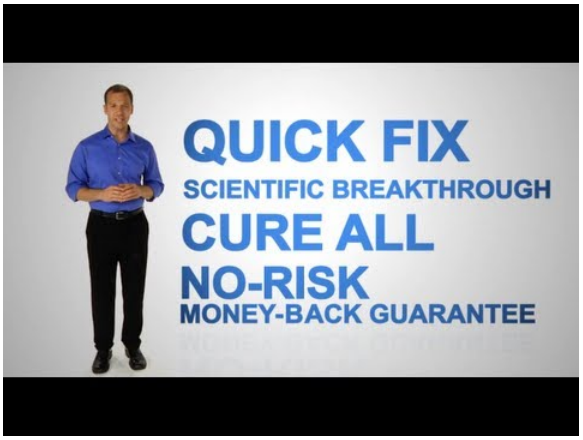
*Bogus product! Danger! Health fraud alert!*

You’ll never see these warnings on health products, but that’s what you ought to be thinking when you see claims like “miracle cure,” “revolutionary scientific breakthrough,” or “alternative to drugs or surgery.”

Health fraud scams have been around for hundreds of years. The snake oil salesmen of old have morphed into the deceptive, high-tech marketers of today. They prey on people’s desires for easy solutions to difficult health problems—from losing weight to curing serious diseases like cancer.

According to the Food and Drug Administration (FDA), a health product is fraudulent if it is deceptively promoted as being effective against a disease or health condition but has not been scientifically proven safe and effective for that purpose.

Scammers promote their products through newspapers, magazines, TV infomercials and cyberspace. You can find health fraud scams in retail stores and on countless websites, in popup ads and spam, and on social media sites like Facebook and Twitter.




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### Not Worth the Risk

Health fraud scams can do more than waste your money. They can cause serious injury or even death, says Gary Coody, R.Ph., FDA’s national health fraud coordinator. “Using unproven treatments can delay getting a potentially life-saving diagnosis and medication that actually works. Also, fraudulent products sometimes contain hidden drug ingredients that can be harmful when unknowingly taken by consumers.”

Fraudulent products often make claims related to:

- weight loss
- sexual performance
- memory loss
- serious diseases such as cancer, diabetes, heart disease, arthritis and Alzheimer’s.

### A Pervasive Problem

Fraudulent products not only won’t work—they could cause serious injury. In the past few years, FDA laboratories have found more than 100 weight-loss products, illegally marketed as dietary supplements, that contained sibutramine, the active ingredient in the prescription weight-loss drug Meridia. In 2010, Meridia was withdrawn from the U.S. market after studies showed that it was associated with an increased risk of heart attack and stroke.

Fraudulent products marketed as drugs or dietary supplements are not the only health scams on the market. FDA found a fraudulent and expensive light therapy device with cure-all claims to treat fungal meningitis, Alzheimer’s, skin cancer, concussions and many other unrelated diseases. Generally, making health claims about a medical device without FDA clearance or approval of the device is illegal.

“Health fraud is a pervasive problem,” says Coody, “especially when scammers sell online. It’s difficult to track down the responsible parties. When we do find them and tell them their products are illegal, some will shut down their website. Unfortunately, however, these same products may reappear later on a different website, and sometimes may reappear with a different name.”

## Tip-Offs

FDA offers some tip-offs to help you identify rip-offs.

- **One product does it all.** Be suspicious of products that claim to cure a wide range of diseases. A New York firm claimed its products marketed as dietary supplements could treat or cure senile dementia, brain atrophy, atherosclerosis, kidney dysfunction, gangrene, depression, osteoarthritis, dysuria, and lung, cervical and prostate cancer. In October 2012, at FDA’s request, U.S. marshals seized these products.
- **Personal testimonials.** Success stories, such as, “It cured my diabetes” or “My tumors are gone,” are easy to make up and are not a substitute for scientific evidence.
- **Quick fixes.** Few diseases or conditions can be treated quickly, even with legitimate products. Beware of language such as, “Lose 30 pounds in 30 days” or “eliminates skin cancer in days.”
- **“All natural.”** Some plants found in nature (such as poisonous mushrooms) can kill when consumed. Moreover, FDA has found numerous products promoted as “all natural” but that contain hidden and dangerously high doses of prescription drug ingredients or even untested active artificial ingredients.
- **“Miracle cure.”** Alarms should go off when you see this claim or others like it such as, “new discovery,” “scientific breakthrough” or “secret ingredient.” If a real cure for a serious disease were discovered, it would be widely reported through the media and prescribed by health professionals—not buried in print ads, TV infomercials or on Internet sites.
- **Conspiracy theories.** Claims like “The pharmaceutical industry and the government are working together to hide information about a miracle cure” are always untrue and unfounded. These statements are used to distract consumers from the obvious, common-sense questions about the so-called miracle cure.

Even with these tips, fraudulent health products are not always easy to spot. If you’re tempted to buy an unproven product or one with questionable claims, check with your doctor or other health care professional first.

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# 28.3: Quick Tips for Evaluating Health Websites

Content on the Internet is unregulated; anyone can publish anything on the Internet. There is sound medical information on the Internet along with dangerous information. You need to be able to tell the difference.

Ask yourself the following:

- Why did the person create the page?
- What's in it for them?
- Are they trying to sell me something?

Criteria for evaluating information from the web:

## Accuracy

- Is the information based on sound medical research? Can the information on the web page be verified by another source?
- Are the sources cited reliable?
- Are there grammatical and spelling errors?
- Are there footnotes, bibliographies, or references so that you can verify the information? Are these reliable? (a citation to *Parade* magazine does not have the same weight as an article from *JAMA* )

## Authority

- Who published the page? What are the person's credentials? What do you know about them?
- Is the person backed by a known organization? (the American Association for Cancer Therapy may be a made-up name for something operating out of someone's basement.)
- Is the person affiliated with a university? If so, is the person a student or a faculty member?
- Can you easily find contact information on the web page? Check the "about us" link, usually found at the beginning or the end of a webpage. What does the "About Us" section tell you about the purpose of the organization? Can you find a physical location for the organization? Or is the only way to contact the organization through a webform?
- What is the domain name? (.edu, .gov ) Is it a personal page or supported by the organization? The tilde (~) means that the site is a personal page (compare an address like med.harvard.edu/~jsmith/headache to med.harvard.edu/neurology/headache)

## Bias/Objectivity

- Is the information showing just one point of view?
- What kind of institution sponsored the webpage? A pharmaceutical company? A non-profit organization?
- Is advertising clearly marked?
- Can you tell if the information you are reading is advertisement?
- Do the graphics, fonts, and verbiage play upon emotions? Beware of CAPITAL LETTERS, EXCLAMATION POINTS!!!!! Or words like MIRACLE CURE!!!
- Is the author using data improperly to promote a position or a product?

## Currency/Timeliness

- Is there a date on the page?
- When was the page last updated?
- Do the links work?
- Has there been more recent research on the subject? Many medical treatments change with the publication of new studies. What was published a year ago may be outdated now.

## Coverage

- Is the information complete?
- Are there sources given for additional information?

## Additional Resources

MedlinePlus Guide to Healthy Web Surfing
http://www.nlm.nih.gov/medlineplus/healthywebsurfing.html

Trust It or Trash It? (evaluation tool)

Trust It or Trash It? (printer-friendly handout)

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# Glossary

**Sample Word 1** | Sample Definition 1

# Detailed Licensing

## Overview

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**Webpages:** 195

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