

INTRODUCTION TO HEALTH OER TEXTBOOK



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Introduction to Health OER Textbook

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Licensing

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CHAPTER OVERVIEW

1: Healthy Behaviors and Wellness

By Jonathan Howard

Learning Objectives

- Define the nine dimensions of wellness
- Identify health problems in the United States
- Identify the behaviors that promote wellness
- Behavior Modification: how change occurs, barriers to change, and how to successfully overcome barriers and make lasting lifestyle changes

1.1: Why Study Wellness?

1.2: Dimensions of Wellness

1.3: Health Problems in the United States

1.4: Behaviors That Promote Wellness

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1.1: Why Study Wellness?

As most college students do, you have probably set goals. Obviously, your individual goals differ from those of your fellow classmates, but everyone's goals share one common attribute: their intention to improve individual wellbeing. However, there are as many ideas about how to do that as there are individuals. Do your goals involve making more money, achieving better health, improving your relationships? Holistic wellness involves all those aspects of life and more. This chapter explains the importance of overall wellness, which is about more than being physically and mentally healthy, free from illness and disease. In fact, the study of wellness incorporates all aspects of life. Achieving overall wellness means living actively and fully. People in this state exude confidence, optimism, and self-efficacy; they have the energy reserves to do what needs to be done today and to plan for a better tomorrow. The most effective and transformative goals are those designed to achieve the highest level of personal wellness.

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1.2: Dimensions of Wellness

Wellness is a familiar term, but what is its true definition? Is it simply the absence of disease? This chapter will define all the components of holistic wellness and describe the factors that contribute to not only a person's physical and mental health, but also their ability to develop, thrive, succeed, enjoy life, and meet challenges head on with confidence and resolve.

To achieve this type of overall wellness, a person must be healthy in nine interconnected dimensions of wellness: physical, emotional, intellectual, spiritual, social, environmental, occupational, financial, and cultural. A description of each dimension follows.

The Nine Dimensions of Wellness

- *Occupational Wellness*

An occupationally well person enjoys the pursuit of a career which is fulfilling on a variety of levels. This person finds satisfaction and enrichment in work, while always in pursuit of opportunities to reach the next level of professional success.

- *Financial Wellness*

Those who are financially well are fully aware of their current financial state. They set long- and short-term goals regarding finances that will allow them to reach their personal

- *Physical Wellness*

People who are physically well actively make healthy decisions on a daily basis. They eat a nutritionally balanced diet; they try to get an adequate amount of sleep, and they visit the doctor routinely. They make a habit of exercising three to five times per week; they have the ability to identify their personal needs and are aware of their body's limitations. They maintain positive interpersonal relationships and make healthy sexual decisions that are consistent with their personal values and beliefs.

- *Emotional Wellness*

An emotionally well person successfully expresses and manages an entire range of feelings, including anger, doubt, hope, joy, desire, fear, and many others. People who are emotionally well maintain a high level of self-esteem. They have a positive body-image and the ability to regulate their feelings. They know where to seek support and help regarding their mental health, including but not limited to, seeking professional counseling services.

- *Intellectual Wellness*

Those who enjoy intellectual wellness engage in lifelong learning. They seek knowledge and activities that further develop their critical thinking and heighten global awareness. They engage in activities associated with the arts, philosophy, and reasoning.

- *Spiritual Wellness*

People who can be described as spiritually well have identified a core set of beliefs that guide their decision making, and other faith-based endeavors. While firm in their spiritual beliefs, they understand others may have a distinctly different set of guiding principles. They recognize the relationship between spirituality and identity in all individuals.

- *Social Wellness*

A socially well person builds healthy relationships based on interdependence, trust, and respect. Those who are socially well have a keen awareness of the feelings of others. They develop a network of friends and co-workers who share a common purpose, and who provide support and validation.

- *Environmental Wellness*

An environmentally well person appreciates the external cues and stimuli that an environment can provide. People who have achieved environmental wellness recognize the limits to controlling an environment and seek to understand the role an individual plays in the environment.

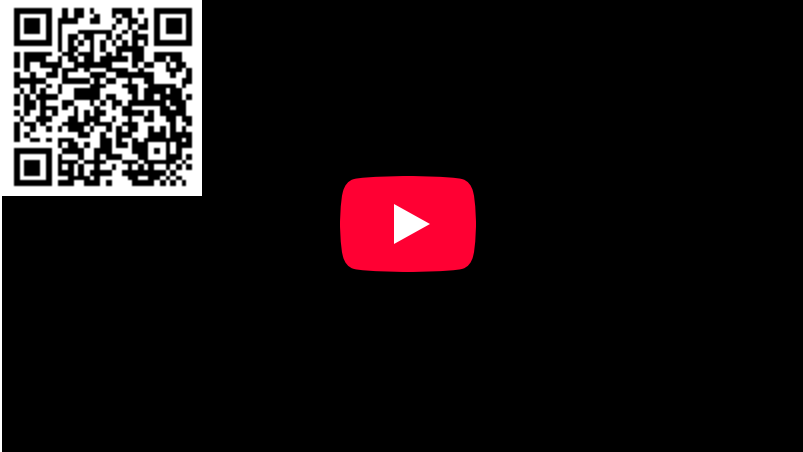
- *Cultural Wellness*

Culturally well people are aware of their own cultural background, as well as the diversity and richness present in other cultural backgrounds. Cultural wellness implies understanding, awareness and intrinsic respect for aspects of diversity. A culturally well person acknowledges and accepts the impact of these aspects of diversity on sexual orientation, religion, gender, racial and ethnic backgrounds, age groups, and disabilities.¹

For more information on the nine dimensions of wellness, click on the link below:

[Nine Dimensions of Wellness](#)

A video about the nine dimensions of wellness,



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1.3: Health Problems in the United States

Americans today experience health problems that people who lived 100 years ago did not encounter. What are the factors that account for these health problems that have arisen over the past 100 years? Most health problems faced by people in the U.S. are chronic diseases that are preventable and caused by everyday choices and unhealthy lifestyles.

The link below provides more information about the leading causes of death in the United States:

[Leading Causes of Death](#)

To see a 2014 chart that shows the leading cause of death by age group, click on the link below:

[Leading Cause of Death by Age Group](#)

In the video below, you will learn about the determinants of health as outlined by Healthy People 2020. Healthy People 2020 is a federal advisory committee comprised of non-federal, independent subject matter experts who gather data and provide advice on how to promote health and prevent disease in America:



In the meantime, the Healthy People 2020 program has updated, and been renamed [Healthy People 2030](#) website, which contains data and technical information about the program's objectives. The video below is the announcement for the update



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1.4: Behaviors That Promote Wellness

Bad habits are hard to break, but choosing to eat healthier and exercise more provides benefits that go far beyond a more ideal body weight and shape. Being physically fit can stave off many of the diseases and medical conditions discussed in the previous section, including heart disease, the number 1 killer in America. Exercise reduces stress and eases depression. Healthier employees are also more productive. Being physically fit nurtures the mind, body, and spirit and is the cornerstone of wellness. The links below provide information about behaviors within your control that contribute to an improved quality of life and increased wellness.

[Six Behaviors That Contribute to Wellness](#)

A video on lifestyle choices and their effect on wellbeing



[Behaviors that Contribute to Wellness Presentation](#)

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1.5: Behavior Modification

Making permanent lifestyle changes is one of the greatest challenges a person can face. This section will explore how changes to behavior occur, the psychological barriers that hamper efforts to change, and tips for making lasting change.

How Changes in Behavior Occur

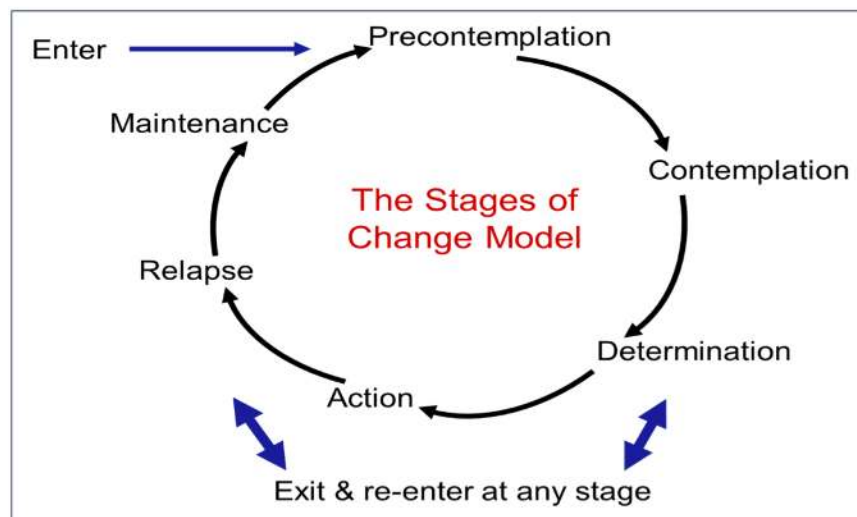
The Transtheoretical Model, also called the **Stages of Change Model**, was developed by James Prochaska and Carlo DiClemente in the late 1970s. Considered the dominant model for describing how behavior changes occur, it evolved through studies examining the experiences of smokers who quit on their own and comparing them with the experiences of those requiring further treatment. The goal of those studies was to understand why some people were capable of quitting on their own. It was determined that people quit smoking if they were ready to do so. Thus, the Transtheoretical Model (TTM) focuses on the decision-making of the individual and is a model of intentional change. The TTM operates on the assumption that people do not change behaviors quickly and decisively. Rather, change in behavior, especially habitual behavior, occurs continuously through a cyclical process. The TTM is not a theory but a model; different behavioral theories and constructs can be applied to various stages of the model where they may be most effective.

The TTM posits that individuals move through six stages of change: precontemplation, contemplation, preparation, action, maintenance, and termination. Termination was not part of the original model and is less often used in application of stages of change for health-related behaviors. For each stage of change, different intervention strategies are most effective at moving the person to the next stage of change and subsequently through the model to maintenance, the ideal stage of behavior.

Six Stages of Change:

- *Stage 1: Precontemplation*

In this stage, people do not intend to take action in the foreseeable future (defined as within the next 6 months). People are often unaware that their behavior is problematic or produces negative consequences. People in this stage often underestimate the pros of changing behavior and place too much emphasis on the cons of changing behavior.



- *Stage 2: Contemplation*

In this stage, people are intending to start the healthy behavior in the foreseeable future (defined as within the next 6 months). People recognize that their behavior may be problematic, and a more thoughtful and practical consideration of the pros and cons of changing the behavior takes place, with equal emphasis placed on both. Even with this recognition, people may still feel ambivalent toward changing their behavior.

- *Stage 3: Preparation (Determination)*

In this stage, people are ready to take action within the next 30 days. People start to take small steps toward the behavior change, and they believe changing their behavior can lead to a healthier life.

- *Stage 4: Action*

In this stage, people have recently changed their behavior (defined as within the last 6 months) and intend to keep moving forward with that behavior change. People may exhibit this by modifying their problem behavior or acquiring new healthy behaviors.

- *Stage 5: Maintenance*

In this stage, people have sustained their behavior change for a while (defined as more than 6 months) and intend to maintain the behavior change going forward. People in this stage work to prevent relapse to earlier stages.

- *Stage 6: Termination*

In this stage, people have no desire to return to their unhealthy behaviors and are sure they will not relapse. Since this is rarely reached, and people tend to stay in the maintenance stage, this stage is often not considered in health promotion programs.

To progress through the stages of change, people apply cognitive, affective, and evaluative processes. Ten processes of change have been identified, with some processes being more relevant to a specific stage of change than other processes. These processes result in strategies that help people make and maintain change.

Ten Processes of Change:

1. *Consciousness Raising* Increasing awareness about the healthy behavior.
2. *Dramatic Relief*
Emotional arousal about the health behavior, whether positive or negative arousal.
3. *Self-Reevaluation*
Self-reappraisal to realize the healthy behavior is part of who they want to be.
4. *Environmental Reevaluation*
Social reappraisal to realize how their unhealthy behavior affects others.
5. *Social Liberation*
Environmental opportunities that exist to show society is supportive of the healthy behavior.
6. *Self-Liberation*
Commitment to change behavior based on the belief that achievement of the healthy behavior is possible.
7. *Helping Relationships*
Finding supportive relationships that encourage the desired change.
8. *Counter-Conditioning*
Substituting healthy behaviors and thoughts for unhealthy behaviors and thoughts.
9. *Reinforcement Management* Rewarding the positive behavior and reducing the rewards that come from negative behavior.
10. *Stimulus Control*
Re-engineering the environment to have reminders and cues that support and encourage the healthy behavior and remove those that encourage the unhealthy behavior.

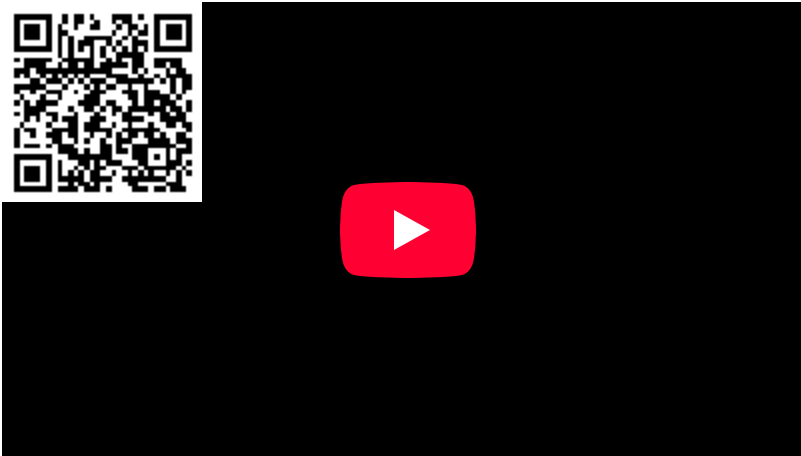
Limitations of the Transtheoretical Model

Limitations of the model include the following:

- The theory ignores the social context in which change occurs, such as socioeconomic status and income.
- The lines between the stages can be arbitrary with no set criteria of how to determine a person's stage of change. The questionnaires that have been developed to assign a person to a stage of change are not always standardized or validated.
- No clear sense exists for how much time is needed for each stage, or how long a person can remain in a stage.
- The model assumes that individuals make coherent and logical plans in their decision-making process when this is not always true.

The Transtheoretical Model provides suggested strategies for public health interventions to address people at various stages of the decision-making process. Using strategies suggested by TTM can result in interventions that are more effective because they are tailored for a specific group of people. In other words, the interventions involve a message or program component that has been specifically created for a target population's level of knowledge and motivation. The TTM encourages an assessment of an individual's current stage of change and accounts for relapse in people's decision-making process.²

For more information about TTM, especially as it relates to exercise, watch the video



One of the most effective tools for changing behavior is goal setting. The links below provide information on how to set goals effectively to achieve greater success in goal attainment.

[Goal Setting Info from Oregon State University's Academic Success Center](#)

Two videos that may help





[Making S.M.A.R.T. Goals Activity](#)

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1.6: Lifestyle Modification Barriers

Dr. James M. Olson, a psychology professor at the University of Western Ontario, London, has identified several psychological barriers that commonly prevent people from taking action, even when inaction poses a threat to their health. These barriers occur during 3 stages of behavior modification: admission of the problem, initial attempts to change, and long-term change as outlined below:

- *Barriers to Admission of the problem*

The first step in lasting change is admitting a problem exists. People often fail to change behavior that poses a risk to their health because they deny a risk exists, trivialize their personal risk, feel invulnerable, make a faulty conceptualization, (i.e., they attribute early warning signs to a benign cause), or experience debilitating emotions when contemplating preventative measures.

- *Barriers to Initial Attempts to Change*

At this stage, people acknowledge the need to change but struggle to accomplish their goals. This failure is a result of lack of knowledge, low self-efficacy (the belief in one's own ability to succeed at change), and dysfunctional attitudes.

- *Barriers to long-term change*

Just because a person has experienced success in changing a behavior, that doesn't mean the change is permanent. Barriers to long-term change include cognitive and motivational drift (diminishing enthusiasm for the need to change), lack of perceived improvement, lack of social support, and lapses.

To read more about these barriers to change, including strategies for overcoming these barriers, read Dr. Olson's entire article linked below:

[Psychological Barriers to Behavior Change](#)

A presentation on overcoming barriers to change by the National Institute for Health and Clinical Excellence (NHS) is linked below:

[Overcoming Barriers to Change](#)

Fostering Wellness in Your Life

You are once again feeling motivated to eat better, exercise more, drink less caffeine or make any number of the positive lifestyle changes you have been telling yourself you want to make. You have tried before—probably declaring another attempt as a New Year's resolution—but without experiencing much success. Making a lifestyle change is challenging, especially when you want to transform many things at once. This time, think of those changes not as a resolution but as an evolution.

Lifestyle changes are a process that take time and require support. Once you are ready to make a change, the difficult part is committing and following through. So do your research and make a plan that will prepare you for success. Careful planning means setting small goals and taking things one step at a time.

Here are five tips from the American Psychological Association (APA) that will assist you in making lasting, positive lifestyle and behavior changes:

- *Make a plan that will stick.*

Your plan is a map that will guide you on this journey of change. You can even think of it as an adventure. When making your plan, be specific. Want to exercise more? Detail the time of day when you can take walks and how long you will walk. Write everything down, and ask yourself if you are confident that these activities and goals are realistic for you. If not, start with smaller steps. Post your plan where you will most often see it as a reminder.

- *Start small.*

After you've identified realistic short-term and long-term goals, break down your goals into small, manageable steps that are specifically defined and can be measured. Is your long-term goal to lose 20 pounds within the next five months? A good weekly goal would be to lose one pound a week. If you would like to eat healthier, consider as a goal for the week replacing dessert with a healthier option, like fruit or yogurt. At the end of the week, you will feel successful knowing you met your goal.

- *Change one behavior at a time.* Unhealthy behaviors develop over the course of time, so replacing unhealthy behaviors with healthy ones requires time. Many people run into problems when they try to change too much too fast. To improve your

success, focus on one goal or change at a time. As new healthy behaviors become a habit, try to add another goal that works toward the overall change you are striving for.

- *Involve a buddy.*

Whether it be a friend, co-worker or family member, someone else on your journey will keep you motivated and accountable. Perhaps it can be someone who will go to the gym with you or someone who is also trying to stop smoking. Talk about what you are doing. Consider joining a support group. Having someone with whom to share your struggles and successes makes the work easier and the mission less intimidating.

- *Ask for support.*

Accepting help from those who care about you and will listen strengthens your resilience and commitment. If you feel overwhelmed or unable to meet your goals on your own, consider seeking help from a psychologist. Psychologists are uniquely trained to understand the connection between the mind and body, as well as the factors that promote behavior change. Asking for help does not mean a lifetime of therapy; even just a few sessions can help you examine and set attainable goals or address the emotional issues that may be getting in your way.

Start with “Why?”

Making changes in habitual behavior requires a deep and abiding belief that change is needed. Your desire to change may be motivated by personal goals, or it may be the result of the impact your improved wellness will have on those you love. Nietzsche said, “He who has a strong enough *why* can bear almost any *how*.”

Once you have a compelling reason to change, develop a plan and commit to that plan. If you experience a moment of weakness, do not waste time on self- condemnation. Revisit your compelling reason and reaffirm your commitment to change. The health, peace, and sense of wellbeing inherent in the highest level of your own personal wellness is more than worth the effort required to change.

For more information about making permanent lifestyle changes, go to the APA website linked below:

[Lifestyle Changes That Last](#)

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1.7: Assessing Your Personal Lifestyle Behaviors

Complete the following lab. Please print, complete, and submit the evaluation linked below to D2L.

[Lifestyle Evaluation Lab](#)

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¹Auburn University. Division of Student Affairs.

²Boston University School of Public Health.

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CHAPTER OVERVIEW

1.8: Stress

By Jonathan Howard

Learning Objectives

- Define stress
- Describe the effects of stress on wellbeing
- Identify effective strategies for managing stress
- Assess your own levels of stress

In today's fast-paced society, most people complain about being stressed. However, when they use the term *stress*, they rarely know its true meaning. The word carries many negative connotations and is associated with an unpleasant or traumatic event. As such, people mistakenly believe that stress is simply the nervousness and tension experienced prior to, during, or after a negative event. In fact, the effects of stress are physiological, emotional, *and* psychological. Additionally, not all levels of stress are detrimental. The stress athletes experience right before a big game or college students feel right before an exam can enhance focus and increase their ability to concentrate. Stress is either good or bad depending on how long it persists and how it is perceived by the individual. This chapter will provide a deeper understanding of what stress is and provide effective strategies for managing stress.

[1.8.1: What is Stress and How Does it Affect Wellness?](#)

[1.8.2: What Are the Strategies for Managing Stress?](#)

[1.8.3: Assess Your Stress Level](#)

Thumbnail: Anxiety by Munch.

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1.8.1: What is Stress and How Does it Affect Wellness?

Stress is defined as the body's physical, mental, and emotional response to a particular stimulus, called a **stressor**. This adaption/coping-response helps the body prepare for challenging situations. It is the level of a person's response to a stressor that determines whether the experience is positive or negative. As a hardworking college student, you may feel as if you know the meaning of stress all too well. You may dream of a future where the demands on your time are diminished, so you can escape the high levels of stress you are feeling now. Unfortunately, regardless of their situation, everyone experiences stress on a regular basis. The good news is, not all stress is bad! Small levels of stress can enhance cognitive brain function. Stress may provide the motivation and concentration you need to write an essay, practice a speech, or prepare for a job interview. For most people, these types of stressors are manageable and not harmful. Stressors that have the potential for harm include the sudden loss of a loved one, the unexpected ending of a romantic relationship, or the unfair demands of an unreasonable boss.

Defining Stress

Stress, then, is more than simply the tension and apprehension generated by problems, obstacles, or traumatic events. Stress is the body's automatic response ([physical](#), mental, and [emotional](#)) to any stressor. It is a natural and unavoidable part of life, and it can be empowering and motivating, or harmful and potentially dangerous.

For more information on stress click on the links below:

[What is Stress?](#)

[Understanding and Dealing with Stress](#)

Below is a video on stress.



Effects of Stress on Wellness

As stated previously, not all stress is bad. In fact, the stress associated with riding a roller coaster, watching a scary movie, or scaling a cliff can enhance these experiences. Regardless of whether the stress experienced is negative or positive, the effects on the body are identical.

When a person senses that a situation demands action, the body responds by releasing chemicals into the blood. The hypothalamus signals the adrenal glands to release a surge of hormones that include adrenaline and cortisol. The physiological effects of those chemicals—enhanced focus, quicker reaction time, and increased heart rate, energy, and strength—are quite beneficial when faced with a potentially dangerous situation that is temporary.

Unfortunately, most of the stressors people face—work, school, finances, relationships—are a part of everyday life, and thus, inescapable. Experiencing ongoing, unavoidable stress can result in some very unpleasant and harmful effects, both mental and physical. Chronic stress can cause upset stomach, headaches, sleep problems, and heart disease. It can also cause depression, anxiety, and even memory loss.

To watch a video that describes the effects of stress in detail, click on the link below:



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1.8.2: What Are the Strategies for Managing Stress?

Although stress in everyday life is unavoidable, there are ways to cope with it that will minimize or eliminate its harmful effects.

The Anxiety and Depression Association of America (ADAA) provides a list of effective strategies for coping with stress. That document is linked here: [Tips: Coping Strategies](#). For your convenience, it is also reprinted below with the ADAA's permission.

When you are feeling anxious or stressed, these strategies will help you cope:

- **Take a time-out.** Practice yoga, listen to music, meditate, get a massage, or learn relaxation techniques. Stepping back from the problem helps clear your head.
- **Eat well-balanced meals.** Do not skip any meals. Do keep healthful, energy-boosting snacks on hand.
- **Limit alcohol and caffeine,** which can aggravate anxiety and trigger panic attacks.
- **Get enough sleep.** When stressed, your body needs additional sleep and rest.
- **Exercise daily** to help you feel good and maintain your health. Check out the fitness tips below.
- **Take deep breaths.** Inhale and exhale slowly.
- **Count to 10 slowly.** Repeat, and count to 20 if necessary.
- **Do your best.** Instead of aiming for perfection, which isn't possible, be proud of however close you get.
- **Accept that you cannot control everything.** Put your stress in perspective: Is it really as bad as you think?
- **Welcome humor.** A good laugh goes a long way.
- **Maintain a positive attitude.** Make an effort to replace negative thoughts with positive ones.
- **Get involved.** Volunteer or find another way to be active in your community, which creates a support network and gives you a break from everyday stress.
- **Learn what triggers your anxiety.** Is it work, family, school, or something else you can identify? Write in a journal when you're feeling stressed or anxious and look for a pattern.
- **Talk to someone.** Tell friends and family you're feeling overwhelmed, and let them know how they can help you. Talk to a physician or therapist for professional help.
- **Get help online.** Lantern offers online programs guided by professional coaches to help you turn healthy anxiety management into a habit. (*Sponsored*)
 - **Listen to podcasts on a wide range of topics**
 - **Watch recorded webinars on topics ranging from how to worry less, coping with panic attacks, treatments for children, and helping suicidal families, and many more.**

Fitness Tips: Stay Healthy, Manage Stress

To receive the greatest benefits from exercising, try to include at least 2 1/2 hours of moderate-intensity physical activity (e.g., brisk walking) each week, 1 1/4 hours of a vigorous-intensity activity (such as jogging or swimming laps), or a combination of the two.

- **5 X 30:** Jog, walk, bike, or dance three to five times a week for 30 minutes.
- **Set small daily goals** and aim for daily consistency rather than perfect workouts. It is better to walk every day for 15–20 minutes than to wait until the weekend for a three-hour fitness marathon. Lots of scientific data suggests that frequency is most important.
- **Find forms of exercise** that are fun or enjoyable. Extroverted people often like classes and group activities. People who are more introverted often prefer solo pursuits.
- **Distract yourself** with an iPod or other portable media player to download audiobooks, podcasts, or music. Many people find it is more fun to exercise while listening to material they enjoy.
- **Recruit** an “exercise buddy.” It is often easier to stick to your exercise routine when you have to stay committed to a friend, partner, or colleague.
- **Be patient** when you start a new exercise program. Most sedentary people require about four to eight weeks to feel coordinated and sufficiently in shape so that exercise feels easier.

Additional strategies for coping with stress are linked below:



[Stress Management](#)

[10 Tips to Manage Stress](#) This is a link to WebMD with a video on how to manage stress

To hear the world's most relaxing sound (according to research), click on the link below:



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1.8.3: Assess Your Stress Level

Are you more or less stressed than your peers? The website linked below contains a stress test. On the website, scroll down to the “Quiz: Are You Stressed?”

[How Stressed Are You?](#)

Below is a link to the Lab for this chapter on stress. Please be certain to get a PDF of your results and submit it in D2L:

[Lab for Chapter on Stress](#)

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CHAPTER OVERVIEW

2: Psychological Health

Psychological health is a level of psychological well-being or an absence of Psychological illness - the state of someone who is "functioning at a satisfactory level of emotional and behavioral adjustment". From the perspectives of positive psychology or of holism, Psychological health may include an individual's ability to enjoy life, and to create a balance between life activities and efforts to achieve psychological resilience. Psychological health includes "subjective well-being, perceived self-efficacy, autonomy, competence, inter-generational dependence, and self-actualization of one's intellectual and emotional potential, among others."

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2.1: Intro to Psychological Health



Figure 2.1.1 Maslow's Motivation Model

Maslow's hierarchy of needs is a theory in psychology proposed by Abraham Maslow in his 1943 paper "A Theory of Human Motivation" in *Psychological Review*. Maslow used the terms "physiological", "safety", "belonging" and "love", "esteem", "self-actualization", and "self-transcendence" to describe the pattern that human motivations generally move through. The goal of Maslow's Theory is to attain the sixth level of stage: self-transcendent needs.

Maslow's hierarchy of needs is often portrayed in the shape of a pyramid with the largest, most fundamental needs at the bottom and the need for self-actualization and self-transcendence at the top.

The most fundamental and basic four layers of the pyramid contain what Maslow called "deficiency needs" or "d-needs": esteem, friendship and love, security, and physical needs. If these "deficiency needs" are not met – with the exception of the most fundamental (physiological) need – there may not be a physical indication, but the individual will feel anxious and tense. Maslow's theory suggests that the most basic level of needs must be met before the individual will strongly desire (or focus motivation upon) the secondary or higher level needs.

The human brain is a complex system and has parallel processes running at the same time, thus many different motivations from various levels of Maslow's hierarchy can occur at the same time. Maslow spoke clearly about these levels and their satisfaction in terms such as "relative", "general", and "primarily". Instead of stating that the individual focuses on a certain need at any given time, Maslow stated that a certain need "dominates" the human organism. Thus Maslow acknowledged the likelihood that the different levels of motivation could occur at any time in the human mind, but he focused on identifying the basic types of motivation and the order in which they should be met.

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2.2: Social Health

The capacity for an individual to develop and flourish is deeply influenced by immediate social surroundings – including their opportunity to engage positively with family members, friends or colleagues, and earn a living for themselves and their families – and also by the socioeconomic circumstances in which said individual find himself/herself. Restricted or lost opportunities to gain an education and income are especially pertinent socio-economic factors.

Psychoneuroimmunology is defined as the examination of the interactions among psychological, behavioral, and social factors with immunological and neuroendocrine outcomes. It is now well established that psychological factors, especially chronic stress, can lead to impairments in immune system function in both the young and older adults. In several studies of older adults, those who are providing care for a relative with dementia report high levels of stress and exhibit significant impairments in immune system functioning when compared with non-caregivers. Stress-induced changes in the immune system may affect a number of outcomes, including slowing the wound healing process and increasing susceptibility to infections.

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2.3: Developing and Protecting Individual Attributes

At its core, mental health and well-being rests on the capacity of individuals to manage their thoughts, feelings and behavior, as well as their interactions with others. It is essential that these core attributes of self-control, resilience and confidence be allowed to develop and solidify in the formative stages of life, so that individuals are equipped to deal with the complex choices and potential adversities they will face as they grow older.

Alcohol, tobacco and drug use pose risks to mental and physical health, particularly among pregnant women and adolescents. Raising awareness about the health risks of substance use can be accompanied by implementation of a number of proven strategies for reducing their use, including fiscal measures (namely, increased excise taxes) and regulatory instruments (such as comprehensive restrictions on advertising, minimum age of use and restrictions on smoking in public places).

Maintaining a healthy diet and regular physical exercise are also protective factors for mental health and can be considered as part of a holistic approach to health promotion and protection in the population.

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2.4: Supporting Families and Communities

Individual-level mental health and well-being is strongly mediated by the immediate social context in which people live, work and carry out their day-to-day activities. The focus of family- and community-level attention is therefore to foster living and working conditions that enable psychosocial development (particularly among vulnerable persons) and promote positive interactions within and between families and social groups. Certain mental health promotion and protection strategies are targeted at specific groups, including: home-based interventions for socioeconomically disadvantaged families and for children with a mentally ill parent; prevention of intimate partner violence; school-based interventions for children and adolescents exhibiting emotional or behavioral problems; work-based interventions for adults looking for employment or struggling to cope at work; community-based interventions aimed at enhanced social participation of older adults; and psychosocial support for persons affected by conflict or disaster.

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2.5: Supporting Vulnerable Groups in Society

At the level of social and environmental determinants, key predictors of – and also consequences of – mental ill-health include lack of access to basic amenities and services, social exclusion, discrimination and exposure to violence, conflict or disasters. State-wide policy instruments that can address these failings and contribute towards social equality, inclusion and security include: anti-discrimination laws and campaigns; social protection for the poor; and elaboration of peaceful relations within and across national or ethnic boundaries.

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2.6: Mental Illness

We have all had some exposure to mental illness, but do we really understand it or know what it is? Many of our preconceptions are incorrect. A mental illness can be defined as a health condition that changes a person's thinking, feelings, or behavior (or all three) and that causes the person distress and difficulty in functioning. As with many diseases, mental illness is severe in some cases and mild in others. Individuals who have a mental illness don't necessarily look like they are sick, especially if their illness is mild. Other individuals may show more explicit symptoms such as confusion, agitation, or withdrawal.

Even if you or a family member has not experienced mental illness directly, it is very likely that you have known someone who has. Estimates are that at least one in four people is affected by mental illness either directly or indirectly.

Consider the following statistics to get an idea of just how widespread the effects of mental illness are in society:

- According to recent estimates, approximately 20 percent of Americans, or about one in five people over the age of 18, suffer from a diagnosable mental disorder in a given year.
- Four of the 10 leading causes of disability—major depression, bipolar disorder, schizophrenia, and obsessive-compulsive disorder—are mental illnesses.
- About 3 percent of the population have more than one mental illness at a time.
- About 5 percent of adults are affected so seriously by mental illness that it interferes with their ability to function in society. These severe and persistent mental illnesses include schizophrenia, bipolar disorder, other severe forms of depression, panic disorder, and obsessive-compulsive disorder.
- Approximately 20 percent of doctors' appointments are related to anxiety disorders such as panic attacks. Eight million people have depression each year.
- Two million Americans have schizophrenia disorders, and 300,000 new cases are diagnosed each year.

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2.7: Mood Disorders

Major mood disorders are depression, bipolar disorder, and dysthymic disorder. Like anxiety, depression might seem like something that everyone experiences at some point, and it is true that most people feel sad or “blue” at times in their lives. A true depressive episode, however, is more than just feeling sad for a short period. It is a long-term, debilitating illness that usually needs treatment to cure. And bipolar disorder is characterized by dramatic shifts in energy and mood, often affecting the individual’s ability to carry out day-to-day tasks. Bipolar disorder used to be called manic depression because of the way that people would swing between manic and depressive episodes.

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2.8: Depression

Depression, or depressive disorders, is a leading cause of disability in the United States as well as worldwide. It affects an estimated 9.5 percent of American adults in a given year. Nearly twice as many women as men have depression. Depression is more than just being in a bad mood or feeling sad. Everyone experiences these feelings on occasion, but that does not constitute depression. Depression is actually not a single disease; there are three main types of depressive disorders. They are major depressive disorder, dysthymia, and bipolar disorder (manic-depression).

While some of the symptoms of depression are common during a passing “blue mood,” major depressive disorder is diagnosed when a person has five or more of the symptoms nearly every day during a two-week period. Symptoms of depression include a sad mood, a loss of interest in activities that one used to enjoy, a change in appetite or weight, oversleeping or difficulty sleeping, physical slowing or agitation, energy loss, feelings of worthlessness or inappropriate guilt, difficulty concentrating, and recurrent thoughts of death or suicide.

When people have depression, their lives are affected severely: they have trouble performing at work or school, and they aren’t interested in normal family and social activities. In adults, an untreated major depressive episode lasts an average of nine months. At least half of the people who experience an episode of major depression will have another episode of depression at some point.

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2.9: Dysthymic Disorder

Dysthymia is less severe than major depressive disorder, but it is more chronic. In dysthymia, a depressed mood along with at least two other symptoms of depression persist for at least two years in adults, or one year in children or adolescents. These symptoms may not be as disabling, but they do keep affected people from functioning well or feeling good. Dysthymia often begins in childhood, adolescence, or early adulthood. On average, untreated dysthymia lasts four years in children and adolescents.

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2.10: Bipolar Disorder

A third type of depressive disorder is bipolar disorder, also called manic-depression. A person who has bipolar disorder alternates between episodes of major depression and mania (periods of abnormally and persistently elevated mood or irritability). During manic periods, the person will also have three or more of the following symptoms: overly inflated self-esteem, decreased need for sleep, increased talkativeness, racing thoughts, distractibility, increased goal-directed activity or physical agitation, and excessive involvement in pleasurable activities that have a high potential for painful consequences.

While in a manic phase, adolescents may engage in risky or reckless behaviors such as fast driving and unsafe sex. Bipolar disorder frequently begins during adolescence or young adulthood. Adults with bipolar disorder often have clearly defined episodes of mania and depression, with periods of mania every two to four years.

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2.11: Factors That Influence Psychological Well-Being

Infancy and Early Childhood

There is a strong body of evidence to show the importance of attachment by neonates to their mothers or other primary caregivers for subsequent social and emotional development. Separation from the primary caregiver - due for example to parental absence or rejection - leads to anxiety, stress and insecurity. Post-natal depression among new mothers can likewise contribute to sub-optimal attachment and development. Parents who have difficulties in bonding, have limited skills or exhibit negative attitudes place their children at increased risk of exposure to stress and behavioral problems. Other important risks to physical and cognitive development in infancy and early childhood include maltreatment and neglect (by parents and other caregivers), malnutrition and infectious or parasitic diseases.

Individual attributes and behaviors

These relate to a person's innate and learned ability to deal with thoughts and feelings and to manage him/herself in daily life ('emotional intelligence'). It is also the capacity to deal with the social world around by partaking in social activities, taking responsibilities or respecting the views of others ('social intelligence'). An individual's mental health state can also be influenced by genetic and biological factors; that is, determinants that persons are born or endowed with, including chromosomal abnormalities (e.g. Down's syndrome) and intellectual disability caused by prenatal exposure to alcohol or oxygen deprivation at birth.

Social and economic circumstances

The capacity for people to develop and flourish is deeply influenced by their immediate social surroundings – including their opportunity to engage positively with family members, friends or colleagues, and earn a living for themselves and their families – and also by the socioeconomic circumstances in which they find themselves. Restricted or lost opportunities to gain an education and income are especially pertinent socio-economic factors.

Environmental factors

The wider sociocultural and geopolitical environment in which people live can also affect an individual's, household's or community's mental health status, including levels of access to basic commodities and services (water, essential health services, the rule of law), exposure to predominating cultural beliefs, attitudes or practices, as well as by social and economic policies formed at the national level; for example, the on-going global financial crisis is expected to have significant mental health consequences, including increased rates of suicide and harmful alcohol use. Discrimination, social or gender inequality and conflict are examples of adverse structural determinants of mental well-being.

Personality

Personality measures turn out to be good predictors of your health, your sexual promiscuity, your likelihood of divorce, how happy you typically are—even your taste in paintings. Personality is a much better predictor of these things than social class or age. The origin of these differences is in part innate. That is to say, when people are adopted at birth and brought up by new families, their personalities are more similar to their blood relatives than to the ones they grew up with. The differences begin to emerge early in life and are surprisingly stable across the decades. This is not to say that people cannot change, but major change is the exception rather than the rule. Personality differences tend to manifest themselves through the quick, gut-feeling, intuitive, and emotional systems of the human mind. The slower, rational, deliberate systems show less variation in output from person to person. Deliberate rational strategies can be used to over-ride intuitive patterns of response, and this is how people wishing to change their personalities or feelings have to go about it.

So what are the major ways personalities can differ? The dominant approach is to think of the space of possible personalities as being defined by a number of dimensions. Each person can be given a location in the space by their scores on all the different dimensions. Virtually all theories agree on two of the main dimensions, though they differ on how many additional ones they recognize.

Five factors

- **Openness to experience:** (inventive/curious vs. consistent/cautious). Appreciation for art, emotion, adventure, unusual ideas, curiosity, and variety of experience. Openness reflects the degree of intellectual curiosity, creativity and a preference for novelty and variety a person has. It is also described as the extent to which a person is imaginative or independent and depicts a personal preference for a variety of activities over a strict routine. High openness can be perceived as unpredictability or lack of focus. Moreover, individuals with high openness are said to pursue self-actualization specifically by seeking out intense, euphoric experiences. Conversely, those with low openness seek to gain fulfillment through perseverance and are characterized as pragmatic and data-driven—sometimes even perceived to be dogmatic and closed-minded. Some disagreement remains about how to interpret and contextualize the openness factor.
- **Conscientiousness:** (efficient/organized vs. easy-going/careless). A tendency to be organized and dependable, show self-discipline, act dutifully, aim for achievement, and prefer planned rather than spontaneous behavior. High conscientiousness is often perceived as stubbornness and obsession. Low conscientiousness is associated with flexibility and spontaneity, but can also appear as sloppiness and lack of reliability.
- **Extraversion:** (outgoing/energetic vs. solitary/reserved). Energy, positive emotions, surgency, assertiveness, sociability and the tendency to seek stimulation in the company of others, and talkativeness. High extraversion is often perceived as attention-seeking, and domineering. Low extraversion causes a reserved, reflective personality, which can be perceived as aloof or self-absorbed.
- **Agreeableness:** (friendly/compassionate vs. challenging/detached). A tendency to be compassionate and cooperative rather than suspicious and antagonistic towards others. It is also a measure of one's trusting and helpful nature, and whether a person is generally well-tempered or not. High agreeableness is often seen as naive or submissive. Low agreeableness personalities are often competitive or challenging people, which can be seen as argumentativeness or untrustworthiness.
- **Neuroticism:** (sensitive/nervous vs. secure/confident). The tendency to experience unpleasant emotions easily, such as anger, anxiety, depression, and vulnerability. Neuroticism also refers to the degree of emotional stability and impulse control and is sometimes referred to by its low pole, "emotional stability". A high need for stability manifests itself as a stable and calm personality, but can be seen as uninspiring and unconcerned. A low need for stability causes a reactive and excitable personality, often very dynamic individuals, but they can be perceived as unstable or insecure.

Assess yourself! This is an interactive version of the IPIP Big-Five Factor Markers, a measure of the big five personality traits: [Big 5 Personality Test](#)

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2.12: Physiological Needs

Physiological needs are the physical requirements for human survival. If these requirements are not met, the human body cannot function properly and will ultimately fail. Physiological needs are thought to be the most important; they should be met first.

Air, water, and food are metabolic requirements for survival in all animals, including humans. Clothing and shelter provide necessary protection from the elements. While maintaining an adequate birth rate shapes the intensity of the human sexual instinct, sexual competition may also shape said instinct.

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2.13: The Causes of Depression (depressive disorders)

Depression, like other mental illnesses, is probably caused by a combination of biological, environmental, and social factors, but the exact causes are not yet known. For years, scientists thought that low levels of certain neurotransmitters (such as serotonin, dopamine, or norepinephrine) in the brain caused depression. However, scientists now believe that the interplay of factors leading to depression is much more complex. Genetic causes have been suggested from family studies that have shown that between 20 and 50 percent of children and adolescents with depression have a family history of depression and that children of depressed parents are more than three times as likely as children with nondepressed parents to experience a depressive disorder. Abnormal endocrine function, specifically of the hypothalamus or pituitary, may play a role in causing depression. Other risk factors for depressive disorders in youths include stress, cigarette smoking, loss of a parent, the breakup of a romantic relationship, attention disorders, learning disorders, abuse, neglect, and other trauma including experiencing a natural disaster.

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2.14: Treating Depression

A variety of antidepressant medications and psychotherapies are used to treat depression. The most effective treatment for most people is a combination of medication and psychotherapy. Many of us are aware that medications are available to treat depressive disorders—we see the ads on television and in magazines. Up to 70 percent of people with depression can be treated effectively with medication.

Medications used to treat depressive disorders usually act on the neurotransmission pathway. For example, some medications affect the activity of certain neurotransmitters, such as serotonin or norepinephrine. Different depressive disorders require different medication therapies. For example, individuals who have bipolar disorder are often treated with a mood-stabilizing drug, such as lithium, during their manic phase and a combination of mood-stabilizer and antidepressant medications during their depressive phase.

Medications usually lead to relief from the symptoms of depression within six to eight weeks. If one drug doesn't relieve symptoms, doctors can prescribe a different antidepressant drug. As with drugs to treat other mental illnesses, patients are monitored closely by their doctor for symptoms of depression and for side effects. Patients who continue to take their medication for at least six months after recovery from major depression are 70 percent less likely to experience a relapse. Psychotherapy helps patients learn more effective ways to deal with the problems in their lives. These therapies usually involve 6 to 20 weekly meetings. These treatment plans should be revised if there is no improvement of symptoms within three or four months.

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2.15: Coping with Depression

People who have depression (or another depressive disorder) feel exhausted, worthless, helpless, and hopeless. These negative thoughts and feelings that are part of depression make some people feel like giving up. As treatment takes effect, these thoughts begin to go away.

Some strategies that can help a person waiting for treatment to take effect include setting realistic goals in light of the depression and assuming a reasonable amount of responsibility; breaking large tasks into small ones, setting some priorities, and doing what one can as one can; trying to be with other people and to confide in someone—it is usually better than being alone and secretive; participating in activities that may make one feel better; getting some mild exercise, going to a movie or a ball game, or participating in religious, social, or other activities; expecting one's mood to improve gradually, not immediately (feeling better takes time); postponing important decisions until the depression has lifted and discussing big decisions with family or friends who have a more objective view of the situation; remembering that positive thinking will replace the negative thinking that is part of the depression as one's depression responds to treatment; and letting one's family and friends help.

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2.16: 2.23 Anxiety Disorders

Anxiety Disorders affect about 40 million American adults age 18 years and older (about 18%) in a given year, causing them to be filled with fearfulness and uncertainty. Unlike the relatively mild, brief anxiety caused by a stressful event (such as speaking in public or a first date), anxiety disorders last at least 6 months and can get worse if they are not treated.

Anxiety disorders commonly occur along with other mental or physical illnesses, including alcohol or substance abuse, which may mask anxiety symptoms or make them worse. In some cases, these other illnesses need to be treated before a person will respond to treatment for the anxiety disorder.

Panic Disorders

“For me, a panic attack is almost a violent experience. I feel disconnected from reality. I feel like I’m losing control in a very extreme way. My heart pounds really hard, I feel like I can’t get my breath, and there’s an overwhelming feeling that things are crashing in on me.”

“It started 10 years ago, when I had just graduated from college and started a new job. I was sitting in a business seminar in a hotel and this thing came out of the blue. I felt like I was dying.”

“In between attacks there is this dread and anxiety that it’s going to happen again. I’m afraid to go back to places where I’ve had an attack. Unless I get help, there soon won’t be anyplace where I can go and feel safe from panic.”

Panic disorder is a real illness that can be successfully treated. It is characterized by sudden attacks of terror, usually accompanied by a pounding heart, sweatiness, weakness, faintness, or dizziness. During these attacks, people with panic disorder may flush or feel chilled; their hands may tingle or feel numb; and they may experience nausea, chest pain, or smothering sensations. Panic attacks usually produce a sense of unreality, a fear of impending doom, or a fear of losing control.

A fear of one’s own unexplained physical symptoms is also a symptom of panic disorder. People having panic attacks sometimes believe they are having heart attacks, losing their minds, or on the verge of death. They can’t predict when or where an attack will occur, and between episodes many worry intensely and dread the next attack.

Panic attacks can occur at any time, even during sleep. An attack usually peaks within 10 minutes, but some symptoms may last much longer. Panic disorder affects about 6 million American adults and is twice as common in women as men. Panic attacks often begin in late adolescence or early adulthood, but not everyone who experiences panic attacks will develop panic disorder. Many people have just one attack and never have another. The tendency to develop panic attacks appears to be inherited.

Obsessive-Compulsive Disorder

“I couldn’t do anything without rituals. They invaded every aspect of my life. Counting really bogged me down. I would wash my hair three times as opposed to once because three was a good luck number and one wasn’t. It took me longer to read because I’d count the lines in a paragraph. When I set my alarm at night, I had to set it to a number that wouldn’t add up to a ‘bad’ number.”

“I knew the rituals didn’t make sense, and I was deeply ashamed of them, but I couldn’t seem to overcome them until I had therapy.”

“Getting dressed in the morning was tough, because I had a routine, and if I didn’t follow the routine, I’d get anxious and would have to get dressed again. I always worried that if I

didn't do something, my parents were going to die. I'd have these terrible thoughts of harming my parents. That was completely irrational, but the thoughts triggered more anxiety and more senseless behavior. Because of the time I spent on rituals, I was unable to do a lot of things that were important to me."

People with obsessive-compulsive disorder (OCD) have persistent, upsetting thoughts (obsessions) and use rituals (compulsions) to control the anxiety these thoughts produce. Most of the time, the rituals end up controlling them.

For example, if people are obsessed with germs or dirt, they may develop a compulsion to wash their hands over and over again. If they develop an obsession with intruders, they may lock and relock their doors many times before going to bed. Being afraid of social embarrassment may prompt people with OCD to comb their hair compulsively in front of a mirror-sometimes they get "caught" in the mirror and can't move away from it. Performing such rituals is not pleasurable. At best, it produces temporary relief from the anxiety created by obsessive thoughts.

Healthy people also have rituals, such as checking to see if the stove is off several times before leaving the house. The difference is that people with OCD perform their rituals even though doing so interferes with daily life and they find the repetition distressing. Although most adults with OCD recognize that what they are doing is senseless, some adults and most children may not realize that their behavior is out of the ordinary.

OCD affects about 2.2 million American adults, and the problem can be accompanied by eating disorders, other anxiety disorders, or depression. It strikes men and women in roughly equal numbers and usually appears in childhood, adolescence, or early adulthood. One-third of adults with OCD develop symptoms as children, and research indicates that OCD might run in families.

Post-Traumatic Stress Disorder

"I was raped when I was 25 years old. For a long time, I spoke about the rape as though it was something that happened to someone else. I was very aware that it had happened to me, but there was just no feeling."

"Then I started having flashbacks. They kind of came over me like a splash of water. I would be terrified. Suddenly I was reliving the rape. Every instant was startling. I wasn't aware of anything around me, I was in a bubble, just kind of floating. And it was scary. Having a flashback can wring you out."

"The rape happened the week before Thanksgiving, and I can't believe the anxiety and fear I feel every year around the anniversary date. It's as though I've seen a werewolf. I can't relax, can't sleep, don't want to be with anyone. I wonder whether I'll ever be free of this terrible problem."

Post-traumatic stress disorder (PTSD) develops after a terrifying ordeal that involved physical harm or the threat of physical harm. The person who develops PTSD may have been the one who was harmed, the harm may have happened to a loved one, or the person may have witnessed a harmful event that happened to loved ones or strangers. PTSD was first brought to public attention in relation to war veterans, but it can result from a variety of traumatic incidents, such as mugging, rape, torture, being kidnapped or held captive, child abuse, car accidents, train wrecks, plane crashes, bombings, or natural disasters such as floods or earthquakes.

People with PTSD may startle easily, become emotionally numb (especially in relation to people with whom they used to be close), lose interest in things they used to enjoy, have trouble feeling affectionate, be irritable, become more aggressive, or even become violent. They avoid situations that remind them of the original incident, and anniversaries of the incident are often very difficult. PTSD symptoms seem to be worse if the event that triggered them was deliberately initiated by another person, as in a mugging or a kidnapping.

Most people with PTSD repeatedly relive the trauma in their thoughts during the day and in nightmares when they sleep. These are called flashbacks. Flashbacks may consist of images, sounds, smells, or feelings, and are often triggered by ordinary occurrences,

such as a door slamming or a car backfiring on the street. A person having a flashback may lose touch with reality and believe that the traumatic incident is happening all over again.

Not every traumatized person develops full-blown or even minor PTSD. Symptoms usually begin within 3 months of the incident but occasionally emerge years afterward. They must last more than a month to be considered PTSD. The course of the illness varies. Some people recover within 6 months, while others have symptoms that last much longer. In some people, the condition becomes chronic.

PTSD affects about 7.7 million American adults, but it can occur at any age, including childhood. Women are more likely to develop PTSD than men, and there is some evidence that susceptibility to the disorder may run in families. PTSD is often accompanied by depression, substance abuse, or one or more of the other anxiety disorders.

Social Phobia (Social Anxiety Disorder)

“In any social situation, I felt fear. I would be anxious before I even left the house, and it would escalate as I got closer to a college class, a party, or whatever. I would feel sick in my stomach—it almost felt like I had the flu. My heart would pound, my palms would get sweaty, and I would get this feeling of being removed from myself and from everybody else.”

“When I would walk into a room full of people, I’d turn red and it would feel like everybody’s eyes were on me. I was embarrassed to stand off in a corner by myself, but I couldn’t think of anything to say to anybody. It was humiliating. I felt so clumsy, I couldn’t wait to get out.”

Social phobia, also called social anxiety disorder, is diagnosed when people become overwhelmingly anxious and excessively self-conscious in everyday social situations. People with social phobia have an intense, persistent, and chronic fear of being watched and judged by others and of doing things that will embarrass them. They can worry for days or weeks before a dreaded situation. This fear may become so severe that it interferes with work, school, and other ordinary activities, and can make it hard to make and keep friends.

While many people with social phobia realize that their fears about being with people are excessive or unreasonable, they are unable to overcome them. Even if they manage to confront their fears and be around others, they are usually very anxious beforehand, are intensely uncomfortable throughout the encounter, and worry about how they were judged for hours afterward.

Social phobia can be limited to one situation (such as talking to people, eating or drinking, or writing on a blackboard in front of others) or may be so broad (such as in generalized social phobia) that the person experiences anxiety around almost anyone other than the family.

Physical symptoms that often accompany social phobia include blushing, profuse sweating, trembling, nausea, and difficulty talking. When these symptoms occur, people with social phobia feel as though all eyes are focused on them.

Social phobia affects about 15 million American adults. Women and men are equally likely to develop the disorder, which usually begins in childhood or early adolescence. There is some evidence that genetic factors are involved. Social phobia is often accompanied by other anxiety disorders or depression, and substance abuse may develop if people try to self-medicate their anxiety.

A specific phobia is an intense, irrational fear of something that poses little or no actual danger. Some of the more common specific phobias are centered around closed-in places, heights, escalators, tunnels, highway driving, water, flying, dogs, and injuries involving blood. Such phobias aren’t just extreme fear; they are irrational fear of a particular thing. You may be able to ski the world’s tallest mountains with ease but be unable to go above the 5th floor of an office building. While adults with phobias realize that these fears are irrational, they often find that facing, or even thinking about facing, the feared object or situation brings on a panic attack or severe anxiety.

Specific phobias affect an estimated 19.2 million adult Americans and are twice as common in women as men. They usually appear in childhood or adolescence and tend to persist into adulthood. The causes of specific phobias are not well understood, but there is some evidence that the tendency to develop them may run in families.

Generalized Anxiety Disorder (GAD)

"I always thought I was just a worrier. I'd feel keyed up and unable to relax. At times it would come and go, and at times it would be constant. It could go on for days. I'd worry about what I was going to fix for a dinner party, or what would be a great present for somebody. I just couldn't let something go."

"When my problems were at their worst, I'd miss work and feel just terrible about it. Then I worried that I'd lose my job. My life was miserable until I got treatment."

"I'd have terrible sleeping problems. There were times I'd wake up wired in the middle of the night. I had trouble concentrating, even reading the newspaper or a novel. Sometimes I'd feel a little lightheaded. My heart would race or pound. And that would make me worry more. I was always imagining things were worse than they really were. When I got a stomachache, I'd think it was an ulcer."

People with generalized anxiety disorder (GAD) go through the day filled with exaggerated worry and tension, even though there is little or nothing to provoke it. They anticipate disaster and are overly concerned about health issues, money, family problems, or difficulties at work. Sometimes just the thought of getting through the day produces anxiety.

GAD is diagnosed when a person worries excessively about a variety of everyday problems for at least 6 months. People with GAD can't seem to get rid of their concerns, even though they usually realize that their anxiety is more intense than the situation warrants. They can't relax, startle easily, and have difficulty concentrating. Often they have trouble falling asleep or staying asleep. Physical symptoms that often accompany the anxiety include fatigue, headaches, muscle tension, muscle aches, difficulty swallowing, trembling, twitching, irritability, sweating, nausea, lightheadedness, having to go to the bathroom frequently, feeling out of breath, and hot flashes.

When their anxiety level is mild, people with GAD can function socially and hold down a job. Although they don't avoid certain situations as a result of their disorder, people with GAD can have difficulty carrying out the simplest daily activities if their anxiety is severe. GAD affects about 6.8 million American adults, including twice as many women as men. The disorder develops gradually and can begin at any point in the life cycle, although the years of highest risk are between childhood and middle age. There is evidence that genes play a modest role in GAD.

Other anxiety disorders, depression, or substance abuse often accompany GAD, which rarely occurs alone. GAD is commonly treated with medication or cognitive-behavioral therapy, but co-occurring conditions must also be treated using the appropriate therapies.

Treatment of Anxiety Disorders

In general, anxiety disorders are treated with medication, specific types of psychotherapy, or both. Treatment choices depend on the problem and the person's preference. Before treatment begins, a doctor must conduct a careful diagnostic evaluation to determine whether a person's symptoms are caused by an anxiety disorder or a physical problem. If an anxiety disorder is diagnosed, the type of disorder or the combination of disorders that are present must be identified, as well as any coexisting conditions, such as depression or substance abuse. Sometimes alcoholism, depression, or other coexisting conditions have such a strong effect on the individual that treating the anxiety disorder must wait until the coexisting conditions are brought under control.

People with anxiety disorders who have already received treatment should tell their current doctor about that treatment in detail. If they received medication, they should tell their doctor what medication was used, what the dosage was at the beginning of treatment, whether the dosage was increased or decreased while they were under treatment, what side effects occurred, and whether

the treatment helped them become less anxious. If they received psychotherapy, they should describe the type of therapy, how often they attended sessions, and whether the therapy was useful.

Often people believe that they have “failed” at treatment or that the treatment didn’t work for them when, in fact, it was not given for an adequate length of time or was administered incorrectly. Sometimes people must try several different treatments or combinations of treatment before they find the one that works for them.

Personality Disorders

Personality disorders are long-term patterns of thoughts and behaviors that cause serious problems with relationships and work. People with personality disorders have difficulty dealing with everyday stresses and problems. They often have stormy relationships with other people. The exact cause of personality disorders is unknown. However, genes and childhood experiences may play a role. Symptoms vary widely depending on the specific type of personality disorder. Treatment usually includes talk therapy and sometimes medicine.

Borderline Personality Disorder

Borderline personality disorder is a serious mental illness marked by unstable moods, behavior, and relationships. In 1980, the Diagnostic and Statistical Manual for Mental Disorders, Third Edition (DSM-III) listed borderline personality disorder as a diagnosable illness for the first time. Most psychiatrists and other mental health professionals use the DSM to diagnose mental illnesses. Because some people with severe borderline personality disorder have brief psychotic episodes, experts originally thought of this illness as atypical, or borderline, versions of other mental disorders. While mental health experts now generally agree that the name “borderline personality disorder” is misleading, a more accurate term does not exist yet. Most people who have borderline personality disorder suffer from:

- Problems with regulating emotions and thoughts
- Impulsive and reckless behavior
- Unstable relationships with other people

People with this disorder also have high rates of co-occurring disorders, such as depression, anxiety disorders, substance abuse, and eating disorders, along with self-harm, suicidal behaviors, and completed suicides. According to data from a subsample of participants in a national survey on mental disorders, about 1.6 percent of adults in the United States have borderline personality disorder in a given year. Borderline personality disorder is often viewed as difficult to treat. However, recent research shows that borderline personality disorder can be treated effectively, and that many people with this illness improve over time.

According to the DSM, Fourth Edition, Text Revision (DSM-IV-TR), to be diagnosed with borderline personality disorder, a person must show an enduring pattern of behavior that includes at least five of the following symptoms:

- Extreme reactions—including panic, depression, rage, or frantic actions—to abandonment, whether real or perceived
- A pattern of intense and stormy relationships with family, friends, and loved ones, often veering from extreme closeness and love (idealization) to extreme dislike or anger (devaluation)
- Distorted and unstable self-image or sense of self, which can result in sudden changes in feelings, opinions, values, or plans and goals for the future (such as school or career choices)
- Impulsive and often dangerous behaviors, such as spending sprees, unsafe sex, substance abuse, reckless driving, and binge eating.
- Recurring suicidal behaviors or threats or self-harming behavior, such as cutting
- Intense and highly changeable moods, with each episode lasting from a few hours to a few days
- Chronic feelings of emptiness and/or boredom. Inappropriate, intense anger or problems controlling anger
- Having stress-related paranoid thoughts or severe dissociative symptoms, such as feeling cut off from oneself, observing oneself from outside the body, or losing touch with reality.

Seemingly mundane events may trigger symptoms. For example, people with borderline personality disorder may feel angry and distressed over minor separations — such as vacations, business trips, or sudden changes of plans — from people to whom they feel close. Studies show that people with this disorder may see anger in an emotionally neutral face and have a stronger reaction to words with negative meanings than people who do not have the disorder.

Schizophrenia

Schizophrenia affects approximately 1 percent of the population, or 2.2 million U.S. adults. Men and women are equally affected. The illness usually emerges in young people in their teens or twenties. Although children over the age of five can develop schizophrenia, it is rare before adolescence. In children, the disease usually develops gradually and is often preceded by developmental delays in motor or speech development. Childhood-onset schizophrenia tends to be harder to treat and has a less favorable prognosis than does the adult-onset form.

The Symptoms of schizophrenia:

There are many myths and misconceptions about schizophrenia. Schizophrenia is not a multiple or split personality, nor are individuals who have this illness constantly incoherent or psychotic. Although the media often portray individuals with schizophrenia as violent, in reality, very few affected people are dangerous to others. In fact, individuals with schizophrenia are more likely to be victims of violence than violent themselves. Schizophrenia has severe symptoms. A diagnosis of schizophrenia requires that at least two of the symptoms below be present during a significant portion of a one-month period: delusions (false beliefs such as conspiracies, mind control, or persecution); hallucinations (usually voices criticizing or commenting on the person's behavior); disorganized speech (incomprehensible or difficult to understand); grossly disorganized or catatonic behavior; and negative symptoms such as flat emotions, lack of facial expressions, and inattention to basic self-care needs such as bathing and eating.

However, the presence of either one of the first two symptoms is sufficient to diagnose schizophrenia if the delusions are especially bizarre or if the hallucinations consist of one or more voices that keep a running commentary on the person's behavior or thoughts. The DSM-IV specifies additional criteria for a diagnosis of schizophrenia: occupational dysfunction, persistence of the disturbance for at least six months, exclusion of a mood disorder, exclusion of a substance-abuse or medical condition that causes similar symptoms, and consideration of a possible pervasive developmental disorder. The course of schizophrenia varies considerably from one individual to the next. Most people who have schizophrenia experience at least one, and usually more, relapses after their first psychotic episode. Relapses are periods of more intense symptoms of illness (hallucinations and delusions). During remissions, the negative symptoms related to emotion or personal care are usually still present. About 10 percent of patients remain severely ill for long periods of time and do not return to their previous state of mental functioning. Several long-term studies found that as many as one-third to one-half of people with schizophrenia improve significantly or even recover completely from their illness.

The Causes of Schizophrenia

Like the other mental illnesses discussed here, scientists are still working to determine what causes schizophrenia. Also like the other mental illnesses, genetic and environmental factors most likely interact to cause the disease. Several studies suggest that an imbalance of chemical neurotransmitter systems of the brain, including the dopamine, GABA, glutamate, and norepinephrine neurotransmitter systems, are involved in the development of schizophrenia. Family, twin, and adoption studies support the idea that genetics plays an important role in the illness. For example, children of people with schizophrenia are 13 times more likely, and identical twins are 48 times more likely, to develop the illness than are people in the general population. Scientists continue to look at genes that may play a role in causing schizophrenia. One gene of interest to scientists who study schizophrenia codes for an enzyme that breaks down dopamine in the synapse.

Treating Schizophrenia

There is no cure for schizophrenia; however, effective treatments that make the illness manageable for most affected people are available. The optimal treatment includes antipsychotic medication combined with a variety of psychotherapeutic interventions. Since the 1950s, doctors have used antipsychotic drugs, such as chlorpromazine and haloperidol, to relieve the hallucinations and delusions typical of schizophrenia. Recently, newer (also called atypical) antipsychotic drugs such as risperidone and clozapine have proven to be more effective. Early and sustained treatment that includes antipsychotic medication is important for long-term improvement of the course of the disease. Patients who discontinue medication are likely to experience a relapse of their illness. People who manage schizophrenia best combine medication with psychosocial rehabilitation (life-skills training). Therapies that combine family and community support, education, and behavioral and cognitive skills to address specific challenges help schizophrenic patients improve their functioning and the quality of their lives.

Suicide and Self-harm

Suicide is among the most common causes of death in the United States. People may consider suicide when they are hopeless and can't see any other solution to their problems. Often it's related to serious depression, alcohol or substance abuse, or a major stressful event.

People who have the highest risk of suicide are white men. But women and teens report more suicide attempts. If someone talks about suicide, you should take it seriously. Urge them to get help from their doctor or the emergency room, or call the **National Suicide Prevention Lifeline at 1-800-273-TALK (8255)**.

Therapy and medicines can help most people who have suicidal thoughts. Treating mental illnesses and substance abuse can reduce the risk of suicide.

Suicidal behavior is complex. Some risk factors vary with age, gender, or ethnic group and may occur in combination or change over time. Suicide is a major, preventable public health problem. In 2007, it was the tenth leading cause of death in the U.S., accounting for 34,598 deaths. The overall rate was 11.3 suicide deaths per 100,000 people. An estimated 11 attempted suicides occur per every suicide death.

In 2007, suicide was the third leading cause of death for young people ages 15 to 24. As in the general population, young people were much more likely to use firearms, suffocation, and poisoning than other methods of suicide, overall. However, while adolescents and young adults were more likely to use firearms than suffocation, children were dramatically more likely to use suffocation.

There were also gender differences in suicide among young people, as follows:

- Nearly five times as many males as females ages 15 to 19 died by suicide.
- Just under six times as many males as females ages 20 to 24 died by suicide.

Research shows that risk factors for suicide include:

- depression and other mental disorders, or a substance-abuse disorder (often in combination with other mental disorders). More than 90 percent of people who die by suicide have these risk factors.
- prior suicide attempt
- family history of mental disorder or substance abuse
- family history of suicide
- family violence, including physical or sexual abuse
- firearms in the home, the method used in more than half of suicides
- incarceration
- exposure to the suicidal behavior of others, such as family members, peers, or media figures.

However, suicide and suicidal behavior are not normal responses to stress; many people have these risk factors, but are not suicidal. Research also shows that the risk for suicide is associated with changes in brain chemicals called neurotransmitters, including serotonin. Decreased levels of serotonin have been found in people with depression, impulsive disorders, and a history of suicide attempts, and in the brains of suicide victims. Public health approaches to preventing suicide include establishing telephone crisis hot lines, restricting access to suicide methods (for example, firearms), counseling media to reduce “copycat” suicides, screening teens for risk factors of suicide, and training professionals to improve recognition and treatment of mood disorders. Research about the effectiveness of these methods indicates that the screening and training strategies are more helpful for preventing suicides among young people than the other methods are.

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2.17: The Stigma of Mental Illness

Words can hurt. Many derogatory words and phrases are used in relation to mental illness. However, these words maintain the stereotyped image and not the reality about mental illness. Try not to use these words, and encourage students not to use them. It is more appropriate to refer to “a person who has a mental illness” when speaking about someone. “Mentally ill people are nuts, crazy, wacko.” “Mentally ill people are morally bad.” “Mentally ill people are dangerous and should be locked in an asylum forever.” “Mentally ill people need somebody to take care of them.” How often have we heard comments like these or seen these types of portrayals in movies, television shows, or books? We may even be guilty of making comments like them ourselves. Is there any truth behind these portrayals, or is that negative view based on our ignorance and fear?

Stigmas are negative stereotypes about groups of people. Common stigmas about people who are mentally ill are

- Individuals who have a mental illness are dangerous.
- Individuals who have a mental illness are irresponsible and can’t make life decisions for themselves.
- People who have a mental illness are childlike and must be taken care of by parents or guardians.
- People who have a mental illness should just get over it.

Each of those preconceptions about people who have a mental illness is based on false information. Very few people who have a mental illness are dangerous to society. Most can hold jobs, attend school, and live independently. A person who has a mental illness cannot simply decide to get over it any more than someone who has a different chronic disease such as diabetes, asthma, or heart disease can. A mental illness, like those other diseases, is caused by a physical problem in the body.

Stigmas against individuals who have a mental illness lead to injustices, including discriminatory decisions regarding housing, employment, and education. Overcoming the stigmas commonly associated with mental illness is yet one more challenge that people who have a mental illness must face. Indeed, many people who successfully manage their mental illness report that the stigma they face is in many ways more disabling than the illness itself. The stigmatizing attitudes toward mental illness held by both the public and those who have a mental illness lead to feelings of shame and guilt, loss of self-esteem, social dependence, and a sense of isolation and hopelessness. One of the worst consequences of stigma is that people who are struggling with a mental illness may be reluctant to seek treatment that, in most cases, would significantly relieve their symptoms.

Providing accurate information is one way to reduce stigmas about mental illness. Advocacy groups protest stereotypes imposed upon those who are mentally ill. They demand that the media stop presenting inaccurate views of mental illness and that the public stops believing these negative views. A powerful way of countering stereotypes about mental illness occurs when members of the public meet people who are effectively managing a serious mental illness: holding jobs, providing for themselves, and living as good neighbors in a community. Interaction with people who have mental illnesses challenges a person’s assumptions and changes a person’s attitudes about mental illness.

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2.18: Safety Needs

Once a person's physiological needs are relatively satisfied, his/her safety needs take precedence and dominate behavior. In the absence of physical safety – due to war, natural disaster, family violence, childhood abuse, etc. – people may (re-)experience post-traumatic stress disorder or transgenerational trauma. In the absence of economic safety – due to economic crisis and lack of work opportunities – these safety needs manifest themselves in ways such as a preference for job security, grievance procedures for protecting the individual from unilateral authority, savings accounts, insurance policies, disability accommodations, etc. This level is more likely to be found in children as they generally have a greater need to feel safe.

Safety and Security needs include:

- Personal security
- Financial security
- Health and well-being
- Safety net against accidents/illness and their adverse impacts

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2.19: Social Belonging

After physiological and safety needs are fulfilled, the third level of human needs is interpersonal and involves feelings of belongingness. This need is especially strong in childhood and it can override the need for safety as witnessed in children who cling to abusive parents. Deficiencies within this level of Maslow's hierarchy – due to hospitalism, neglect, shunning, ostracism, etc. – can adversely affect the individual's ability to form and maintain emotionally significant relationships in general, such as:

- Friendships
- Intimacy
- Family

According to Maslow, humans need to feel a sense of belonging and acceptance among their social groups, regardless whether these groups are large or small. For example, some large social groups may include clubs, co-workers, religious groups, professional organizations, sports teams, and gangs. Some examples of small social connections include family members, intimate partners, mentors, colleagues, and confidants. Humans need to love and be loved – both sexually and non-sexually – by others. Many people become susceptible to loneliness, social anxiety, and clinical depression in the absence of this love or belonging element. This need for belonging may overcome the physiological and security needs, depending on the strength of the peer pressure.

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2.20: Esteem

All humans have a need to feel respected; this includes the need to have self-esteem and self-respect. Esteem presents the typical human desire to be accepted and valued by others. People often engage in a profession or hobby to gain recognition. These activities give the person a sense of contribution or value. Low self-esteem or an inferiority complex may result from imbalances during this level in the hierarchy. People with low self-esteem often need respect from others; they may feel the need to seek fame or glory. However, fame or glory will not help the person to build their self-esteem until they accept who they are internally. Psychological imbalances such as depression can hinder the person from obtaining a higher level of self-esteem or self-respect. Most people have a need for stable self-respect and self-esteem. Maslow noted two versions of esteem needs: a "lower" version and a "higher" version. The "lower" version of esteem is the need for respect from others. This may include a need for status, recognition, fame, prestige, and attention. The "higher" version manifests itself as the need for self-respect. For example, the person may have a need for strength, competence, mastery, self-confidence, independence, and freedom. This "higher" version takes precedence over the "lower" version because it relies on an inner competence established through experience. Deprivation of these needs may lead to an inferiority complex, weakness, and helplessness.

Maslow states that while he originally thought the needs of humans had strict guidelines, the "hierarchies are interrelated rather than sharply separated". This means that esteem and the subsequent levels are not strictly separated; instead, the levels are closely related.

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2.21: Self-Actualization

"What a man can be, he must be."

This quotation forms the basis of the perceived need for 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. As previously mentioned, Maslow believed that to understand this level of need, the person must not only achieve the previous needs, but master them.

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2.22: Self-Transcendence

In his later years, Abraham Maslow explored a further dimension of needs, while criticizing his own vision on self-actualization. The self only finds its actualization in giving itself to some higher goal outside oneself, in altruism and spirituality, which is essentially the desire to reach infinite. "Transcendence refers to the very highest and most inclusive or holistic levels of human consciousness, behaving and relating, as ends rather than means, to oneself, to significant others, to human beings in general, to other species, to nature, and to the cosmos" (Farther Reaches of Human Nature, New York 1971, p. 269).

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2.23: Mental Health

According to the World Health Organization (WHO), mental health includes "subjective wellbeing, perceived self-efficacy, autonomy, competence, inter-generational dependence, and self-actualization of one's intellectual and emotional potential, among others." The WHO further states that the well-being of an individual is encompassed in the realization of their abilities, coping with normal stresses of life, productive work and contribution to their community. Cultural differences, subjective assessments, and competing professional theories all affect how "mental health" is defined. A widely accepted definition of health by mental health specialists is psychoanalyst Sigmund Freud's definition: the capacity "to work and to love".

Mental Health Issues Are Prevalent Among College Students

Mental health issues are a leading impediment to academic success among college students. Untreated mental illness in the college student population — including depression, anxiety and eating disorders — is associated with lower GPA and higher probability of dropping out of school. Treatment is effective and available yet because of an unnecessary shame surrounding these issues, mental health is not discussed and too many students are suffering in silence

- An estimated 26 percent of Americans ages 18 and older – or about 1 in 4 adults - live with a diagnosable mental health disorder.
- Half of all serious adult psychiatric illnesses – including major depression, anxiety disorders, and substance abuse – start by 14 years of age. Three-fourths of them are present by 25 years of age.
- Compared to older adults, the 18-24 year old age group shows the lowest rate of help-seeking.

Mental Health Issues Impact Students' Ability To Succeed:

- Almost one third of all college students report having felt so depressed that they had trouble functioning.
- Mental health issues in the college student population, such as depression, anxiety, and eating disorders, are associated with lower GPA and higher probability of dropping out of college.
- More than 80 percent of college students felt overwhelmed by all they had to do in the past year and 45 percent have felt things were hopeless.

Mental health issues can be deadly:

- Suicide is the 2nd leading cause of death among college students, claiming the lives of 1,100 students each year.
- 67% of college students tell a friend they are feeling suicidal before telling anyone else.
- More than half of college students have had suicidal thoughts and 1 in 10 students seriously consider attempting suicide. Half of students who have suicidal thoughts never seek counseling or treatment.
- 80-90% of college students who die by suicide were not receiving help from their college counseling centers

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2.24: Emotional Health

Emotional well-being is a term that has been used increasingly in recent decades. The implications of decreased emotional well-being are related to mental health concerns such as stress, depression, and anxiety. These in turn can contribute to physical ill-health such as digestive disorders, sleep disturbances, and general lack of energy.[1] The profile of a person prone to emotional distress is usually someone with low self-esteem, pessimistic, very self-critical, etc. and people who need to constantly assert themselves through their behavior. They also tend to be afraid, overly worried about the future, and focused on the past.

On the positive side, enhanced emotional well-being is seen to contribute to upward spirals in increasing coping ability, self-esteem, performance and productivity at work, and even longevity. Thoughts determine feelings, and thoughts are nothing more than firings of neurons. And those feelings that thoughts generate make the body release extremely addicting substances like adrenaline and cortisol. Like with any other addiction, the need to continually feed off these addicting substances tends to make the body think and feel in a certain way. When someone decides to disengage from these emotional addictions, he/she must learn to think differently.

Emotions and feelings are part of every step a person takes. A person must learn how to manage himself/herself in order to reach the maximum potential in all aspects of life. Good emotional health leads to better physical health, prevents diseases, and makes it possible to enjoy life and be happier. In this way you can become a “medicine person” through mirror neurons, those that lead to empathy and fire to imitate the emotions of others. Mirror neurons are what make you feel good when you’re with someone who is positive, cheerful and motivational. At the other extreme are the so-called “toxic people”, who make others around them feel bad.

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2.25: Spiritual Health

The spiritual dimension is understood to imply a phenomenon that is not material in nature, but belongs to the realm of ideas, beliefs, values and ethics that have arisen in the minds and conscience of human beings, particularly ennobling ideas. Ennobling ideas have given rise to health ideals, which have led to a practical strategy for Health for All that aims at attaining a goal that has both a material and non-material component. If the material component of the strategy can be provided to people, the non-material or spiritual one is something that has to arise within people and communities in keeping with their social and cultural patterns. The spiritual dimension plays a great role in motivating people's achievement in all aspects of life.

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CHAPTER OVERVIEW

3: Stress

By Jonathan Howard

Learning Objectives

- Define stress
- Describe the effects of stress on wellbeing
- Identify effective strategies for managing stress
- Assess your own levels of stress

In today's fast-paced society, most people complain about being stressed. However, when they use the term *stress*, they rarely know its true meaning. The word carries many negative connotations and is associated with an unpleasant or traumatic event. As such, people mistakenly believe that stress is simply the nervousness and tension experienced prior to, during, or after a negative event. In fact, the effects of stress are physiological, emotional, *and* psychological. Additionally, not all levels of stress are detrimental. The stress athletes experience right before a big game or college students feel right before an exam can enhance focus and increase their ability to concentrate. Stress is either good or bad depending on how long it persists and how it is perceived by the individual. This chapter will provide a deeper understanding of what stress is and provide effective strategies for managing stress.

[3.1: What is Stress and How Does it Affect Wellness?](#)

[3.2: What Are the Strategies for Managing Stress?](#)

[3.3: Assess Your Stress Level](#)

Thumbnail: Anxiety by Munch.

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3.1: What is Stress and How Does it Affect Wellness?

Stress is defined as the body's physical, mental, and emotional response to a particular stimulus, called a **stressor**. This adaption/coping-response helps the body prepare for challenging situations. It is the level of a person's response to a stressor that determines whether the experience is positive or negative. As a hardworking college student, you may feel as if you know the meaning of stress all too well. You may dream of a future where the demands on your time are diminished, so you can escape the high levels of stress you are feeling now. Unfortunately, regardless of their situation, everyone experiences stress on a regular basis. The good news is, not all stress is bad! Small levels of stress can enhance cognitive brain function. Stress may provide the motivation and concentration you need to write an essay, practice a speech, or prepare for a job interview. For most people, these types of stressors are manageable and not harmful. Stressors that have the potential for harm include the sudden loss of a loved one, the unexpected ending of a romantic relationship, or the unfair demands of an unreasonable boss.

Defining Stress

Stress, then, is more than simply the tension and apprehension generated by problems, obstacles, or traumatic events. Stress is the body's automatic response ([physical](#), mental, and [emotional](#)) to any stressor. It is a natural and unavoidable part of life, and it can be empowering and motivating, or harmful and potentially dangerous.

For more information on stress click on the links below:

[What is Stress?](#)

[Understanding and Dealing with Stress](#)

Below is a video on stress.



Effects of Stress on Wellness

As stated previously, not all stress is bad. In fact, the stress associated with riding a roller coaster, watching a scary movie, or scaling a cliff can enhance these experiences. Regardless of whether the stress experienced is negative or positive, the effects on the body are identical.

When a person senses that a situation demands action, the body responds by releasing chemicals into the blood. The hypothalamus signals the adrenal glands to release a surge of hormones that include adrenaline and cortisol. The physiological effects of those chemicals—enhanced focus, quicker reaction time, and increased heart rate, energy, and strength—are quite beneficial when faced with a potentially dangerous situation that is temporary.

Unfortunately, most of the stressors people face—work, school, finances, relationships—are a part of everyday life, and thus, inescapable. Experiencing ongoing, unavoidable stress can result in some very unpleasant and harmful effects, both mental and physical. Chronic stress can cause upset stomach, headaches, sleep problems, and heart disease. It can also cause depression, anxiety, and even memory loss.

To watch a video that describes the effects of stress in detail, click on the link below:



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3.2: What Are the Strategies for Managing Stress?

Although stress in everyday life is unavoidable, there are ways to cope with it that will minimize or eliminate its harmful effects.

The Anxiety and Depression Association of America (ADAA) provides a list of effective strategies for coping with stress. That document is linked here: [Tips: Coping Strategies](#). For your convenience, it is also reprinted below with the ADAA's permission.

When you are feeling anxious or stressed, these strategies will help you cope:

- **Take a time-out.** Practice yoga, listen to music, meditate, get a massage, or learn relaxation techniques. Stepping back from the problem helps clear your head.
- **Eat well-balanced meals.** Do not skip any meals. Do keep healthful, energy-boosting snacks on hand.
- **Limit alcohol and caffeine,** which can aggravate anxiety and trigger panic attacks.
- **Get enough sleep.** When stressed, your body needs additional sleep and rest.
- **Exercise daily** to help you feel good and maintain your health. Check out the fitness tips below.
- **Take deep breaths.** Inhale and exhale slowly.
- **Count to 10 slowly.** Repeat, and count to 20 if necessary.
- **Do your best.** Instead of aiming for perfection, which isn't possible, be proud of however close you get.
- **Accept that you cannot control everything.** Put your stress in perspective: Is it really as bad as you think?
- **Welcome humor.** A good laugh goes a long way.
- **Maintain a positive attitude.** Make an effort to replace negative thoughts with positive ones.
- **Get involved.** Volunteer or find another way to be active in your community, which creates a support network and gives you a break from everyday stress.
- **Learn what triggers your anxiety.** Is it work, family, school, or something else you can identify? Write in a journal when you're feeling stressed or anxious and look for a pattern.
- **Talk to someone.** Tell friends and family you're feeling overwhelmed, and let them know how they can help you. Talk to a physician or therapist for professional help.
- **Get help online.** Lantern offers online programs guided by professional coaches to help you turn healthy anxiety management into a habit. (*Sponsored*)
 - **Listen to podcasts on a wide range of topics**
 - **Watch recorded webinars on topics ranging from how to worry less, coping with panic attacks, treatments for children, and helping suicidal families, and many more.**

Fitness Tips: Stay Healthy, Manage Stress

To receive the greatest benefits from exercising, try to include at least 2 1/2 hours of moderate-intensity physical activity (e.g., brisk walking) each week, 1 1/4 hours of a vigorous-intensity activity (such as jogging or swimming laps), or a combination of the two.

- **5 X 30:** Jog, walk, bike, or dance three to five times a week for 30 minutes.
- **Set small daily goals** and aim for daily consistency rather than perfect workouts. It is better to walk every day for 15–20 minutes than to wait until the weekend for a three-hour fitness marathon. Lots of scientific data suggests that frequency is most important.
- **Find forms of exercise** that are fun or enjoyable. Extroverted people often like classes and group activities. People who are more introverted often prefer solo pursuits.
- **Distract yourself** with an iPod or other portable media player to download audiobooks, podcasts, or music. Many people find it is more fun to exercise while listening to material they enjoy.
- **Recruit** an “exercise buddy.” It is often easier to stick to your exercise routine when you have to stay committed to a friend, partner, or colleague.
- **Be patient** when you start a new exercise program. Most sedentary people require about four to eight weeks to feel coordinated and sufficiently in shape so that exercise feels easier.

Additional strategies for coping with stress are linked below:



[Stress Management](#)

[10 Tips to Manage Stress](#) This is a link to WebMD with a video on how to manage stress

To hear the world's most relaxing sound (according to research), click on the link below:



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3.3: Assess Your Stress Level

Are you more or less stressed than your peers? The website linked below contains a stress test. On the website, scroll down to the “Quiz: Are You Stressed?”

[How Stressed Are You?](#)

Below is a link to the Lab for this chapter on stress. Please be certain to get a PDF of your results and submit it in D2L:

[Lab for Chapter on Stress](#)

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CHAPTER OVERVIEW

4: Substance Use and Abuse

By Althea Moser

Learning Objectives

- Address addiction and risk factors for addiction
- Define types of drugs, possible health effects, and treatment options
- Explore the abuse of alcohol, nicotine, e-cigarettes, and prescription drugs and their role in addiction
- Assess personal risk for substance use and abuse

[4.1: Drug Abuse and Addiction](#)

[4.2: Types of Drugs, Possible Health Effects, and Treatment Options](#)

[4.3: Alcohol, Nicotine, e-cigarettes, and Prescription Drugs](#)

[4.4: Assessing Your Personal Risk Factors for Substance Use and Abuse-](#)

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4.1: Drug Abuse and Addiction

What is drug addiction?

Addiction is defined as a chronic, relapsing brain disease that is characterized by compulsive drug seeking and use, despite harmful consequences. It is considered a brain disease because drugs change the brain by changing its structure and how it works. These brain changes can be long-lasting and can lead to the harmful behaviors seen in people who abuse drugs.

Addiction is a lot like other diseases, such as heart disease. Both disrupt the normal, healthy functioning of the underlying organ, have serious harmful consequences, and are preventable and treatable, but if left untreated, can last a lifetime.

Why do people use drugs?

In general, people begin taking drugs for a variety of reasons:

- *To feel good*
Most abused drugs produce intense feelings of pleasure. This initial sensation of euphoria is followed by other effects, which differ depending on the type of drug used. For example, with stimulants such as cocaine, the “high” is followed by feelings of power, self-confidence, and increased energy. In contrast, the euphoria caused by opiates, such as heroin, is followed by feelings of relaxation and satisfaction.
- *To feel better*
Some people who suffer from social anxiety, stress-related disorders, and depression begin abusing drugs in an attempt to lessen feelings of distress. Stress can play a major role in initial drug use, continuing drug abuse, or relapse in patients recovering from addiction.
- *To do better*
Some people feel pressure to chemically enhance or improve their cognitive or athletic performance, which can play a role in initial experimentation and continued abuse of drugs, such as prescription stimulants or anabolic/androgenic steroids.
- *To satisfy their curiosity and "because others are doing it"*
In this respect, adolescents are particularly vulnerable because of the strong influence of peer pressure. Teens are more likely than adults to engage in risky or daring behaviors to impress their friends and express their independence from parental and social rules.

If taking drugs makes people feel good or better, what's the problem?

When they first use a drug, people may perceive what seem to be positive effects. They may also believe that they can control their use. However, drugs can quickly take over a person's life. Over time, if drug use continues, other pleasurable activities become less pleasurable and taking the drug becomes necessary for the user just to feel *normal*. They may then compulsively seek and take drugs even though doing so causes tremendous problems for themselves and their loved ones. Some people may start to feel the need to take higher or more frequent doses, even in the early stages of their drug use. These are the telltale signs of an addiction.

Even relatively moderate drug use poses dangers. Consider how a social drinker can become intoxicated, get behind the wheel of a car, and quickly turn a pleasurable activity into a tragedy that affects many lives.

Is continued drug abuse a voluntary behavior?

The initial decision to take drugs is typically voluntary. However, with continued use, a person's ability to exert self-control can become seriously impaired; this impairment in self-control is the hallmark of addiction. Brain imaging studies of people with addiction show physical changes in areas of the brain that are critical to judgment, decision making, learning and memory, and behavior control. Scientists believe that these changes alter the way the brain works and may help explain the compulsive and destructive behaviors of addiction.

Why do some people become addicted to drugs while others do not?

As with any other disease, vulnerability to addiction differs from person to person, and no single factor determines whether a person will become addicted to drugs. In general, the more **risk factors** a person has, the greater the chance that taking drugs will lead to abuse and addiction. **Protective factors**, on the other hand, reduce a person's risk of developing addiction. Risk and

protective factors may be either environmental, such as conditions at home, at school, and in the neighborhood, or biological, for instance, a person's genes, his or her stage of development, and even a person's gender or ethnicity.

Risk and Protective Factors for Drug Abuse and Addiction	
Risk Factors	Protective Factors
Aggressive behavior in childhood	Good self-control
Lack of parental supervision	Parental monitoring and support
Poor social skills	Positive relationships
Drug experimentation	Academic competence
Availability of drugs at school	School anti-drug policies
Community poverty	Neighborhood pride

What environmental factors increase the risk of addiction?

- *Home and family*

The influence of the home environment, especially during childhood, is a very important factor. Children with parents or older family members who abuse alcohol or drugs or engage in criminal behavior, have an increased risk of developing their own drug problems.

- *Peers and school*

Friends and acquaintances can have an increasingly strong influence during adolescence. Drug-using peers can sway even those without risk factors to try drugs for the first time. Academic failure or poor social skills can put a child at further risk for using or becoming addicted to drugs.

What biological factors increase risk of addiction?

- *Genetics*

Scientists estimate that genetic factors account for between 40 and 60 percent of a person's vulnerability to addiction. This includes the effects of environmental factors on the function and expression of a person's genes. A person's stage of development and other medical conditions a person may have are also factors. Adolescents and people with mental disorders are at greater risk of drug abuse and addiction than the general population.

- *Dramatic changes in brain development that occur during adolescence*

One of the brain areas still maturing during adolescence is the prefrontal cortex—the part of the brain that enables us to assess situations, make sound decisions, and keep our emotions and desires under control. The fact that this critical part of the adolescent brain is a work in progress puts teenagers at increased risk for making poor decisions, such as trying drugs or continuing to take them. Also, introducing drugs during this period of development may cause brain changes that have profound and long-lasting consequences.

What other factors increase the risk of addiction?

- *Early use*

Although taking drugs at any age can lead to addiction, research shows that the earlier a person begins to use drugs, the more likely he or she is to develop serious problems. This increased risk may reflect the harmful effects that drugs can have on the developing brain. It may result from a mix of early social and biological vulnerability factors, including unstable family

relationships, exposure to physical or sexual abuse, genetic susceptibility, or mental illness. Still, the fact remains that early use is a strong indicator of problems ahead, including addiction.

- *Method of administration*

Smoking a drug or injecting it into a vein increases its addictive potential. Both smoked and injected drugs enter the brain within seconds, producing a powerful rush of pleasure. However, this intense “high” can fade within a few minutes, taking the abuser down to lower, more normal levels. Scientists believe this starkly felt contrast drives some people to repeated drug usage in an attempt to recapture the fleeting pleasurable state.

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4.2: Types of Drugs, Possible Health Effects, and Treatment Options

Click on the link below and review the information on commonly abused drugs. Make sure to explore the material, including possible health effects and treatment options when applicable, for the following substances:

- Alcohol
- GHB
- Inhalants
- Marijuana
- Methamphetamine
- Cocaine
- Heroin
- LSD
- MDMA/Molly
- Tobacco

[Commonly Abused Drugs](#)

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4.3: Alcohol, Nicotine, e-cigarettes, and Prescription Drugs

Click on the following links to learn more about alcohol and alcohol abuse:

- [Alcohol Abuse FAQs](#)
- [College Drinking](#)

Click on the following link for information about nicotine addiction:

- [Nicotine Addiction](#)

Watch the video linked below to learn about the consequences of teens using e- cigarettes:



Transcript

Watch the video linked below to learn more about prescription drug abuse in teens:



Transcript

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4.4: Assessing Your Personal Risk Factors for Substance Use and Abuse-

Complete **one** of the following Labs to assess your personal risk factors for substance use and abuse. Choose the Lab most relevant for you. Submit the Lab per your Instructor's directions.

If you drink alcohol complete the following Lab:

1. [Alcohol Use Lab](#)

If you smoke cigarettes, complete the following Lab:

2. [Cigarette Use Lab](#)
-

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CHAPTER OVERVIEW

5: Nutrition

Learning Objectives

- Summarize the basics of nutrition
- Define macronutrients and micronutrients
- Categorize and describe the body's sources of energy
- Analyze intake of nutrition and make appropriate changes

[5.1: The Basics of Nutrition](#)

[5.2: Calories \(Food Energy\)](#)

[5.3: References and Links](#)

[5.4: Basic Nutrition and Healthy Eating](#)

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5.1: The Basics of Nutrition

Nutrition can be defined as the science of the action of food, beverages, and their components in biological systems. A nutrient is a compound that provides a needed function in the body. Nutrients can be further classified based on the amount needed in the body. **Macronutrients** are the nutrients the body needs in larger amounts. **Micronutrients** are also important nutrients, but ones the body needs in smaller amounts.

Macronutrients	Micronutrients
Carbohydrate	Vitamins
Protein	Minerals
Lipids	
Water	

Macronutrients

- *Carbohydrates*: The word carbohydrate literally means "hydrated carbon," or carbon with water. Thus, it is no surprise that carbohydrates are made up of carbon, hydrogen, and oxygen. Sucrose (table sugar) is an example of a commonly consumed carbohydrate. Some dietary examples of carbohydrates are whole-wheat bread, oatmeal, rice, sugary snacks/drinks, and pasta.
- *Proteins*: Like carbohydrates, proteins are comprised of carbon, hydrogen, and oxygen, but they also contain nitrogen. Several dietary sources of proteins include nuts, beans/legumes, skim milk, egg whites, and meat.
- *Lipids*: Lipids consist of fatty acids, triglycerides, phospholipids, and sterols (cholesterol). Lipids are also composed of carbon, hydrogen, and oxygen. Some dietary sources of lipids include, oils, butter, and egg yolks.
- *Water*: Water is made up of hydrogen and oxygen and is the only macronutrient that provides no energy.

Micronutrients

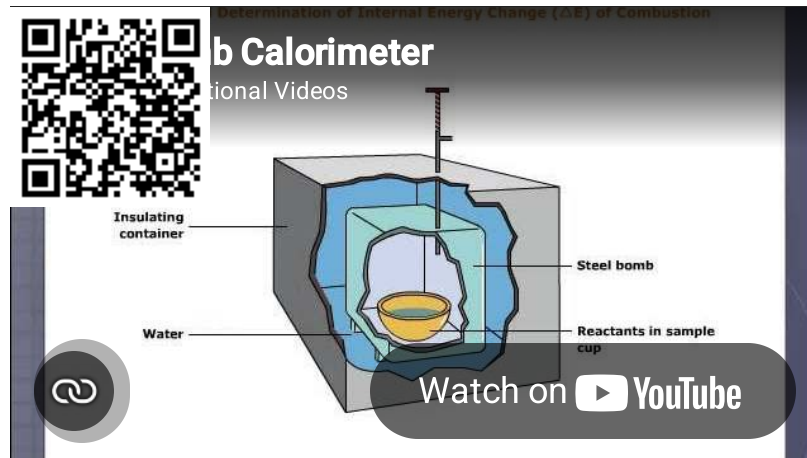
- *Vitamins*: These compounds are essential for normal physiologic processes in the body.
- *Minerals*: Minerals are the elements (think periodic table) that are essential for normal physiologic processes in the body.

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5.2: Calories (Food Energy)

Food energy is measured in kilocalories (kcal), commonly referred to as calories. Although technically incorrect, this terminology is so familiar that it will be used throughout this course. A kilocalorie is the amount of energy needed to raise 1 kilogram of water 1 degree Celsius. A food's kilocalories are determined by putting the food into a bomb calorimeter and determining the energy output: Energy = Measurement of Heat Produced. Below is a picture of a bomb calorimeter and a link to a video showing how one is used.



<https://www.youtube.com/watch?v=YXo9B2AbH0s>

The number of kilocalories per gram for each nutrient is shown below:

Nutrient	Energy (kcal/g)
Carbohydrate	4
Protein	4
Lipids	9
Water	0
Vitamins	0
Minerals	0

As the table above illustrates, only carbohydrates, protein, and lipids provide energy. However, there is another dietary energy source that is not a nutrient— alcohol. To emphasize, alcohol is *not* a nutrient, but it does provide 7 kilocalories of energy per gram.

Knowing the number of calories in each nutrient allows a person to calculate/estimate the amount of calories contained in any food consumed.

Carbohydrates

Carbohydrates have become, surprisingly, quite controversial. Some people passionately extol the merits of carbohydrates, while others berate them as nutritional assassins. However, it is important to understand that carbohydrates are a diverse group of compounds that have a multitude of effects on bodily functions. Thus, trying to make blanket statements about carbohydrates is not a good idea.

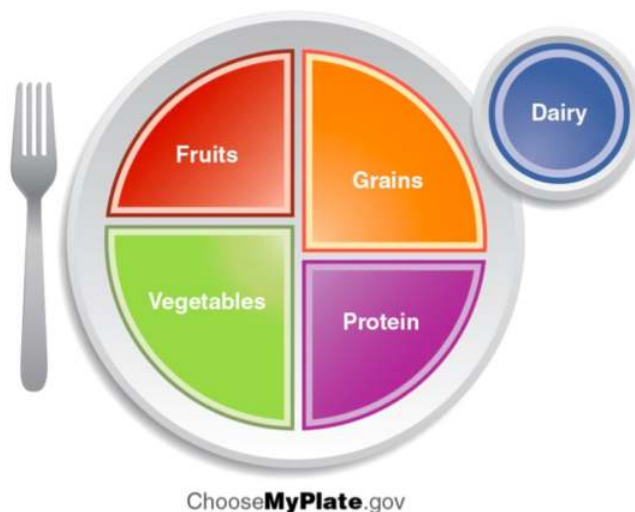
My Plate

Derived from OpenStax

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) 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.



MyPlate. The U.S. Department of Agriculture developed food guidelines called MyPlate to help demonstrate how to maintain a healthy lifestyle. Derived from OpenStax- You can download material: <http://cnx.org/contents/14fb4ad7-39a...482e3e22@8.108>.

High-Fructose Corn Syrup

Food manufacturers are always searching for cheaper ways to produce their products. One extremely popular method for reducing costs is the use of high-fructose corn syrup as an alternative to sucrose. High-fructose corn syrup is approximately 50% glucose and 50% fructose, which is the same as sucrose. Nevertheless, because increased consumption of high-fructose corn syrup has coincided with increased obesity in the United States, a lot of controversy surrounds its use.

Alternative sweeteners are simply alternatives to sucrose and other mono- and disaccharides that provide sweetness.

Below are several links that provide additional information about glucose, corn syrup, and sugar.

The New York Times article linked below discusses the growing popularity of sugar compared to high fructose corn syrup: "[Sugar is Back on Food Labels, This Time as a Selling Point](#)"

The website linked below provides a wealth of information about all things sweet, such as corn syrup, sugar substitutes, sugar supplements, and granulated fructose.

[Corn Syrup](#)

The article linked below explains why the Corn Refiners Association has asked for permission to change the name of high fructose corn syrup to corn sugar and why the US Food and Drug Administration rejected that request:

["No New Name for High Fructose Corn Syrup"](#)

Protein

Protein is another major macronutrient that, like carbohydrates, consists of small repeating units. But instead of sugars, proteins are made up of amino acids.

Proteins can be classified as either complete or incomplete. Complete proteins provide adequate amounts of all nine essential amino acids. Animal proteins, such as meat, fish, milk, and eggs, are good examples of complete proteins. Incomplete proteins do not contain adequate amounts of one or more of the essential amino acids. For example, if a protein does not provide enough of the essential amino acid leucine it would be considered incomplete. Leucine would be referred to as the **limiting amino acid** because there is not enough of it for the protein to be complete. Most plant foods are incomplete proteins, with a few exceptions, such as soy. The table below shows the limiting amino acids in some plant foods.

Self Magazine's Nutrition Data website is a useful resource for determining protein quality and identifying complementary proteins. To use the site, go to www.nutritiondata.com, type the name of the food you want information on in the search bar and hit Enter. When you have selected your food from the list of possibilities, you will be given information about this food. Included in this information is the Protein Quality section. This will give you an amino acid score and a figure that illustrates which amino acid(s) is limiting. If your food is an incomplete protein, you can click "Find foods with a complementary profile." This will take you to a list of dietary choices that will provide complementary proteins for your food.

The chapter linked below is from a book published by the National Academies of Sciences, Engineering, and Medicine and provides an exhaustive examination of the role protein and amino acids play in human health.

[Protein and Amino Acids](#)

Fat

There is neither bad nor good cholesterol, despite the common use of these descriptions in reference to LDL and HDL, respectively. Cholesterol is cholesterol. HDL and LDL contain cholesterol but are actually lipoproteins that will be described later. It is not necessary to include cholesterol in your diet because our bodies have the ability to synthesize the required amounts. The figure below gives you an idea of the cholesterol content of a variety of foods.

www.webmd.com/cholesterol-management/foods-to-avoid-for-high-cholesterol

Fiber

The simplest definition of fiber is indigestible matter. Indigestible means that it survives digestion in the small intestine and reaches the large intestine.

There are the three major fiber classifications:

- *Dietary fiber*: This type of fiber contains both nondigestible carbohydrates and lignin and is always intrinsic and intact in plants.
- *Functional fiber*: This type of fiber contains nondigestible carbohydrates only and can be isolated, extracted, or synthesized. Functional fiber can be from plants or animals and produces beneficial physiological effects in humans.
- *Total Fiber*: Fiber that contains both dietary fiber and functional fiber.

Vitamins

Derived from OpenStax-

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](#) and [Table](#)).

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.

Derived from OpenStax-

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](#) and [Table](#) provide a summary of minerals and their function in the body.

Derived from OpenStax-

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Framingham Heart Study History <http://www.framinghamheartstudy.org/about/history.html>.

Framingham Heart Study Research Milestones - <https://framinghamheartstudy.org/fhs-about/research-milestones/>

The Nurses Health Study - http://www.channing.harvard.edu/nhs/?page_id=70

Health Professionals Follow-Up Study – <http://www.hsph.harvard.edu/hpfs/>

Links and references found at the end of the section on Protein:

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<http://en.wikipedia.org/wiki/File:L-tyrosine-skeletal.png>

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<http://upload.wikimedia.org/wikipedia/commons/a/a6/PBJ.jpg> (This link doesn't work)

http://en.wikipedia.org/wiki/File:Red_beans_and_rice.jpg (This links to a great picture of red beans and rice)

Schaafsma G. (2000) The protein digestibility-corrected amino acid score. J Nutr 130(7): 1865S.

Derived from OpenStax- You can download material Download for free at <http://cnx.org/contents/14fb4ad7-39a1-4eee-ab6e-3ef2482e3e22@8.108>.

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SECTION OVERVIEW

5.4: Basic Nutrition and Healthy Eating

The word nutrition first appeared in 1551 and comes from the Latin word *nutrire*, meaning “to nourish.” Today, we define *nutrition* as the sum of all processes involved in how organisms obtain nutrients, metabolize them, and use them to support all of life’s processes. *Nutritional science* is the investigation of how an organism is nourished, and incorporates the study of how nourishment affects personal health, population health, and planetary health. Nutritional science covers a wide spectrum of disciplines. As a result, nutritional scientists can specialize in particular aspects of nutrition such as biology, physiology, immunology, biochemistry, education, psychology, sustainability, and sociology. Without adequate nutrition the human body does not function optimally, and severe nutritional inadequacy can lead to disease and even death. The typical American diet is lacking in many ways, from not containing the proper amounts of essential nutrients, to being too speedily consumed, to being only meagerly satisfying.

Thumbnail: Cornucopia of fruit and vegetables. (CC BY-SA 3.0; Jina Lee).

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CHAPTER OVERVIEW

6: Physical Fitness

Being physically active is one of the most important steps that Americans of all ages can take to improve their health. 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. 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.

6.1: Physical Fitness

6.1.1: Exercise- Not a Passing Fad

6.1.2: What are Physical Activity and Exercise?

6.2: Health Benefits Associated with Regular Physical Activity

6.3: Health Related Components of Physical Fitness

6.4: Adding Physical Activity to Your Life

6.5: Implementing Your Fitness Plan

6.5.1: Additional Safety Concerns

Thumbnail: Photographic reflections of Australian swimmer Daniel Bell in action during Day 03 of the 2000 Sydney Paralympic Games. (CC BY-SA 3.0; Australian Paralympic Committee/Australian Sports Commission).

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6.1: Physical Fitness

Being physically active is one of the most important steps that Americans of all ages can take to improve their health. 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. 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;
- Injuries or sudden heart attacks.

There have also been additional studies by the Advisory Committee of the U.S. Department of Health and Human Services. 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.

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6.1.1: Exercise- Not a Passing Fad

The benefits of physical activity and exercise are universally recognized—and have been for far longer than one might think. Our Paleolithic ancestors regularly engaged in physical activity to survive. However, rather than chasing after a soccer ball to win a game or taking a leisurely stroll down a tree-lined path, they “worked out” by chasing after their next meal. For them, no exercise meant no food. How’s that for a health benefit?

With the advent of sedentary agriculture some 10,000 years ago, that same level of peak performance was no longer necessary. As our ancestors continued to devise more advanced means of acquiring food, physical activity declined. It wasn’t until the fourth century BCE, that the Greek physician Herodicus, recognized the importance of being physically active outside of a hunter-gatherer society. He practiced gymnastic medicine, a branch of Greek medicine that relied on vigorous exercise as a treatment. During that same time period, Hippocrates, who is often referred to as the Father of Modern Medicine, asserted, “If we could give every individual the right amount of nourishment and exercise, not too little and not too much, we would have found the safest way to health.” In the 12 century CE, the Jewish philosopher Rabbi Moses ben Maimon, a physician to the Sultan of Egypt, stated, “Anyone who lives a sedentary life and does not exercise, even if he eats good foods and takes care of himself according to proper medical principles, all his days will be painful ones and his strength will wane.” The 15th century theologian and scholar Robert Burton went so far as to declare that *not* exercising, or “idleness” as he referred to it in his widely read tome, *The Anatomy of Melancholy*, was the “bane of body and mind.” Burton also warned that the lack of exercise was the sole cause of melancholy (the name given depression at that time) and “many other maladies.” Burton claimed that idleness was one of the seven deadly, as well as “the nurse of naughtiness,” and the “chief author of mischief.” For Burton, exercise was not only essential for good health, but a means of avoiding eternal damnation.

By the 16th century, the benefits of exercise were widely accepted, at least among the wealthy and the educated, who had access to leisure. During this time period, H. Mercurialis defined exercise as “the deliberate and planned movement of the human frame, accompanied by breathlessness, and undertaken for the sake of health or fitness.” This definition is still widely used today.

Beyond the physical health benefits, there are affective benefits associated with group games and activities. Ancient Mayans organized the first team game called the Ball Game. It consisted of two teams trying to get a ball through a hoop mounted approximately 23 feet on a wall. The rules were to get the ball through the hoop using certain parts of the body. In some cases the captain of the losing team gave himself as a human sacrifice to the winning team, an act that was believed by the Mayans to be a vital part of prosperity.

American Indians are thought to have founded the modern game of lacrosse, as well as other stick games. Lacrosse, which received its name from French settlers, was more than a form of recreation. It was a cultural event used to settle disputes between tribes.



Figure 6.1.1.1: Lacrosse Players. George Catlin. Date unknown.

The outcome of the game, as well as the choosing of teams, was thought to be controlled supernaturally. As such, game venues and equipment were prepared ritualistically.

From Ancient History to Modern Times

In retrospect, the perceived benefits of exercise have changed very little since Herodotus or the American Indians. Mounting research supports historical assertions that exercise is vital to sustaining health and quality of life. Culturally, sports play a huge role in growth and development of youth and adults. Physically, there is indisputable evidence that regular exercise promotes healthy functioning of the brain, heart, and the skeletal and muscular systems. Exercise also reduces risk for chronic diseases, such as cancer, diabetes, and obesity. Regular exercise can even improve emotional health and overall wellbeing.

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6.1.2: What are Physical Activity and Exercise?

Physical activity is defined as any movement carried out by skeletal muscle that requires energy and is focused on building health. Health benefits include improved blood pressure, blood-lipid profile, and heart health. Acceptable physical activity includes yard work, house cleaning, walking the dog, or taking the stairs instead of the elevator. Physical activity does not have to be done all at once. It can be accumulated through various activities throughout the day. Although typing on a phone or laptop or playing video games does involve skeletal muscle and requires a minimal amount of energy, the amount required is not sufficient to improve health.

Despite the common knowledge that physical activity is tremendously beneficial to one's health, rates of activity among Americans continue to be below what is needed. According to the Center for Disease Control (CDC), only 1 in 5 (21%) of American adults meet the recommended physical activity guidelines from the Surgeon General. Less than 3 in 10 high school students get 60 minutes or more of physical activity per day. Non-Hispanic whites (26%) are more active than their Hispanic (16%) and Black counterparts (18%) as is the case for males (54%) and females (46%). Those with more education and those whose household income is higher than poverty level are more likely to be physically active.¹

The word *exercise*, although often used interchangeably with the phrase *physical activity*, denotes a sub-category of physical activity. **Exercise** is a planned, structured, and repetitive movement pattern intended to improve fitness. As a positive side-effect, it significantly improves health as well. Fitness improvements include the heart's ability to pump blood, increased muscle size, and improved flexibility.

Components of Health-Related Fitness

In order to carry out daily activities without being physically overwhelmed, a minimal level of fitness is required. To perform daily activities without fatigue, it is necessary to maintain health in five areas: cardiorespiratory endurance, muscular strength and endurance, flexibility, and body composition. These five areas are called the components of health-related fitness. Development of these areas will improve your quality of life, reduce your risk of chronic disease, and optimize your health and well-being. Each of these 5 areas will be explored in depth at a later time. Below is a brief description of each.

- *Cardiorespiratory endurance*Cardiorespiratory endurance is the ability to carry out prolonged, large muscle, dynamic movements at a moderate to high level of intensity. This relates to your heart's ability to pump blood and your lungs' ability to take in oxygen.
- *Muscular strength*
Muscular strength is the ability of the muscles to exert force over a single or maximal effort.
- *Muscular endurance*
Muscular endurance is the ability to exert a force over a period of time or repetitions.
- *Flexibility*
Flexibility is the ability to move your joints through a full range of motion.
- *Body Composition*
Body composition is the relative amount of fat mass to fat-free mass.

As previously stated, these areas are significant in that they influence your quality of life and overall health and wellness.

Skill-Related Components of Fitness

In addition to the 5 health-related components, there are 6 skill-related components that assist in developing optimal fitness: speed, agility, coordination, balance, power, and reaction time. Although important, these areas do not directly affect a person's health. A person's ability to perform ladder drills (also known as agility drills) is not related to his/her heart health. However, coordination of muscle movements may be helpful in developing muscular strength through resistance training. As such, they may indirectly affect the 5 areas associated with health-related fitness. Skill-related components are more often associated with sports performance and skill development.

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6.2: Health Benefits Associated with Regular Physical Activity

Table 6.2.1: Health Benefits Associated with Regular Physical Activity in Children and Adolescents

Strong Evidence	Moderate Evidence
- Improved cardiorespiratory and muscular fitness - Improved bone health - Improved cardiovascular and metabolic health biomarkers - Favorable body composition	Reduced symptoms of depression

Table 6.2.2: Health Benefits Associated with Regular Physical Activity in Adults and Older Adults

Strong Evidence	Moderate to Strong Evidence	Moderate 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)	- Better functional health (for older adults) - Reduced abdominal obesity	- 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

These studies have also prompted questions as to what type and how much physical activity is needed for various health benefits. That led to the development of The Physical Activity Guidelines for Americans, which gives guidance on the amount of physical activity that will provide health benefits for all Americans. 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. For more details on the Physical Activity Guidelines for Americans please see the table below:

Table 6.2.3 For Important Health Benefits Adults Need at Least

2 hours and 30 minutes (150 minutes) of moderate aerobic activity every week (i.e., brisk walking) every week OR 1 hour and 15 minutes (75 minutes) of vigorous intensity aerobic activity (i.e., jogging or running) every week; OR An equivalent mix of moderate-and-vigorous intensity aerobic activity	AND	Muscle-strengthening activities on 2 or more days a week that work all major muscle groups (legs hips, back, abdomen, chest, shoulders, and arms)
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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.

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6.3: Health Related Components of Physical Fitness

In many studies related to physical fitness and health, researchers have focused on **exercise**, as well as on the more broadly defined concept of **physical activity**. Physical activity is defined by the World Health Organization as any bodily movement produced by skeletal muscles that requires energy expenditure, while 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. Although physical activity and exercise are defined concepts, the ultimate focus of the health related components of physical fitness is to provide a framework for components that are necessary for good health. They are cardiorespiratory (CR) endurance (also called aerobic endurance), flexibility, muscular strength, muscular endurance, and body composition.

Cardiorespiratory 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)

Table 6.3.1

Examples of Different Aerobic Physical Activities and Intensities	
Moderate Intensity	Vigorous Intensity
• Walking briskly (3 miles per hour or faster, but not race-walking) • Water aerobics • Bicycling slower than 10 miles per hour • Tennis (doubles) • Ballroom dancing • General gardening	• 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

Frequency and Duration

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.

Intensity

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. 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.

Muscular Strength and Endurance

- **Muscular strength:** The ability of muscles to exert maximal effort.
- **Muscular endurance:** The ability of muscles to exert submaximal effort repetitively (contract over and over again or hold a contraction for a long time).

Activities for Muscular Strength and Endurance

These kind of activities, 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).

Activities for Muscular Strength and Endurance 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). Repetitions play a key role in determining if an activity is improving muscular strength or endurance. Low repetitions with more weight will focus more on muscular strength, while high repetitions with less weight will focus more on muscular endurance. 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.

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.

Flexibility

Flexibility is the ability of moving a joint through the range of motion. 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. Although there are not specific national guidelines for flexibility, adults should do flexibility exercises at least two or three days each week to improve range of motion. This can be done by holding a stretch for 10-30 seconds to the point of tightness or slight discomfort. Repeat each stretch two to four times, accumulating 60 seconds per stretch.

Body composition

The percentage of the body composed of lean tissue (muscle, bone, fluids, etc.) and fat tissue. Changes in body composition usually occur as a result of improvements in the other components of health related physical fitness, as well as changes in eating habits. This is discussed in more detail in the Weight Management and Healthy Eating Chapter.

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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6.4: Adding Physical Activity to Your Life

Overcoming the Barrier to Being Physical Active

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. Please visit the link below to see a full table of SUGGESTIONS FOR OVERCOMING PHYSICAL ACTIVITY BARRIERS:

courses.candelalearning.com/...yto-your-life/

Creating your own Fitness Program

The first step to implementing a fitness program is to identify your goals. As discussed in earlier chapters, goals should be specific, measurable, action-oriented, realistic and time-bound (SMART). Progress can be difficult to track if goals are vague and open-ended, such as *"I will exercise more."* Here is an example of a SMART goal for fitness:

- Specific: *"I will walk for 30 minutes a day 3-5 days per week"*
- Measurable: *"I will improve my resting heart rate over the next month"*
- Action-Oriented: *"I will research walking routes around my home and campus"*
- Realistic: *"I will increase my walking to 45 minutes per day in one month"*
- Time Bound: *"I will try this walking program for one month and then reassess my goals"*

You can also make a SMART Goal in one statement, such as *"I will walk for 30 minutes 3-5 days per week for the next month in order to improve my resting heart rate."*

FITT Principle

Using the FITT principle is one way remember the guidelines for physical activity and create a prescription for improvement in your health-related physical fitness.

- **Frequency:** how often a person performs a health-related physical activity.
- **Intensity:** how hard a person exercises during a physical activity period. Intensity can be measured in different ways, depending on the related health-related component.
- **Time:** also known as duration. Refers to the amount of time or repetitions when performing a physical activity.
- **Type:** the kind of exercise or physical activity a person is performing.

Adapted from:

www.ode.state.or.us/teachlear...tprinciple.pdf

Table 6.4.1

	Cardiorespiratory	Flexibility	Muscular Endurance	Muscular Strength
F Frequency	3-5 times per week Increase frequency as you get into better shape	Should be a regular part of your warm-up and cool-down Increase frequency as you get into better shape	Daily for some muscle groups Perform 3-4 times per week Increase frequency as you get into better shape	Perform 3 times per week Different muscle groups each time you work out Increase frequency as you get into better shape
I Intensity	50%-60% of heart rate reserve Increase intensity as you get into better shape	Stretch all major muscles and joints; hold for 15-30 seconds Perform 1-3 repetitions Increase intensity as you get into better shape	Less than 50% of your predicted 1-rep max Start with body weight then add resistance 15 or more reps/1-3 sets Increase intensity as you get into better shape	60%-80% of 1-rep max 8-12 reps / 1-3 sets Increase intensity as you get into better shape
T Time	20-60 minutes of continuous activity Increase the time as you get into better shape	10-20 minutes Increase the time as you get into better shape	30-60 minutes Increase the time as you get into better shape	15-60 minutes Increase the time as you get into better shape
T Type	Running, cycling, swimming, and activities that use large muscles	Perform static stretches and controlled dynamic stretches	Resistance training (body weight/ tubing/medicine balls/free weights)	Resistance training (body weight/ tubing/medicine balls/free weights)

Measuring Intensity

Target Heart Rate and Estimated Maximum Heart Rate

Exercise intensity can be measured using either heart rate or the rating of perceived exertion (RPE) method. We will look at each of these methods in turn. There are two methods of using heart rate to measure exercise intensity: the percentage of maximal heart rate method and the heart rate reserve (HRR), or karvonen method.

As its name suggests, the percentage of maximal heart rate method involves prescribing exercise at a certain percentage of maximum heart rate. To find out a person's true maximum heart rate we need to measure it in a laboratory. However, for most people this is impractical; therefore we can estimate maximum heart rate using the formula '220 – age'.

Example 1: Percentage Heart Rate Method

Case study: 'Mariella', age 30

1. Calculate maximum heart rate (HR_{max})

- Estimated $HR_{max} = 220 - \text{age}$
- $= 220 - 30 = 190 \text{ bpm}$ (beats per minute)

2. Calculate exercise intensity

- ACSM guidelines = 55–90% of HR_{max}
- Lower target (55%) = $190 \times 55\%$
- $= 190 \times 0.55 = 104.5 \text{ bpm}$ (we would round this up to 105 bpm)
- Upper target (90%) = $190 \times 90\%$
- $= 190 \times 0.90 = 171 \text{ bpm}$

This formula gives us an idea of maximum heart rate, but we must remember that it is just an estimate and not completely accurate. Therefore using this method, according to ACSM guidelines, Mariella should exercise at a heart rate somewhere between **105 and**

171 bpm. This is quite a wide range so, depending on her fitness levels, you would need to decide whether to prescribe Mariella exercise to the upper or lower end of this scale.

Please note that there are online calculators available to calculate all of this information for you. Once such calculator can be found at:

http://www.sparkpeople.com/resource/...tor_target.asp

The HRR method is thought to be more accurate than the percentage of maximal heart rate method because it takes the individual's resting heart rate into account. The formula for calculating HRR can be seen in Box 2. The ACSM recommends that to improve aerobic fitness, exercise intensity should be set at either 40–85 per cent of (HRR) or 55–90 per cent of maximum heart rate (HR_{max}) (Pollock et al., 1998). These ranges are deliberately broad to reflect different levels of fitness; that is, someone with relatively low levels of fitness who has just started an exercise programme may need to work on the lower end of the scale, whereas someone who has a higher level of fitness, perhaps who has been exercising for a while, may need to work at an intensity towards the upper end of the scale. This demonstrates the importance of *progression* in an exercise programme.

Example 2: Heart Rate Reserve Method

Case study: 'Mariella', age 30

1. **Calculate maximum heart rate (HR_{max})**
 - Estimated $HR_{max} = 220 - \text{age}$
 - $= 220 - 30 = \mathbf{190 \text{ bpm}}$ (beats per minute)
2. **Measure resting heart rate (HR_{rest})**
 - You would measure this either using a heart rate monitor or manually, using your fingers. Ideally it should be measured first thing in the morning. Let's imagine that Mariella's HR_{rest} has been measured at **70 bpm**.
3. **Calculate heart rate reserve (HRR)**
 - $HRR = HR_{max} - HR_{rest} = 190 - 70 = \mathbf{120 \text{ bpm}}$
4. **Calculate exercise intensity**
 - ACSM guidelines = 40–85% HRR
 - Lower target (40%) = $(HRR \times 40\%) + HR_{rest}$
 - $= (120 \times 0.40) + 70$
 - $= 48 + 70 = \mathbf{118 \text{ bpm}}$
 - Upper target (85%) = $(HRR \times 85\%) + HR_{rest}$
 - $= (120 \times 0.85) + 70$
 - $= 102 + 70$
 - $= \mathbf{172 \text{ bpm}}$

Using this method, according to ACSM guidelines, Mariella should exercise somewhere between **118 and 172 bpm**.

Borg Scale

An alternative to using heart rate methods is the RPE method of measuring exercise intensity. However, you should note that it is difficult to give a general recommendation for RPE, as it is by its very nature open to personal interpretation; that is, what I consider to be a 12 may be different to what you consider to be a 12. RPE can be a useful way of measuring exercise intensity when heart rate monitoring is difficult or inappropriate. For example, some types of medication (e.g. beta blockers) given to people with hypertension lower the heart rate, and therefore heart rate measurement is not appropriate for people on this type of medication. The **Borg Rating of Perceived Exertion (RPE) Scale** is one way to measure 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. 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, 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.

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.



Figure 6.4.1 Taking your heart rate

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6.5: Implementing Your Fitness Plan

The Beneficial Effects of Increasing Physical Activity: It's About Overload, Progression, and Specificity

Creating a safe and effective fitness program involves knowing certain basic principles of physical fitness: 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. These principles should be taken into consideration during any exercise program if you expect to meet your goals.

Designing a program

Warm-up and Cool down Activities

Warm-up and cool-down activities are an important 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.

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.

Achieving Your Physical Activities: 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.

Be 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 module 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.

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. 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. 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. 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. 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.

Increase Physical Activity Gradually Over Time

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 to 15 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. 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:

1. The right equipment for the activity
2. Appropriately fitted
3. Appropriately maintained
4. Used consistently and correctly.

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.

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.

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.

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.

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.

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6.5.1: Additional Safety Concerns

As activity rates among Americans increase, specifically outdoor activities, safety concerns also rise. Unfortunately, the physical infrastructure of many American cities does not accommodate active lifestyles. Limited financial resources and de-emphasis on public health means local and state governments are unlikely to allocate funds for building roads with sidewalks, creating walking trails that surround parks, or adding bike lanes. In addition, time constraints and inconvenience make it challenging for participants to travel to areas where these amenities are available. As a result, exercise participants share roads and use isolated trails/pathways, inherently increasing the safety risks of being active.

A key principle in outdoor safety is to recognize and avoid the extremes. For example, avoid roads that experience heavy traffic or are extremely isolated. Avoid heavy populated areas as well as places where no one is around. Do not exercise in the early morning or late at night, during extreme cold or extreme heat. To minimize safety risks during these types of environmental conditions, do not use headphones that could prevent you from hearing well and remaining alert, do not exercise alone, prepare for adequate hydration in the heat, and use warm clothing in extreme cold to avoid frostbite. Extreme conditions require extra vigilance on your part.

A second key principle, whether outdoor or indoor, is to simply use common sense. While this caveat seems obvious, it gets ignored far too often. Always remember the purpose of your exercise is for enjoyment and improved health. If these objectives could be compromised by going for a run at noon in 95-degree heat, or lifting large amounts of weight without a spotter, you should reconsider your plan. Before exercising in what could be risky conditions, ask yourself, “Is there a safer option available?”

Lastly, be aware of the terrain and weather conditions. Walking or jogging on trails is a wonderful way to enjoy nature, but exposed roots and rocks present a hazard for staying upright. Wet, muddy, or icy conditions are additional variables to avoid in order to complete your exercise session without an accident.

The document linked below from the University of Texas at San Antonio Police Department outlines specific safety tips that will help you stay safe in your activities.

[Safety Tips for Runners, Walkers, and Joggers](#)

Environmental Conditions

When exercising outdoors, you must consider the elements and other factors that could place you at increased risk of injury or illness.

Heat-Related Illness

Heat-related illnesses, such as heat cramps, heat exhaustion, and heat stroke, contributed to 7,233 deaths in the United States between 1999 and 2009. A 2013 report released by the Center for Disease Control stated that about 658 deaths from heat-related illnesses occurred every year which account for more deaths than tornadoes, hurricanes, and lightning combined. Of those deaths, most were male, older adults.⁸

The number one risk factor associated with heat-related illness is hydration, the starting point of all heat-related illness. Unfortunately, sweat loss can occur at a faster rate than a person can replace with fluids during exercise, especially at high intensities. Even when trying to hydrate, ingestion of large amounts of fluids during exercise can lead to stomach discomfort. What does this mean? Hydration must begin before exercise and must become part of your daily routine.

Several practical methods of monitoring hydration levels can assist in preventing illness. One simple method, while not full proof, is to simply monitor the color of your urine. In a hydrated state, urination will occur frequently (every 2–3 hours) and urine will have very little color. In a dehydrated state, urination occurs infrequently in low volume and will become more yellow in color.

Another simple method involves weighing yourself before and after a workout (see lab). This is a great way to see firsthand how much water weight is lost during an exercise session primarily as a result of sweat. Your goal is to maintain your pre- and post-body weight by drinking fluids during and after the workout to restore what was lost. This method, when combined with urine-monitoring, can provide a fairly accurate assessment of hydration levels.

The best preventative measure for maintaining a hydrated state is simply drinking plenty of water throughout the day. In previous years, recommendations for the amount of water to drink were a one size fits all of about 48–64 oz. per day, per person. In an effort to individualize hydration, experts now recommend basing fluid intake on individual size, gender, activity levels, and climate. Generally, half an ounce (fluid ounces) to 1 ounce per pound of body weight is recommended.⁹ For a 150-pound individual, this would mean 75–150 ounces of water per day! While there is still considerable debate over the exact amounts, no one disputes the importance of continually monitoring your hydration using one of the techniques described previously. Insufficient hydration leads to poor performance, poor health, and potentially serious illness.

It should be noted that electrolyte “sport” drinks, such as Gatorade and PowerAde, are often used to maintain hydration. While they can be effective, these types of drinks were designed to replace electrolytes (potassium, sodium, chloride) that are lost through sweating during physical activity. In addition, they contain carbohydrates to assist in maintaining energy during activities of long duration. If the activity planned is shorter than 60 minutes in duration, water is still the recommended fluid. For activities beyond 60 minutes, a sports drink should be used.

Cold-Related Illnesses

Much like extremely hot environmental conditions, cold weather can create conditions equally as dangerous if you fail to take proper precautions. To minimize the risk of cold-related illness, you must prevent the loss of too much body heat. The three major concerns related to cold-related illnesses are hypothermia, frost-nip, and frost bite.

As with heat-related illness, the objective of preventing cold-related illness is to maintain the proper body temperature of between 98.6 and 99.9 degrees Fahrenheit. If body temperature falls below 98.6 F, multiple symptoms may appear, indicating the need to take action. Some of those symptoms include:

- Shivering
- Numbness and stiffness of joints and appendages
- Loss of dexterity and/or poor coordination
- Peeling or blistering of skin, especially to exposed areas
- Discoloration of the skin in the extremities

When walking or jogging in the cold, it is important to take the necessary steps to avoid problems that can arise from the environmental conditions.

- *Hydration is key.*

Cold air is usually drier air, which leads to moisture loss through breathing and evaporation. Staying hydrated is key in maintaining blood flow and regulating temperature.

- *Stay dry.*

Heat loss occurs 25x faster in water than on dry land. As such, keeping shoes and socks dry and clothing from accumulating too much sweat will allow for more effective body temperature regulation.

- *Dress appropriately.*

Because of the movement involved, the body will produce heat during the exercise session. Therefore, the key point is to direct moisture (sweat) away from the skin. This is controlled most effectively by layering your clothing. A base layer of moisture-wicking fabric should be used against the skin while additional layers should be breathable. This will channel moisture away from the skin, and any additional layers of clothing, without it becoming saturated in sweat. If exercising on a windy day, use clothing that protects from the wind and is adjustable so you can breathe.

- *Cover the extremities.*

Those parts of the body farthest away from the heart (toes, fingers, and ears) tend to get coldest first. Take the appropriate steps to cover those areas by using gloves, moisture-wicking socks, and a winter cap to cover your head.

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CHAPTER OVERVIEW

7: Muscular Strength and Endurance

By Jonathan Howard

Learning Objectives

- Describe muscular structure and function
- Identify types of muscles
- Describe an effective resistance exercise program
- Assess your muscular strength and endurance
- Understand the dangers of supplements

Muscles are used for movement in the body. The largest portion of energy expenditure in the body happens in muscles while helping us perform daily activities with ease and improving our wellness. Muscular strength is the amount of force that a muscle can produce one time at a maximal effort, and muscular endurance is the ability to repeat a movement over an extended period of time. Resistance training is the method of developing muscular strength and muscular endurance, which in turns improves wellness. This chapter explores many ways to resistance train. However, achieving the best muscular performance requires the assistance of a trained professional. For more information download this pdf on [Muscular Strength and Endurance](#)

[7.1: Muscular Physiology](#)

[7.2: Resistance Exercise Programing](#)

[7.3: Supplements](#)

[7.4: Assessing your Muscular Strength and Endurance](#)

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7.1: Muscular Physiology

Muscles are highly specialized to contract forcefully. Muscles are powered by muscle cells, which contract individually within a muscle to generate force. This force is needed to create movement. There are over 600 muscles in the human body; they are responsible for every movement we make, from pumping blood through the heart and moving food through the digestive system, to blinking and chewing. Without muscle cells, we would be unable to stand, walk, talk, or perform everyday tasks.

Types of Muscle

There are three types of muscle:

- *Skeletal Muscle* - Responsible for body movement.
- *Cardiac Muscle* - Responsible for the contraction of the heart.
- *Smooth Muscle* - Responsible for many tasks, including movement of food along intestines, enlargement and contraction of blood vessels, size of pupils, and many other contractions.

Skeletal Muscle Structure and Function

Skeletal muscles are attached to the skeleton and are responsible for the movement of our limbs, torso, and head. They are under conscious control, which means that we can consciously choose to contract a muscle and can regulate how strong the contraction actually is. Skeletal muscles are made up of a number of **muscle fibers**. Each muscle fiber is an individual muscle cell and may be anywhere from 1 mm to 4 cm in length. When we choose to contract a muscle fiber—for instance we contract our bicep to bend our arm upwards—a signal is sent from our brain via the spinal cord to the muscle. This signals the muscle fibers to contract. Each nerve will control a certain number of muscle fibers. The nerve and the fibers it controls are called a **motor unit**. Only a small number of muscle fibers will contract to bend one of our limbs, but if we wish to lift a heavy weight then many more muscles fibers will be recruited to perform the action. This is called muscle **fiber recruitment**.

Each muscle fiber is surrounded by connective tissue called an **external lamina**. A group of muscle fibers are encased within more connective tissue called the **endomysium**. The group of muscle fibers and the endomysium are surrounded by more connective tissue called the **perimysium**. A group of muscle fibers surrounded by the perimysium is called a muscle **fasciculus**. A muscle is made up of many muscle fasciculi, which are surrounded by a thick collagenous layer of connective tissue called the **epimysium**. The epimysium covers the whole surface of the muscle.

Muscle fibers also contain many mitochondria, which are energy powerhouses that are responsible for the aerobic production of energy molecules, or **ATP molecules**. Muscle fibers also contain glycogen granules as a stored energy source, and **myofibrils**, which are threadlike structures running the length of the muscle fiber. Myofibrils are made up of two types of protein: 1) **Actin myofilaments**, and 2) **myosin myofilaments**. The actin and myosin filaments form the contractile part of the muscle, which is called

the **sarcomere**. Myosin filaments are thick and dark when compared with actin filaments, which are much thinner and lighter in appearance. The actin and myosin filaments lie on top of one another; it is this arrangement of the filaments that gives muscle its striated or striped appearance. When groups of actin and myosin filaments are bound together by connective tissue they make the myofibrils. When groups of myofibrils are bound together by connective tissue, they make up muscle fibers.

The ends of the muscle connect to bone through a tendon. The muscle is connected to two bones in order to allow movement to occur through a joint. When a muscle contracts, only one of these bones will move. The point where the muscle is attached to a bone that moves is called the **insertion**. The point where the muscle is attached to a bone that remains in a fixed position is called the **origin**.

How Muscles Contract

Muscles are believed to contract through a process called the **Sliding Filament Theory**. In this theory, the muscles contract when actin filaments slide over myosin filaments resulting in a shortening of the length of the sarcomeres, and hence, a shortening of the muscle fibers. During this process the actin and myosin filaments do not change length when muscles contract, but instead they slide past each other.

During this process the muscle fiber becomes shorter and fatter in appearance. As a number of muscle fibers shorten at the same time, the whole muscle contracts and causes the tendon to pull on the bone it attaches to. This creates movement that occurs at the point of insertion.

For the muscle to return to normal (i.e., to lengthen), a force must be applied to the muscle to cause the muscle fibers to lengthen. This force can be due to gravity or due to the contraction of an opposing muscle group.

Skeletal muscles contract in response to an electric signal called an **action potential**. Action potentials are conducted along nerve cells before reaching the muscle fibers. The nerve cells regulate the function of skeletal muscles by controlling the number of action potentials that are produced. The action potentials trigger a series of chemical reactions that result in the contraction of a muscle.

When a nerve impulse stimulates a motor unit within a muscle, all of the muscle fibers controlled by that motor unit will contract. When stimulated, these muscle fibers contract on an all-or-nothing basis. The all- or-nothing principle means that muscle fibers either contract maximally along their length or not at all. Therefore, when stimulated, muscle fibers contract to their maximum level and when not stimulated there is no contraction. In this way, the force generated by a muscle is not regulated by the level of contraction by individual fibers, but rather it is due to the number of muscle fibers that are recruited to contract. This is called **muscle fiber recruitment**. When lifting a light object, such as a book, only a small number of muscle fibers will be recruited. However, those that are recruited will contract to their maximum level. When lifting a heavier weight, many more muscle fibers will be recruited to contract maximally.

When one muscle contracts, another opposing muscle will relax. In this way, muscles are arranged in pairs. An example is when you bend your arm at the elbow: you contract your bicep muscle and relax your tricep muscle. This is the same for every movement in the body. There will always be one contracting muscle and one relaxing muscle. If you take a moment to think about these simple movements, it will soon become obvious that unless the opposing muscle is relaxed, it will have a negative effect on the force generated by the contracting muscle.

A muscle that contracts, and is the main muscle group responsible for the movement, is called the **agonist** or **prime mover**. The muscle that relaxes is called the **antagonist**. One of the effects that regular strength training has is an improvement in the level of relaxation that occurs in the opposing muscle group. Although the agonist/antagonist relationship changes, depending on which muscle is responsible for the movement, every muscle group has an opposing muscle group.

Below are examples of agonist and antagonist muscle group pairings:

AGONIST (Prime Mover)	Antagonist
Latimus Dorsi (upper back)	Deltoids (shoulder)
Rectus Abdominus (stomach)	Erector Spinae (back muscles)
Quadriceps (top of thigh)	Hamstrings (back of thigh)
Gastrocnemius (calf)	Tibialis Anterior (front of lower leg)
Soleus (below calf)	Tibialis Anterior (front of lower leg)

Smaller muscles may also assist the agonist during a particular movement. The smaller muscle is called the **synergist**. An example of a synergist would be the deltoid (shoulder) muscle during a press-up. The front of the deltoid provides additional force during the press-up; however, most of the force is applied by the pectoralis major (chest). Other muscle groups may also assist the movement by helping to maintain a fixed posture and prevent unwanted movement. These muscle groups are called **fixators**. An example of a fixator is the shoulder muscle during a bicep curl or tricep extension.

Types of Muscular Contraction

- *Isometric* - This is a static contraction where the length of the muscle, or the joint angle, does not change. An example is pushing against a stationary object such as a wall. This type of contraction is known to lead to rapid rises in blood pressure.
- *Isotonic* - This is a moving contraction, also known as **dynamic contraction**. During this contraction the muscle fattens, and there is movement at the joint.

Types of Isotonic Contraction

- *Concentric*
This is when the muscle contracts and shortens against a resistance. This may be referred to as the lifting or positive phase. An example would be the lifting phase of the bicep curl.
- *Eccentric*
This occurs when the muscle is still contracting and lengthening at the same time. This may be referred to as the lowering or negative phase.

Muscle Fiber Types

Not all muscle fibers are the same. In fact, there are two main types of muscle fiber:

- *Type I* - Often called slow-twitch or highly-oxidative muscle fibers
- *Type II* - Often called fast-twitch or low-oxidative muscle fibers

Additionally, Type II muscle fibers can be further split into **Type IIa** and **Type IIb**. Type IIb fibers are the truly fast twitch fibers, whereas Type IIa are in between slow and fast twitch. Surprisingly, the characteristics of Type IIa fibers can be strongly influenced by the type of training undertaken. Following a period of endurance training, they will start to strongly resemble Type I fibers, but following a period of strength training they will start to strongly resemble Type IIb fibers. In fact, following several years of endurance training they may end up being almost identical to slow-twitch muscle fibers.

Type I (Slow-Twitch Muscle Fibers)

Slow-twitch muscle fibers contain more **mitochondria**, the organelles that produce aerobic energy. They are also smaller, have better blood supply, contract more slowly, and are more fatigue resistant than their fast-twitch brothers. Slow-twitch muscle fibers produce energy, primarily, through aerobic metabolism of fats and carbohydrates. The accelerated rate of aerobic metabolism is enhanced by the large numbers of mitochondria and the enhanced blood supply. They also contain large amounts of **myoglobin**, a pigment similar to hemoglobin that also stores oxygen. The myoglobin provides an additional store of oxygen for when oxygen supply is limited. This extra oxygen, along with the slow-twitch muscle fibers' slow rate of contraction, increases their endurance capacity and enhances their fatigue resistance. Slow-twitch muscle fibers are recruited during continuous exercise at low to moderate levels.

Type IIb (Fast-Twitch Low-oxidative Muscle Fibers)

These fibers are larger in size, have a decreased blood supply, have smaller mitochondria and less of them, contract more rapidly, and are more adapted to produce energy **anaerobically** (without the need for oxygen) than slow-twitch muscle fibers. Their reduced rate of blood supply, together with their larger size and fewer mitochondria, makes them less able to produce energy aerobically, and are therefore, not well suited to prolonged exercise. However, their faster rate of contraction, greater levels of glycogen, and ability to produce much greater amounts of energy anaerobically make them much more suited to short bursts of energy. Because of their greater speed of contraction and reduced blood supply, they are far less fatigue resistant than slow-twitch fibers, and they tire quickly during exercise.

Numbers of Slow and Fast-Twitch Fibers

The number of slow and fast-twitch fibers contained in the body varies greatly between individuals and is determined by a person's genetics. People who do well at endurance sports tend to have a higher number of slow-twitch fibers, whereas people who are better at sprint events tend to have higher numbers of fast-twitch muscle fibers. Both the slow twitch and fast-twitch fibers can be influenced by training. It is possible through sprint training to improve the power generated by slow twitch fibers, and through endurance training, it is possible to increase the endurance level of fast-twitch fibers. The level of improvement varies, depending

on the individual, and training can never make slow-twitch fibers as powerful as fast-twitch, nor can training make fast-twitch fibers as fatigue resistant as slow-twitch fibers.

Cardiac Muscle Structure and Function

Cardiac muscle cells are only found in the heart. They are elongated and contain actin and myosin filaments, which form **sarcomeres**; these join end to end to form **myofibrils**. The actin and myosin filaments give cardiac muscle a striated appearance. The striations are less numerous than in skeletal muscle. Cardiac muscles contain high numbers of mitochondria, which produce energy through aerobic metabolism. An extensive capillary network of tiny blood vessels supply oxygen to the cardiac muscle cells. Unlike the skeletal muscle cells, the cardiac cells all work as one unit, all contracting at the same time. In short, the sinoatrial node at the top of the heart sends an impulse to the atrioventricular node, which sends a wave of polarization that travels from one heart cell to another causing them all to contract at the same time.

Smooth Muscle Structure and Function

Smooth muscle cells are variable in function and perform numerous roles within the body. They are spindle shaped and smaller than skeletal muscle and contain fewer actin and myosin filaments. The actin and myosin filaments are not organized into sarcomeres, so smooth muscles do not have a striated appearance. Unlike other muscle types, smooth muscle can apply a constant tension. This is called **smooth muscle tone**. Smooth muscle cells have a similar metabolism to skeletal muscle, producing most of their energy aerobically. As such, they are not well adapted to producing energy anaerobically.¹

For more information on muscle physiology, click on the links below:

[Skeletal Muscle Physiology](#)

Fast Twitch versus Slow Twitch Video



Actin and Myosin: the Romeo and Juliet of Muscle Cells



Skeletal Muscles



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7.2: Resistance Exercise Programing

Designing a resistance exercise program can seem like a daunting task. However, the basics are very simple. The table below provides instructions for designing an effective resistance exercise program.

Resistance Exercise Program

F	Frequency of Exercise	How Often	Beginner	2–3 days per week Full-body workout of all 6 body areas 48–72 hours of rest in-between workouts	
			Intermediate to High	4–5 days per week; often perform split workouts (example: Monday and Thursday, work chest, shoulders, triceps, abdominals; Tuesday and Friday, work back, legs, biceps) 48–72 hours of rest in-between workouts	
I	Intensity of Exercise	How Hard	Beginner	60%–70% of maximum strength	
			Intermediate to High	70%–90% of maximum strength	
T	Time of Exercise	–How many reps –How many sets –How much time between sets	Beginner	1–3 Sets 8–12 repetitions	30 sec to 1 minute
			Intermediate to High	Endurance – 12–20+ Reps 2–3 Sets	30 sec to 1 minute
				Strength – 2–6 Reps 3–5 Sets	2 to 5 minutes
T	Type of Exercise	Which Exercises	Weight machines, free weights, resistance tubing, medicine ball, own body weight		

Note

Specificity Principle - you must work each muscle group to have strength gains in that particular part of the body

Recommendations for Resistance Training Exercise

- Perform a minimum of 8 to 10 exercises that train the major muscle groups.
 - Workouts should not be too long. Programs longer than one hour are associated with higher dropout rates.
 - Choose more compound, or multi-joint exercises, which involve more muscles with fewer exercises.
- Perform one set of 8 to 12 repetitions to the point of volitional fatigue.
 - More sets may elicit slightly greater strength gains, but additional improvement is relatively small.
- Perform exercises at least 2 days per week.
 - More frequent training may elicit slightly greater strength gains, but additional improvement is relatively small since progress is made during the recuperation between workouts.
- Adhere as closely as possible to the specific exercise techniques.
- Perform exercises through a full range of motion.
 - Elderly trainees should perform the exercises in the maximum range of motion that does not elicit pain or discomfort.
- Perform exercises in a controlled manner.

- *Maintain a normal breathing pattern.*
- *If possible, exercise with a training partner.*
 - Partners can provide feedback, assistance, and motivation.

Position Stand on Progression Models in Resistance Training for Healthy Adults²

- *Both concentric and eccentric muscle actions*
- *Both single and multiple joint exercises*
- *Exercise sequence*
 - Large before small muscle group exercises
 - Multiple-joint exercises before single-joint exercises
 - Higher intensity before lower intensity exercises
- *When training at a specific RM load*
 - 2-10% increase in load if one to two repetitions over the desired number
- *Training frequency*
 - 2-3 days per week for novice and intermediate training
 - 4-5 days per week for advanced training
- *Novice training*
 - 8-12 repetition maximum (RM)
- *Intermediate to advanced training*
 - 1-12 RM using periodization* (strategic implementation of specific training phases alternating between phases of stress and phases of rest)
 - Eventual emphasis on heavy loading (1-6 RM)
 - At least 3-min rest periods between sets
 - Moderate contraction velocity
 - 1-2 s concentric, 1-2 s eccentric

* For more information on using periodization for weight training, click on the link below:

Periodization for Weight Training

Details

- *Hypertrophy training*
 - 1-12 RM in periodized fashion, with emphasis on the 6-12 RM zone
 - 1- to 2-min rest periods between sets
 - Moderate contraction velocity
 - Higher volume, multiple-set programs
- *Power training* (two general loading strategies):
 - **Strength training**
 - Use of light loads
 - 30-60% of 1 RM
 - Fast contraction velocity
 - 2-3 min of rest between sets for multiple sets per exercise
 - Emphasize multiple-joint exercises especially those involving the total body
 - **Local muscular endurance training**
 - Light to moderate loads
 - 40-60% of 1 RM
 - High repetitions (> 15)
 - Short rest periods (< 90 seconds)

Recommendations should be viewed within the context of an individual's target goals, physical capacity, and training status.

Six Types of Resistance Training

Each type of resistance training benefits muscles in a different way. While these types of resistance training are not new, they could be unique sources of resistance that you have not considered in your quest to add muscle to your frame. Using these forms of resistance alone, in combination with one another, or in combination with the more traditional resistance apparatus, can enable you to diversify your efforts to produce valuable and improved results.

In each type of training, you may use an apparatus to create an environment for resistance. The uniqueness of these sources is found in the way they are implemented. You might use a dumbbell for a particular exercise in some of these alternative resistance methods, but the way you use the resistance through a range of motion may be altogether different.

In isokinetic training, resistance is steady while velocity remains constant. For example, isokinetics are at work with any machine that is hydraulically operated. The opposing forces mirror each other throughout the range of motion. A good example would be pressing down for triceps on a hydraulic machine and having to immediately pull up (the resistance is constant in both directions) into a biceps curl while maintaining the same speed. IKT often involves opposing body parts. Trainers can use a variety of apparatus with their clients to achieve isokinetic stasis between muscle groups.

- *Dynamic Constant Training*

As the name suggests, the most distinctive feature of dynamic constant training (DCT) is that the resistance is constant. A good example of DCT occurs when you use free weights or machines that do not alter resistance, but redirect it instead. The emphasis shifts to different planes along the muscle group being worked. When you work on a shoulder-press machine, for example, the resistance remains constant over the entire range of motion. It is identical from the bottom of the movement to the top and back down again. Only the direction of the resistance varies. The resistance redirects itself through the arc and then redirects itself again when the shoulders let the weight come back down to the starting position.

- *Dynamic Progressive Training*

In dynamic progressive training (DPT), resistance increases progressively as you continue to exercise. DPT is often used as a rehabilitative measure and offers the sort of resistance that builds gradually while remaining completely within the control of the person using it. Equipment includes rubber bands and tubing, springs, and an apparatus controlled by spring-loaded parts. They are low- cost items that are easily accessible and can be used anywhere. Though commonly employed for rehabilitation of torn ligaments, joints, muscles, and broken bones, it is also convenient for travelers on either vacation or business trips. When combined with traditional forms of resistance, this training creates a better-balanced program and provides the muscles with a welcome alternative from time to time.

- *Dynamic Variable Training*

This form of resistance exercise takes up where dynamic constant training leaves off. Whereas DCT employs constant resistance, never varying to accommodate the body's mechanics, DVT can be adapted to the varying degrees of strength of a muscle group throughout a range of motion. Though very few machines succeed in this goal, a few have come close.

Hammer Strength equipment emphasizes common fixed areas of resistance. However, the Strive line of equipment has been able to give the user much more choice in resistance levels during an exercise. Strive equipment uses the DVT principle most effectively because it allows the user to increase resistance at the beginning, middle or end of the range of motion. If your joints are stronger at the end of a movement (the top) or the beginning (the bottom), you can set the resistance accordingly. The Strive line is the most flexible yet of all gym equipment designed to adhere to the DVT principle. It lets you tailor-make your workouts based on your body's mechanics.

- *Isokinetic Training*

In isokinetic training (IKT), the muscle is contracted at a constant tempo. Speed determines the nature of this resistance training, not the resistance itself; however, the training is based on movement carried out during a condition of resistance. IKT can be performed with the body's own weight.

In isokinetic training, resistance is steady while velocity remains constant. For example, isokinetics are at work with any machine that is hydraulically operated. The opposing forces mirror each other throughout the range of motion. A good example would be pressing down for triceps on a hydraulic machine and having to immediately pull up (the resistance is constant in both

directions) into a biceps curl while maintaining the same speed. IKT often involves opposing body parts. Trainers can use a variety of apparatus with their clients to achieve isokinetic stasis between muscle groups.

- *Isometric Training*

Familiar to most people, isometric training (IMT) is an excellent way to build strength with little adverse effect on joints and tendons commonly associated with strength training and lifting heavy weights. Though it appears simple in comparison to traditional resistance training, IMT should not be underrated in its effectiveness. IMT is a method in which the force of contraction is equal to the force of resistance. The muscle neither lengthens nor shortens. You may be wondering how any training occurs without lengthening and shortening the muscles. In IMT, the muscles act against each other or against an immovable object.

Isometric training is what you see swimmers do when they press their hands against a solid wall, forcing all their bodyweight into the wall. Another common IMT exercise is pressing the hands together to strengthen the pectorals and biceps. Pressing against the wall can involve muscles in the front deltoid, chest and biceps. Isometric training has been proven very effective for gaining strength, but this method usually strengthens only the muscles at the point of the isometric contraction. If the greatest resistance and force are acting upon the mid-portion of the biceps, that is where most of the benefit will occur. A comprehensive isometric routine can serve to increase strength in certain body parts.

- *Isotonic Training*

This method demands constant tension, typically with free weights. Though this approach may sound a lot like dynamic constant training, it differs because it does not necessarily redirect the resistance through a range of motion, but rather, keeps tension constant as in the negative portion of an exercise. Complete immobility of the muscle being worked is required. For example, in the preacher curl, the biceps are fixed against the bench. They lift (positive), then release the weight slowly downward (negative), keeping the same tension on the muscles in both directions. This is one reason that free-weight exercise is considered the best form of isotonic training. Merely lifting a dumbbell or barbell, however, is not necessarily enough to qualify as isotonic. The true essence of isotonic training is keeping resistance constant in both the positive and negative portions of each repetition.

Exercise Order for Resistance Training

The general guidelines for exercise order when training all major muscle groups in a workout is as follows:

- Large muscle group exercises (i.e., squat) should be performed before smaller muscle group exercises (i.e., shoulder press).
- Multiple-joint exercises should be performed before single-joint exercises.
- For power training, total body exercises (from most to least complex) should be performed before basic strength exercises. For example, the most complex exercises are the snatch (because the bar must be moved the greatest distance) and related lifts, followed by cleans and presses. These take precedence over exercises such as the bench press and squat.
- Alternating between upper and lower body exercises or opposing (agonist–antagonist relationship) exercises can allow some muscles to rest while the opposite muscle groups are trained. This sequencing strategy is beneficial for maintaining high training intensities and targeting repetition numbers.
- Some exercises that target different muscle groups can be staggered between sets of other exercises to increase workout efficiency. For example, a trunk exercise can be performed between sets of the bench press. Because different muscle groups are stressed, no additional fatigue would be induced prior to performing the bench press. This is especially effective when long rest intervals are used.³

Resistance Training Conclusion

The most effective type of resistance- training routine employs a variety of techniques to create a workout program that is complete and runs the gamut, from basic to specialized. Learning different methods of training, different types of resistance, and the recommended order can help you acquire a balanced, complete physique. That does not mean that these training methods will help everybody to win competitions, but they will help you learn how to tune in to your body and understand its functions through resistance and movement. This knowledge and understanding develops a valuable skill, allowing you to become more adept at finding what works best for you on any given day.

For additional information on resistance exercises, click on the links below:

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7.3: Supplements

Many active people use nutritional supplements and drugs in the quest for improved performance and appearance. Most of these substances are ineffective and expensive, and many are dangerous. A balanced diet should be your primary nutritional strategy.

Below are links that provide additional information about the use of supplements during exercise:

Benefits and Side Effects of Steroid Use



Claims versus actual effects of performance aids

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7.4: Assessing your Muscular Strength and Endurance

Functional Leg Strength Tests

The following tests assess functional leg strength using squats. Most people do squats improperly, increasing their risk of knee and back pain. Before you add weight-bearing squats to your weight-training program, you should determine your functional leg strength, check your ability to squat properly, and give yourself a chance to master squatting movements. The following leg strength tests will help you in each of these areas.

These tests are progressively more difficult, so do not move on to the next test until you have scored at least a 3 on the current test. On each test, give yourself a rating of 0, 1, 3, or 5, as described in the instructions that follow the last test.

Chair Squat

Instructions

1. Sit up straight in a chair with your back resting against the backrest and your arms at your sides. Your feet should be placed more than shoulder-width apart so that you can get them under your body.
2. Begin the motion of rising out of the chair by flexing (bending) at the hips-not the back. Then squat up using a hip hinge movement (no spine movement). Stand without rocking forward, bending your back, or using external support, and keep your head in a neutral position.
3. Return to the sitting position while maintaining a straight back and keeping your weight centered over your feet. Your thighs should abduct (spread) as you sit back in the chair. Use your rear hip and thigh muscles as much as possible as you sit.

Do five repetitions.

Your rating _____

Un-weighted Squat

Instructions

1. Stand with your feet placed slightly more than shoulder-width apart, toes pointed out slightly, hands on hips or across your chest, head neutral, and back straight. Center your weight over your arches or slightly behind.
2. Squat down, keeping your weight centered over your arches and actively flexing (bending) your hips until your legs break parallel. During the movement, keep your back straight, shoulders back, and chest out, and let your thighs part to the side so that you are squatting between your legs.
3. Push back up to the starting position, hinging at the hips and not with the spine, maximizing a straight back and neutral head position.

Do five repetitions.

Your rating _____

Single-Leg Lunge-Squat with Rear-Foot Support

Instructions

1. Stand about 3 feet in front of a bench (with your back to the bench).
2. Place the instep of your left foot on the bench, and put most of your weight on your right leg (your left leg should be bent), with your hands at your sides.
3. Squat on your right leg until your thigh is parallel with the floor. Keep your back straight, chest up, shoulders back, and head neutral.
4. Return to the starting position. Do three repetitions for each leg. Your rating: _____

Rating Your Functional Leg Strength Test Results

- 5 POINTS

Performed the exercise properly with good back and thigh position, weight centered over the middle or rear of the foot, chest out, and shoulders back; good use of hip muscles on the way down and on the way up, with head in a neutral position throughout the movement; maintained good form during all repetitions; abducted (spread) the thighs on the way down during

chair squats and double-leg squats; for single-leg exercises, showed good strength on both sides; for single-leg lunge-squat with rear-foot support, maintained straight back, and knees stayed behind toes.

- **3 POINTS:**

Weight was forward on the toes, with some rounding of the back; used thigh muscles excessively, with little use of hip muscles; head and chest were too far forward; showed little abduction of the thighs during double-leg squats; when going down for single-leg exercises, one side was stronger than the other; form deteriorated with repetitions; for single-leg lunge-squat with rear-foot support and single-leg squat from a bench, could not reach parallel (thigh parallel with floor).

- **1 POINT**

Had difficulty performing the movement, rocking forward and rounding back badly; used thigh muscles excessively, with little use of hip muscles on the way up or on the way down; chest and head were forward; on un-weighted squats, had difficulty reaching parallel; and showed little abduction of the thighs on single-leg exercises, one leg was markedly stronger than the other; could not perform multiple repetitions.

- **0 POINTS**

Could not perform exercise.

Using Your Results

Are you at all surprised by your rating for muscular strength?

What factors, if any, influenced your ability to perform these assessments?

Are you satisfied with your current level of muscular strength as evidenced in your daily life? For example, are you happy with your ability to lift objects, climb stairs, and engage in sports and recreational activities?

Muscle Endurance Assessment

For best results, do not do any strenuous weight training within 48 hours of any test.

The 60-Second Sit-Up Test

- **Equipment**

1. Stopwatch, clock, or watch with a second hand
2. Partner

Warning

DO NOT TAKE THIS TEST IF YOU SUFFER FROM LOW-BACK PAIN.

To prepare, try a few sit-ups to get used to the proper technique and warm up your abdominal muscles.

1. Lie flat on your back on the floor with knees bent, feet flat on the floor, and your fingers interlocked behind your neck and your elbows wide. Your partner should hold your ankles firmly so that your feet stay on the floor as you do the sit-ups.
2. When your partner signals you to begin, raise your head and chest off the floor until your chest touches your knees or thighs, keeping your elbows wide, then return to the starting position. Keep your neck neutral. Do not force your neck forward, and stop if you feel any pain.
3. Perform as many sit-ups as you can in 60 seconds.

Number of sit-ups: _____

To rank your results, please see the chart on page 16.

Ratings for 60-second Sit-up Test:

Number of Sit-Ups						
Men	<i>Very Poor</i>	<i>Poor</i>	<i>Fair</i>	<i>Good</i>	<i>Excellent</i>	<i>Superior</i>
Age: Under 20	Below 36	36 - 40	41 - 46	47 - 50	51 - 61	Above 61
20 - 29	Below 33	33 - 37	38 - 41	42 - 46	47 - 54	Above 54
30 - 39	Below 30	30 - 34	35 - 38	39 - 42	43 - 50	Above 50
40 - 49	Below 24	24 - 28	29 - 33	34 - 38	39 - 46	Above 46
50 - 59	Below 19	19 - 23	24 - 27	28 - 34	35 - 42	Above 42
60 and over	Below 15	15 - 18	19 - 21	22 - 29	30 - 38	Above 38

Number of Sit-Ups						
Women	<i>Very Poor</i>	<i>Poor</i>	<i>Fair</i>	<i>Good</i>	<i>Excellent</i>	<i>Superior</i>
Age: Under 20	Below 28	28 - 31	32 - 35	36 - 45	46 - 54	Above 54
20 - 29	Below 24	24 - 31	32 - 37	38 - 43	44 - 50	Above 50
30 - 39	Below 20	20 - 24	25 - 28	29 - 34	35 - 41	Above 41
40 - 49	Below 14	14 - 19	20 - 23	24 - 28	29 - 37	Above 37
50 - 59	Below 10	10 - 13	14 - 19	20 - 23	24 - 29	Above 29
60 and over	Below 3	3 - 5	6 - 10	11 - 16	17 - 27	Above 27

The Push-Up Test

- *Equipment:*
Mat or towel (optional)

In this test, you will perform either standard push-ups, or modified push-ups, in which you support yourself with your knees. The Cooper Institute developed the ratings for this test with men performing push-ups and women performing modified push-ups. Biologically, males tend to be stronger than females; the modified technique reduces

the need for upper-body strength in a test of muscular endurance. Therefore, for an accurate assessment of upper-body endurance, men should perform standard push-ups and women should perform modified push-ups. (However, in using push-ups as part of a strength-training program, individuals should choose the technique most appropriate for increasing their level of strength and endurance, regardless of gender.)

Instructions

1. For push-ups: Start in the push-up position with your body supported by your hands and feet. For the modified push-ups: Start in the modified push-up position with your body supported by your hand and knees. For both positions, your arms and your back should be straight and your fingers pointed forward.
2. Lower your chest to the floor with your back straight, and then return to the starting position.
3. Perform as many push-ups as you can without stopping.

Number of push-ups: _____

Number of modified push-ups: _____

Rating Your Push-Up Test Result

Your score is the number of completed push-ups or modified push-ups. Refer to the appropriate portion of the table on page 19 for a rating of your upper-body endurance.

Record your rating below and in the chart at the end of this lab.

Rating: _____

Ratings for the Push-Up and Modified Push-Up Test:

Men	Number of Modified Push-Ups					
	<i>Very Poor</i>	<i>Poor</i>	<i>Fair</i>	<i>Good</i>	<i>Excellent</i>	<i>Superior</i>
Age: 18 - 29	Below 22	22 - 28	29 - 36	37 - 46	47 - 61	Above 61
30 - 39	Below 17	17 - 23	24 - 29	30 - 38	39 - 51	Above 51
40 - 49	Below 11	11 - 17	18 - 23	24 - 29	30 - 39	Above 39
50 - 59	Below 9	9 - 12	13 - 18	19 - 24	25 - 38	Above 38
60 and over	Below 6	6 - 9	10 - 17	18 - 22	23 - 27	Above 27
Women	Number of Modified Push-Ups					
	<i>Very Poor</i>	<i>Poor</i>	<i>Fair</i>	<i>Good</i>	<i>Excellent</i>	<i>Superior</i>
Age: 18 - 29	Below 17	17 - 22	23 - 29	30 - 35	36 - 44	Above 44
30 - 39	Below 11	11 - 18	19 - 23	24 - 30	31 - 38	Above 38
40 - 49	Below 6	6 - 12	13 - 17	18 - 23	24 - 32	Above 32
50 - 59	Below 6	6 - 11	12 - 16	17 - 20	21 - 27	Above 27
60 and over	Below 2	2 - 4	5 - 11	12 - 14	15 - 19	Above 19

SOURCE: Based on norms from the Cooper Institute for Aerobic Research, Dallas, Texas; from the Physical Fitness Specialist Manual, Revised 2002.

Used with permission.

The Squat Endurance Test

Instructions

1. Stand with your feet placed slightly more than shoulder width apart, toes pointed out slightly, hands on hips or across your chest, head neutral, and back straight. Center your weight over your arches or slightly behind.
2. Squat down, keeping your weight centered over your arches, until your thighs are parallel with the floor. Push back up to the starting position, maintaining a straight back and neutral head position.
3. Perform as many squats as you can without stopping.

Number of squats: _____

Rating your Squat Endurance Test Result

Your score is the number of completed squats. Refer to the appropriate portion of the table for a rating of your leg muscular endurance. Record your rating below and in the summary at the end of this lab.

Rating: _____

Ratings for the Squat-Endurance Test:

Number of Squats Performed

Men	<i>Very Poor</i>	<i>Poor</i>	<i>Below Average</i>	<i>Average</i>	<i>Above Average</i>	<i>Good</i>	<i>Excellent</i>
Age: 18-25	<25	25-30	31-34	35-38	39-43	44-49	>49
26-35	<22	22-28	29-30	31-34	35-39	40-45	>45
36-45	<17	17-22	23-26	27-29	30-34	35-41	>41
46-55	<9	13-17	18-21	22-24	25-38	29-35	>35
56-65	<9	9-12	13-16	18-20	21-24	25-31	>31
65 +	<7	7-10	11-14	15-18	19-21	22-28	>28
Women	<i>Very Poor</i>	<i>Poor</i>	<i>Below Average</i>	<i>Average</i>	<i>Above Average</i>	<i>Good</i>	<i>Excellent</i>
Age: 18-25	<18	18-24	25-28	29-32	33-36	37-43	>43
26-35	<20	13-20	21-24	25-28	29-32	33-39	>39
36-45	<7	7-14	15-18	19-22	23-26	27-33	>33
46-55	<5	5-9	10-13	14-17	18-21	22-27	>27
56-65	<3	3-6	7-9	10-12	13-17	18-24	>24
65 +	<2	2-4	5-10	11-13	14-16	17-23	>23

SOURCE: Top End Sports. www.topendsports.com/testing/tests/home-squat.htm

Summary of Results

Test	Number Performed	Rating
Sit-up Test		
Push-up Test		
Squat Endurance Test		

Using Your Results

1. Are you at all surprised by your ratings for muscular endurance?
2. What factors, if any, influenced your scores?
3. Are you satisfied with your current level of muscular endurance as evidenced in your daily life, for example, your ability to carry groceries or your books, hike, and do yard work?

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CHAPTER OVERVIEW

8: Body Composition

By Scott Flynn

Learning Objectives

- What is body composition?
- How does body composition affect a person's health?
- What are the health risks and costs associated with overweight and obesity?
- What is the significance of body fat distribution?
- What is Body Mass Index (BMI) and why is it important?

[8.1: Body Weight versus Body Composition](#)

[8.2: Diseases Associated with Excessive Body Fat](#)

[8.3: How Much Fat is Needed?](#)

[8.4: Body Fat Distribution](#)

[8.5: Body Mass Index](#)

[8.6: How to Measure Body Composition](#)

[8.7: Weighing in on the U.S.](#)

[8.8: What Can Be Done?](#)

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8.1: Body Weight versus Body Composition

According to surveys, the top reason American females exercise is for weight control. For males, the top reason is to improve muscle tone while weight control ranks as the fourth most important reason.¹ Levels of attractiveness based on weight and visible musculature are significant points of emphasis in American culture. As such, individuals with well-toned muscles and low body weight are marketed as *superior* within the context of attractiveness, financial success, and multiple other traits. Unfortunately, this emphasis, as seen in mainstream media, can result in unrealistic ideals and potentially harmful behaviors, such as eating disorders.

Unlike the mainstream outlets, which focus on the association between fat levels and physical attractiveness, this chapter focuses on the health-related consequences related to good and bad body composition. **Body composition** is defined as the body's relative amount of fat-free mass (FFM) and fat mass (FM) and is generally expressed as a percentage of total body weight. FFM includes bones, muscles, ligaments, body fluids and other organs, while FM is limited to fat tissue.

The Importance of Measuring Body Composition Rather Than Just Tracking Body Weight

Tracking weight can be helpful, but body composition measurements help separate a person's actual weight from the weight that could be unhealthy.

For example, an individual who weighs 200 pounds and has 8% body fat, such as an athlete, only carries around 16 pounds of FM. However, a 200-pound person who has a sedentary lifestyle and a body composition of 20%, carries 40 pounds of FM. Weight alone, in this case, does not distinguish between FFM and FM and would suggest both individuals have similar health. As body fat percentage increases, the potential for various diseases also increases significantly.

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8.2: Diseases Associated with Excessive Body Fat

According to the National Institute of Health (NIH), a wide array of diseases can be linked to excessive body fat.² Some of them are:

- Type II Diabetes Mellitus
- Hypertension
- Cancer
- Cerebrovascular Disease (Stroke)
- Cardiovascular Disease
- Metabolic Syndrome
- Lung Disorders
 - Sleep Apnea
 - Asthma
- Musculoskeletal Diseases
 - Osteoarthritis
 - Gout
- Gallbladder Disease
- Pancreatitis
- Non-Alcohol Fatty Liver Disease
- Dementia
- Psychological Problems and Quality of Life
- Kidney Disease
- Pregnancy Problems

An explanation of how being overweight relates to each disease (those highlighted) can be viewed by clicking on the following link.

[NIH-Explanation of Disease Risk Associated with Overweight](#)

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8.3: How Much Fat is Needed?

Fat is a necessary component of daily nutrition. It is needed for healthy cellular function, energy, cushioning for vital organs, insulation, and for food flavor.

Fat storage in the body consists of two types of fat: essential and nonessential fat. **Essential fat** is the minimal amount of fat necessary for normal physiological function. For males and females, essential fat values are typically considered to be 3% and 12%, respectively. Fat above the minimal amount is referred to as **nonessential fat**. It is generally accepted that an overall range of 10-22 percent for men and 20-32 percent for women is considered satisfactory for good health. A body composition within the recommended range suggests a person has less risk of developing obesity-related diseases, such as diabetes, high blood pressure, and even some cancers.

A woman's essential fat range is naturally greater than a man's because of fat deposits in breasts, uterus and sex-specific sites. In both males and females, non-essential fat reserves can be healthy, especially in providing substantial amounts of energy.

Excessive body fat is categorized by the terms overweight and obesity. These terms do not implicate social status or physical attractiveness, but rather indicate health risks. **Overweight** is defined as the accumulation of non-essential body fat to the point that it adversely affects health. According to the American College of Sports Medicine (ACSM), the threshold for being characterized as overweight is having a body composition of FM greater than 32% and 19% for females and males, aged 20-39, respectively.³

Obesity is characterized by excessive accumulation of body fat and can be defined as a more serious degree of being overweight. Classifications of obesity begin at body composition of FM greater than 39% and 25% in females and males ages 20- 39, respectively.⁴

Other Health Risks

Diseases are not the only concern with an unhealthy body fat percentage. Several others are listed below.

- *Performance of physical activity*

An important component of a healthy lifestyle and weight management is regular physical activity and exercise. To the contrary, those who live a sedentary lifestyle will find it more difficult to maintain a healthy body weight or develop adequate musculature, endurance, and flexibility. Unfortunately, additional body weight makes it more difficult to be active because it requires more energy and places a higher demand on weak muscles and the cardiovascular system. The result is a self-perpetuating cycle of inactivity leading to more body weight, which leads to more inactivity.

- *Emotional wellness*

Studies indicate obesity is associated with a 25% increase in anxiety and mood disorders, regardless of age or gender. Other studies suggest increases in BMI significantly increase the incidence of personality disorders and anxiety and mood disorders. Additional studies have been able to associate a higher incidence of psychological disorders and suicidal tendencies in obese females compared with obese males.⁵

- *Pre-mature death*

The association between obesity and diseases, such as cancer, CVD, and diabetes, suggests that people with more body fat generally have shorter lifespans. The Center for Disease Control (CDC) estimates up to 365,000 deaths each year can be linked with obesity, representing nearly 15% of all deaths. Other studies have tied the Years of Life Lost to body mass index measurements, estimating anywhere from 2 to 20 years can be lost, depending on ethnicity, age at time of obese classification, and gender.⁶

- *Economic impact*

The physical harm caused by obesity and overweight is mirrored by its economic impact on the health care system. The CDC has estimated the medical costs to be about \$147 billion in 2008, which includes preventative, diagnostic, and treatments. Overweight and obesity also contribute to loss of productivity at work through absenteeism and *presenteeism*, defined as being less productive while working. The annual nationwide productive costs fall within the range of from \$3.38 to \$6.38 billion.⁷

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8.4: Body Fat Distribution

Body composition measurements can help determine health risks and assist in creating an exercise and nutrition plan to maintain a healthy weight. However, the presence of unwanted body fat is not the only concern associated with an unhealthy weight. Where the fat is stored, or fat distribution, also affects overall health risks.

Non-essential fat is primarily stored in **adipose tissue**, or fat cells, located on the surface of the body and surrounding the body's organs. Surface fat, located just below the skin, is called **subcutaneous fat**. Fat that lies deeper in the body surrounding the body's organs is called **visceral fat**. Unlike subcutaneous fat, visceral fat is more often associated with abdominal fat. Researchers have found that excessive belly fat decreases insulin sensitivity, making it easier to develop type II diabetes. It may also negatively impact blood lipid metabolism, contributing to more cases of cardiovascular disease and stroke in patients with excessive belly fat.⁸

Body fat distribution can easily be determined by simply looking in the mirror. The outline of the body, or body shape, would indicate the location of where body fat is stored. Abdominal fat storage patterns are generally compared to the shape of an apple, called the **android shape**. This shape is more commonly found in males and post-menopausal females. In terms of disease risk, this implies males and post-menopausal females are at greater risk of developing health issues associated with excessive visceral fat. Individuals who experience chronic stress tend to store fat in the abdominal region.

A pear-shaped body fat distribution pattern, or **gynoid shape**, is more commonly found in pre-menopausal females. Gynoid shape is characterized by fat storage in the lower body such as the hips and buttocks. This shape may be connected to females' child-bearing abilities as enzymes associated with fat-storage and mobilization are activated during certain times of pregnancy and postpartum.

Besides looking in the mirror to determine body shape, people can use an inexpensive tape measure to measure the diameter of their hips and waist. Many leading organizations and experts currently believe a waist circumference of 40 or greater for males and 35 or greater for females significantly increases risk of disease.⁹

In addition to measuring waist circumference, measuring the waist and the hips and using a waist-to-hip ratio (waist circumference divided by the hip circumference) is equally effective at predicting body fat-related health outcomes. According to the National Heart, Lung, and Blood Institute, a ratio of greater than 0.82 for females and 0.94 for males is associated with a higher risk of developing heart disease, diabetes, and hypertension.¹⁰

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8.5: Body Mass Index

In addition to body composition and waist/hip circumferences, measuring body mass has also been used as an effective method to assess health risks. **Body mass index (BMI)** is a measurement of height (m²) and weight (kg) suggesting that a person's body's weight should be proportional to his or her height. For example, based on the BMI scale, a female with a height of 5'6" should not weigh more than 155 lbs. If her weight exceeded 155 lbs., she would be categorized as "overweight."

$$BMI = \frac{Weight(kg)}{Height(m^2)} \quad (8.5.1)$$

Among several criticisms, the BMI method has been faulted for not distinguishing between FM and FFM, since only the overall weight is taken into account. For athletes, who may be more massive as a result of larger muscles, this criticism holds true. For example, a professional football player who weighs 215 pounds and stands at 6'3" would have the exact same BMI as a relatively sedentary arm-chair quarterback who also weighs 215 pounds with the same height. This discrepancy also exists when applying BMI to the senior population. As age increases, muscle mass declines. Seniors who have experienced years of muscle mass decline but increased body fat may maintain a constant weight despite having a very different body composition.

Other criticisms of using BMI as a health risk assessment tool include its failure to take age or gender into account. As discussed previously, females naturally have more body fat yet are classified in the same context as males. Because this measurement is so widely used by physicians, patients continue to express concerns about the validity of BMI as an indication of fatness.

Regardless of the criticisms, BMI as used for the general population, has been shown to be a reasonable predictor of health outcomes. At its core, it is not intended to be an estimate of body composition, i.e., measure FM and FFM. Instead, it is intended to be used as an estimate of healthy/unhealthy levels of body fat. When used as a means of tracking weight changes over time it can be a valuable tool in predicting health and for recommending lifestyle modifications.¹¹

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8.6: How to Measure Body Composition

Multiple methods exist to estimate body composition. Remember, body composition is the ration of FM and FFM used to help determine health risks. Of the other methods already mentioned (waist, waist- to-hip ratio, and BMI), none provide estimates of body composition but do provide measurements of other weight- related health markers, such as abdominal fat. Experts have designed several methods to estimate body composition. While they are not flawless, they do provide a fairly accurate representation of body composition. The most common are:

- *Hydrostatic Weighing (Underwater Weighing)*

At one time, hydrostatic weighing (also and maybe more accurately called **hydrodensitometry**) was considered the criterion for measuring body composition. Many other methods are founded on this model, in one form or another. This method attempts to measure the density of the body by applying Archimedes' principle: $\text{density} = \text{mass}/\text{volume}$. The mass and volume components are measured by using dry weight and then weight while being submerged in a water tank. Since fat is less dense than muscle tissue, a person with more body fat will weigh less in the water than a similar person with more lean mass. Using the measurements, the density can be determined and converted into body fat percentage. With a small margin of error (around 1-2%) this method is very accurate. Unfortunately, the expense and practicality of building and maintaining a water tank limits access for most. Also, for those with a fear of water, this would obviously not be the preferred method.

- *Dual Energy X-Ray Absorptiometry (DEXA)*

Replacing underwater weighing as the new "gold standard," is DEXA. While underwater weighing accurately compartmentalizes FM and FFM, DEXA adds a third compartment by using low-radiation X-rays to distinguish bone mineral. This addition slightly increases the accuracy of DEXA by eliminating some of the guess work associated with individual differences, such as total body water and bone mineral density.

Originally, DEXA scanners were designed to determine and help diagnose bone density diseases. As a result, they can be found in many physicians' offices. However, a full body scan, which takes only a few minutes, is all that is needed to also determine body fat percentage. Major disadvantages to this method are its high cost and the need for a well-trained professional to operate the equipment and analyze the results.

- *Air Displacement (Plethysmography)*

A good alternative to more expensive methods, air displacement determines body density using the same principle as underwater weighing, by measuring mass and volume. Clearly, the main difference is that mass and volume are being determined by air displacement rather than water displacement. Using a commercial device (the Bod Pod is most commonly referenced), a person sits in a chamber that varies the air pressure allowing for body volume to be assessed. Air displacement provides a viable alternative for those with a fear of water.

Like many other methods, the expense, availability, and training of personnel Air Displacement requires limit accessibility. Additionally, its accuracy is slightly less than underwater weighing.

- *Bio-electrical Impedance Analysis (BIA)*

BIA takes a slightly different approach to measuring FFM. The premise behind BIA is that FFM will be proportional to the electrical conductivity of the body. Fat-tissue contains little water, making it a poor conductor of electricity; whereas, lean tissue contains mostly water and electrolytes, making it an excellent conductor. BIA devices emit a low-level electrical current through the body and measure the amount of resistance the current encounters. Based on the level of impedance, a pre-programmed equation is used to estimate body fat percentage.

The most accurate BIA devices use electrodes on the feet and hands to administer the point-to-point electrical current. The margin of error for these devices falls in the range of 3–5%. Portable or handheld BIA devices that only measure lower or upper body conductivity have a higher margin of error (4–8%).

Because BIA devices primarily measure hydration, circumstances that may influence hydration status at the time of measurement must be taken into account. Recent exercise, bladder content, hydration habits, and meal timing can cause wide measurement variations and influence accuracy. However, this method is generally inexpensive, often portable, and requires limited training to use, making it a very practical option.

- *Skinfold Analysis*

Skinfold analysis is a widely used method of assessing body composition because of its simplicity, portability, and affordability. It is also fairly accurate when administered properly. Margins of error are about 4–7%, depending on the quality of the skinfold calipers and skill of the administrator/technician. The assumption of skinfold measurement is that the amount of subcutaneous fat is proportionate to overall body fat. As such, a technician pinches the skin at various sites and uses calipers to measure and record the diameter of the skin folds. These numbers can then be plugged into an equation to generate an estimate of body fat percentage.

The proportionality of subcutaneous fat and overall body fat depends on age, gender, ethnicity, and activity rates. As such, technicians should use the skinfold technique specific to the equation that accounts for those variables to improve accuracy.

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8.7: Weighing in on the U.S.

Despite the well-known health concerns implicated in overweight and obesity and the availability of multiple methods for assessment and tools to improve body composition, current trends in the United States and around the world are moving in the wrong direction. The unprecedented number of obese Americans has led experts to label it an epidemic, much like they would a disease in a developing country. According to the CDC, the number of American adults (>20 years) that fall into the overweight classification based on BMI are 70.7%. Of those, 37.9% fall within the obese classification. In 1962, the overweight and obesity rates for adults in the U.S. were 32% and 13%, respectively. In other words, overweight trends have more than doubled and obesity rates have almost tripled over the past 50+ years.¹²

Of more concern are the increasing number of obese children ages 6-11 and adolescents ages 12-19, amounting to 17.4% and 20.6%, respectively.¹³ While those numbers have stabilized over the past decade, this has led to a dramatic increase in insulin resistance, a form of diabetes formerly known as adult onset diabetes.

With such a diverse population in the U.S. and with an understanding of how BMI is calculated, it is only natural to question the high number of overweight and obese citizens based on BMI alone. However, it is generally believed this is an accurate portrayal of weight status. In a study attempting to compare BMI measurements to actual body fat percentage, it was determined that the total number of obese citizens may be underestimated, and its current prevalence may be worse than is currently being reported.

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8.8: What Can Be Done?

With the available tools to identify health risks associated with body fat, anyone concerned about their health should gather as much data about body composition and body fat distribution as possible. Compiling multiple measurements and analyzing them provides a better idea of a person's current health status and will help determine the next course of action. For example, BMI alone can be beneficial. But when combined with waist circumference, a greater understanding of risk can be achieved. Likewise, when combining BMI and waist circumference with body fat percentage, an ideal conclusion of health status can be made.

In the lab accompanying this chapter, you will be guided through the process of assessing your BMI, waist circumference, waist-to-hip ratio, and body fat percentage.

The next course of action is to set goals and formulate a plan to get to a healthy range of weight and body fat percentage. Where weight loss is needed, the plan should include a balance of calorie restriction and physical activity/exercise. This might also include tracking your current eating and activity habits. More specific information on weight management strategies will be discussed in a later chapter.

Low Body Composition

Because more people experience excess body fat, the focus up to this point has been on health concerns related to overweight and obesity. However, fat is an essential component to a healthy body, and in rare cases, individuals have insufficient fat reserves, which can also be a health concern. The range of essential body fat for males is 3-5% and 8-12% for females. Attempting to, or intentionally staying in those ranges, through excessive exercise or calorie restriction is not recommended. Unfortunately, low body fat is often associated with individuals struggling with eating disorders, the majority of whom are females.

The main concern of low body fat relates to the number and quality of calories being consumed. Foods not only provide energy but also provide the necessary nutrients to facilitate vital body functions. For example, low amounts of iron from a poor diet can result in anemia. Potassium deficiencies can cause hypokalemia leading to cardiovascular irregularities. If adequate calcium is not being obtained from foods, bone deficiencies will result. Clearly, having low body fat, depending on the cause, can be equally as detrimental to health as having too much.

The health concerns most often linked to low body fat are:

- Reproductive disorders
 - Infrequent or missing menstrual cycles
- Respiratory disorders
- Immune System disorders
- Circulatory disorders
- Premature death

In some cases, despite attempts to gain weight, individuals are unable to gain the pounds needed to maintain a healthy weight. In these cases, as in the case of excess fat, a holistic approach should be taken to determine if the low levels of body fat are adversely affecting health. These individuals should monitor their eating habits to assure they are getting adequate nutrition for their daily activity needs. Additionally, other lifestyle habits should be monitored or avoided, such as smoking, which may suppress hunger.

Additional reading on low body fat and its impact can be found on the Livestrong.com website, on this page: [At what body fat percent do you start losing your period?](#)

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CHAPTER OVERVIEW

9: Cardiovascular Disease, Diabetes, and Cancer

Cardiovascular disease (CVD) is a class of diseases that involve the heart or blood vessels. Cardiovascular disease includes coronary artery diseases (CAD) such as angina and myocardial infarction (commonly known as a heart attack). Other CVDs include stroke, heart failure, hypertensive heart disease, rheumatic heart disease, cardiomyopathy, heart arrhythmia, congenital heart disease, valvular heart disease, carditis, aortic aneurysms, peripheral artery disease, thromboembolic disease, and venous thrombosis.

[9.1: Cardiovascular Disease Intro](#)

[9.2: Stroke](#)

[9.3: Metabolic Syndrome](#)

[9.4: Diabetes](#)

[9.5: Cancer](#)

Thumbnail: Anatomy of the Human Body. (Public Domain).Computer Generated Cross Section 3d Model of Heart (DrJanaOfficial).

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9.1: Cardiovascular Disease Intro

Cardiovascular disease (CVD) is a class of diseases that involve the heart or blood vessels. Cardiovascular disease includes coronary artery diseases (CAD) such as angina and myocardial infarction (commonly known as a heart attack). Other CVDs include stroke, heart failure, hypertensive heart disease, rheumatic heart disease, cardiomyopathy, heart arrhythmia, congenital heart disease, valvular heart disease, carditis, aortic aneurysms, peripheral artery disease, thromboembolic disease, and venous thrombosis.

The underlying mechanisms vary depending on the disease. Coronary artery disease, stroke, and peripheral artery disease involve atherosclerosis, which is the narrowing of the inside of an artery due to the build up of plaque. This may be caused by high blood pressure, smoking, diabetes, lack of exercise, obesity, high blood cholesterol, poor diet, and excessive alcohol consumption, among others. High blood pressure results in 13% of CVD deaths, while tobacco results in 9%, diabetes 6%, lack of exercise 6% and obesity 5%. Rheumatic heart disease may follow untreated strep throat. It is estimated that 90% of CVD is preventable.

Coronary heart disease (CHD), also commonly referred to as just heart disease, is a common term for the buildup of plaque in the heart's arteries that could lead to heart attack. But is there a difference between coronary heart disease and coronary artery disease? The short answer is often no — health professionals frequently use the terms interchangeably. However, coronary heart disease, or CHD, is actually a result of coronary artery disease, or CAD. With coronary artery disease, plaque first grows within the walls of the coronary arteries until the blood flow to the heart's muscle is limited. View an illustration of coronary arteries below:

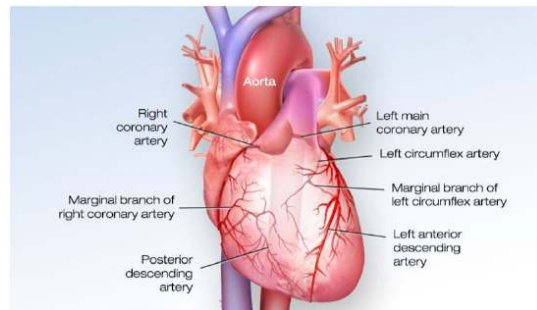


Figure 9.1.1 Coronary Arteries

The **Coronary Arteries** are the blood vessels that supply blood to your heart. They branch off of the aorta at its base. The right coronary artery, the left main coronary, the left anterior descending, and the left circumflex artery, are the four major coronary arteries. Blockage of these arteries is a common cause of angina, heart disease, heart attacks and heart failure.

This restriction of the blood supply to the tissues is also called ischemia. It may be chronic, narrowing of the coronary artery over time and limiting of the blood supply to part of the muscle. Or it can be acute, resulting from a sudden rupture of a plaque and formation of a thrombus or blood clot.

Anatomy of the Cardiovascular System

To fully understand Cardiovascular Diseases, it may be helpful to understand the anatomy of the cardiovascular system. It includes the following:

- **Heart:** the pump, divided into four chambers (R/L atria, R/L ventricles)
- **Arteries:** large vessels carrying oxygen-rich blood away from heart; have thick, muscular wall
- **Arterioles:** smaller arteries
- **Capillaries:** smallest vessels where gas exchange takes place, oxygen is delivered to tissues and carbon dioxide is carried away
- **Veinules:** smallest veins, which carry carbon dioxide-rich blood, back to heart
- **Veins:** biggest vessels that carry carbon dioxide-rich blood back to heart; have one-way valves to prevent gravity from pulling blood backward (away from heart)
- **Atria:** the collecting chambers of the heart, located on top
- **Ventricles:** the pumping chambers of the heart, located on the bottom
- **Aorta:** the largest vessel (artery) in the body; all arteries branch from it

The right side of the heart (right atrium and right ventricle) takes CO₂-rich blood and sends it to the lungs for oxygenation. The left side of the heart (left atrium and ventricle) takes O₂-rich blood and delivers it to the body. The right side is said to be responsible for pulmonary circulation; the left side is said to be responsible for systemic circulation. Because of the distances involved, pulmonary circulation is a relatively low-pressure system, while systemic circulation is a relatively high-pressure system. In fact, when we measure blood pressure we're measuring systemic pressure.

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

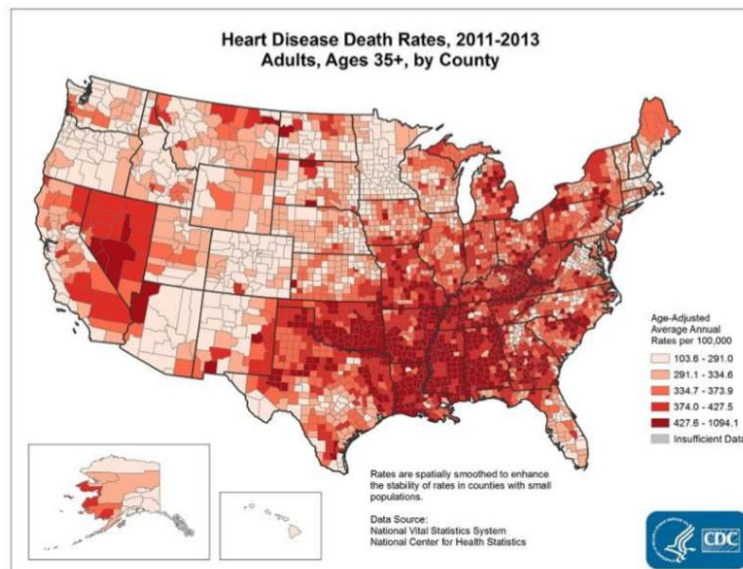


Figure 9.1.2 Heart Disease Death Rates

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.

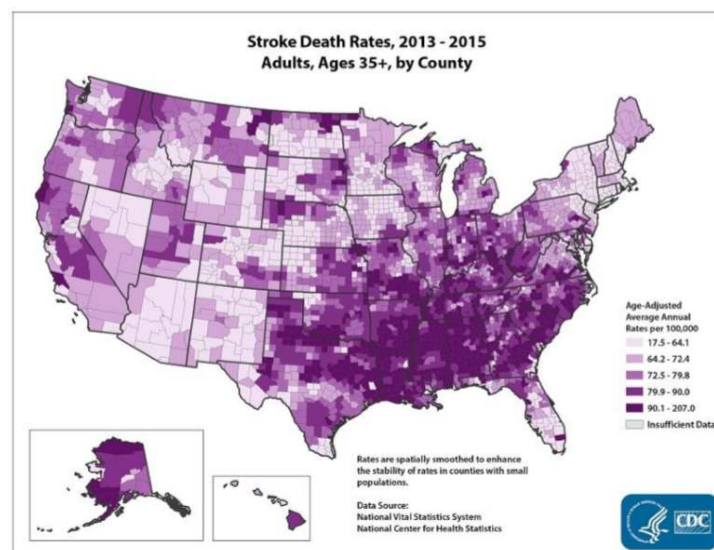


Figure 9.1.3. Stroke Death Rates

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



Figure *PageIndex*4. Plaque Buildup

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.

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.

Risk Factors for Coronary Heart Disease

Coronary heart disease risk factors are conditions or habits that raise your risk of coronary heart disease (CHD) and heart attack. These risk factors also increase the chance that existing CHD will worsen.

There are many known CHD risk factors. You can control some risk factors, but not others.

Risk factors you can control include:

- High blood cholesterol and triglyceride levels (a type of fat found in the blood)
- High blood pressure
- Diabetes and prediabetes
- Overweight and obesity
- Smoking
- Lack of physical activity
- Unhealthy diet
- Stress

The risk factors you can't control are age, gender, and family history of CHD.

Many people have at least one CHD risk factor. Your risk of CHD and heart attack increases with the number of risk factors you have and their severity. Also, some risk factors put you at greater risk of CHD and heart attack than others. Examples of these risk factors include smoking and diabetes. Many risk factors for coronary heart disease start during childhood. This is even more common now because many children are overweight and don't get enough physical activity. Researchers continue to study and learn more about CHD risk factors.

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9.2: Stroke

A stroke is a medical condition in which poor blood flow to the brain results in cell death. This results in part of the brain not functioning properly. The main types of stroke are:

- Ischemic stroke.
- Hemorrhagic stroke.
- Transient ischemic attack (a warning or “mini-stroke”).

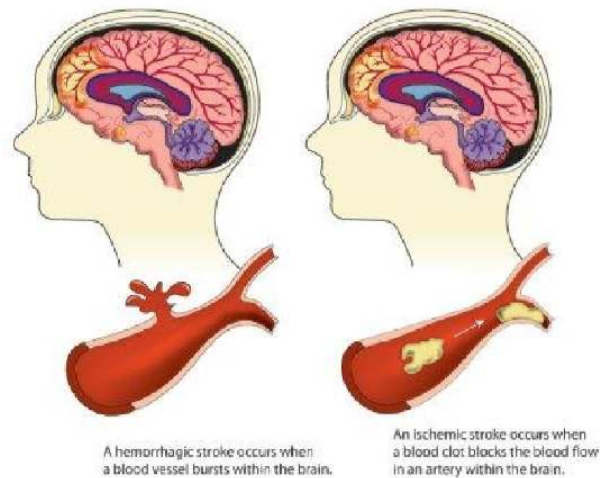


Figure 9.2.1 Hemorrhagic and Ischemic Strokes

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:

1. A TIA is a warning sign of a future stroke.
2. A TIA is a medical emergency, just like a major stroke.
3. 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.
4. There is no way to know in the beginning whether symptoms are from a TIA or from a major type of stroke.

5. Like ischemic strokes, blood clots often cause TIAs.
6. 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.

A health care team can usually find the cause and take steps to prevent a major stroke. Recognizing and treating TIAs can reduce the risk of a major stroke.

Recognizing a Stroke – Think FAST!

During a stroke, every minute counts! Fast treatment can lessen the brain damage that stroke can cause. By knowing the signs and symptoms of stroke, you can take quick action and perhaps save a life—maybe even your own.

Signs of Stroke in Men and Women

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

Call 9-1-1 right away if you or someone else has any of these symptoms.

Acting F.A.S.T. can help stroke patients get the treatments they desperately need. The stroke treatments that work best are available only if the stroke is recognized and diagnosed within 3 hours of the first symptoms. Stroke patients may not be eligible for these if they don't arrive at the hospital in time.

If you think someone may be having a stroke, act F.A.S.T. and do the following simple test:

F—Face: Ask the person to smile. Does one side of the face droop?

A—Arms: Ask the person to raise both arms. Does one arm drift downward?

S—Speech: Ask the person to repeat a simple phrase. Is the speech slurred or strange?

T—Time: If you see any of these signs, call 9-1-1 right away.

Note the time when any symptoms first appear. This information helps health care providers determine the best treatment for each person. Do not drive to the hospital or let someone else drive you. Call an ambulance so that medical personnel can begin life-saving treatment on the way to the emergency room.

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9.3: 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.

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

1. 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.

2. 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

1. 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.

2. 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.

Table 9.3.1. Cholesterol Levels

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
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 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)

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.

List of Treatments for Cardiovascular Disease

- **Drugs:** There are a number of drugs on the market that aid in the prevention and management of all of the aforementioned conditions. They cannot replace the benefits of diet, exercise, and stress management, but should be used in conjunction.
- **Angiogram:** One of many diagnostic tests used to determine location and extent of coronary artery disease.
- **Angioplasty:** A procedure where a balloon is fed through a catheter into a coronary artery and a blockage is opened when the balloon is inflated.
- **Stent:** A "prop" that keeps the artery open following angioplasty.
- **Coronary Artery Bypass Graft:** A surgical procedure in which blockages in coronary arteries are bypassed via grafting of vessels (vein & arterial tissues can be used) around the blockage. This used to be done only "open chest" or "open heart"; modern surgical practice allows for some blockages to be bypassed via small opening in between the ribs (rather than sawing open the breast bone).
- **Endarterectomy:** When the carotid artery (feeds the brain) is opened via a procedure (angioplasty &/or stent, usually).
- **Valve replacements:** valves separate the chambers of the heart. Sometimes those valves become compromised either mechanically or via infection and have to be replaced. Porcine or mechanical valves can be used.
- **Heart transplant:** When a heart has been damaged beyond repair a patient may become a candidate for a transplant; a large percentage of patients awaiting transplants never receive one.

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9.4: Diabetes

Diabetes is a disease that occurs when your blood glucose, also called blood sugar, is too high. Blood glucose is your main source of energy and comes from the food you eat. Insulin, a hormone made by the pancreas, helps glucose from food get into your cells to be used for energy. Sometimes your body doesn't make enough—or any—insulin or doesn't use insulin well. Glucose then stays in your blood and doesn't reach your cells. Over time, having too much glucose in your blood can cause health problems. The most common types of diabetes are type 1, type 2, and gestational diabetes.

Type 1 diabetes

If you have type 1 diabetes, your body does not make insulin. Your immune system attacks and destroys the cells in your pancreas that make insulin. Type 1 diabetes is usually diagnosed in children and young adults, although it can appear at any age. People with type 1 diabetes need to take insulin every day to stay alive.

Type 2 diabetes

If you have type 2 diabetes, your body does not make or use insulin well. You can develop type 2 diabetes at any age, even during childhood. However, this type of diabetes occurs most often in middle-aged and older people. Type 2 is the most common type of diabetes.

Gestational diabetes

Gestational diabetes develops in some women when they are pregnant. Most of the time, this type of diabetes goes away after the baby is born. However, if you've had gestational diabetes, you have a greater chance of developing type 2 diabetes later in life. Sometimes diabetes diagnosed during pregnancy is actually type 2 diabetes.

Other types of diabetes

Less common types include monogenic diabetes, which is an inherited form of diabetes, and cystic fibrosis-related diabetes.

How common is diabetes?

As of 2015, 30.3 million people in the United States, or 9.4 percent of the population, had diabetes. More than 1 in 4 of them didn't know they had the disease. Diabetes affects 1 in 4 people over the age of 65. About 90-95 percent of cases in adults are type 2 diabetes.

Risk Factors for Type 2 Diabetes

Developing type 2 diabetes depends on a combination of risk factors such as genes and lifestyle. Although some risk factors are non-modifiable such as family history, age, or ethnicity, lifestyle risk factors around eating, physical activity, and weight are modifiable. These lifestyle changes can affect one's chances of developing type 2 diabetes. Read about risk factors for type 2 diabetes below and see which ones apply to you. You are more likely to develop type 2 diabetes if you

- are overweight or obese
- are age 45 or older
- have a family history of diabetes
- are African American, Alaska Native, American Indian, Asian American, Hispanic/Latino, Native Hawaiian, or Pacific Islander
- have high blood pressure
- have a low level of HDL ("good") cholesterol, or a high level of triglycerides
- have a history of gestational diabetes or gave birth to a baby weighing 9 pounds or more
- are not physically active
- have a history of heart disease or stroke
- have depression
- have polycystic ovary syndrome, also called PCOS
- have acanthosis nigricans—dark, thick, and velvety skin around your neck or armpits

You can also take the Diabetes Risk Test to learn about your risk for type 2 diabetes.

What health problems can people with diabetes develop?

Over time, high blood glucose leads to problems such as

- heart disease
- stroke
- kidney disease
- eye problems
- dental disease
- nerve damage
- foot problems

Symptoms & Causes of Diabetes

Symptoms of diabetes include

- increased thirst and urination
- increased hunger
- fatigue
- blurred vision
- numbness or tingling in the feet or hands
- sores that do not heal
- unexplained weight loss

Symptoms of type 1 diabetes can start quickly, in a matter of weeks. Symptoms of type 2 diabetes often develop slowly—over the course of several years—and can be so mild that you might not even notice them. Many people with type 2 diabetes have no symptoms. Some people do not find out they have the disease until they have diabetes-related health problems, such as blurred vision or heart trouble.

What causes type 1 diabetes?

Type 1 diabetes occurs when your immune system, the body's system for fighting infection, attacks and destroys the insulin-producing beta cells of the pancreas. Scientists think type 1 diabetes is caused by genes and environmental factors, such as viruses, that might trigger the disease. Studies such as TrialNet are working to pinpoint causes of type 1 diabetes and possible ways to prevent or slow the disease.

What causes type 2 diabetes?

Type 2 diabetes—the most common form of diabetes—is caused by several factors, including lifestyle factors and genes.

Overweight, obesity, and physical inactivity

You are more likely to develop type 2 diabetes if you are not physically active and are overweight or obese. Extra weight sometimes causes insulin resistance and is common in people with type 2 diabetes. The location of body fat also makes a difference. Extra belly fat is linked to insulin resistance, type 2 diabetes, and heart and blood vessel disease.

Insulin resistance

Type 2 diabetes usually begins with insulin resistance, a condition in which muscle, liver, and fat cells do not use insulin well. As a result, your body needs more insulin to help glucose enter cells. At first, the pancreas makes more insulin to keep up with the added demand. Over time, the pancreas can't make enough insulin, and blood glucose levels rise.

Genes and family history

As in type 1 diabetes, certain genes may make you more likely to develop type 2 diabetes. The disease tends to run in families and occurs more often in these racial/ethnic groups:

- African Americans
- Alaska Natives
- American Indians
- Asian Americans
- Hispanics/Latinos

- Native Hawaiians
- Pacific Islanders

Genes also can increase the risk of type 2 diabetes by increasing a person's tendency to become overweight or obese.

What causes gestational diabetes?

Scientists believe gestational diabetes, a type of diabetes that develops during pregnancy, is caused by the hormonal changes of pregnancy along with genetic and lifestyle factors.

Insulin resistance

Hormones produced by the placenta contribute to insulin resistance, which occurs in all women during late pregnancy. Most pregnant women can produce enough insulin to overcome insulin resistance, but some cannot. Gestational diabetes occurs when the pancreas can't make enough insulin.

As with type 2 diabetes, extra weight is linked to gestational diabetes. Women who are overweight or obese may already have insulin resistance when they become pregnant. Gaining too much weight during pregnancy may also be a factor.



Figure 9.4.1. Pregnancy can sometimes contribute to diabetic complications

Hormonal changes, extra weight, and family history can contribute to gestational diabetes.

Genes and family history

Having a family history of diabetes makes it more likely that a woman will develop gestational diabetes, which suggests that genes play a role. Genes may also explain why the disorder occurs more often in African Americans, American Indians, Asians, and Hispanics/Latinas.

What else can cause diabetes?

Genetic mutations, other diseases, damage to the pancreas, and certain medicines may also cause diabetes.

Diagnosing diabetes and prediabetes?

Health care professionals most often use the fasting plasma glucose (FPG) test or the A1C test to diagnose diabetes. In some cases, they may use a random plasma glucose (RPG) test. The FPG blood test measures your blood glucose level at a single point in time. For the most reliable results, it is best to have this test in the morning, after you fast for at least 8 hours. Fasting means having nothing to eat or drink except sips of water.

The A1C test is a blood test that provides your average levels of blood glucose over the past 3 months. Other names for the A1C test are hemoglobin A1C, HbA1C, glycated hemoglobin, and glycosylated hemoglobin test. You can eat and drink before this test. When it comes to using the A1C to diagnose diabetes, your doctor will consider factors such as your age and whether you have anemia or another problem with your blood.¹ The A1C test is not accurate in people with anemia.

How can I lower my chances of developing type 2 diabetes?

Research such as the Diabetes Prevention Program shows that you can do a lot to reduce your chances of developing type 2 diabetes. Here are some things you can change to lower your risk:

- Lose weight and keep it off. You may be able to prevent or delay diabetes by losing 5 to 7 percent of your starting weight.¹ For instance, if you weigh 200 pounds, your goal would be to lose about 10 to 14 pounds.
- Move more. Get at least 30 minutes of physical activity 5 days a week. If you have not been active, talk with your health care professional about which activities are best. Start slowly to build up to your goal.
- Eat healthy foods most of the time. Eat smaller portions to reduce the amount of calories you eat each day and help you lose weight. Choosing foods with less fat is another way to reduce calories. Drink water instead of sweetened beverages.

Manage Diabetes

Although diabetes has no cure, it can be managed by taking the right steps to stay healthy. The National Institute of Health recommends make the following recommendations for managing diabetes:

- **Follow a diabetes meal plan:** Choose fruits and vegetables, beans, whole grains, chicken or turkey without the skin, fish, lean meats, and nonfat or low-fat milk and cheese. Drink water instead of sugar-sweetened beverages. Choose foods that are lower in calories, saturated fat, trans fat, sugar, and salt. Learn more about eating, diet, and nutrition with diabetes.
- **Engage in physical activity daily:** Set a goal to be more physically active. Try to work up to 30 minutes or more of physical activity on most days of the week. Brisk walking and swimming are good ways to move more.
- **Take appropriate medicine:** Take medicine(s) for diabetes and any other health problems, even when feeling good or having reached a healthy blood glucose, blood pressure, and cholesterol goals.
- **Check your blood glucose levels:** For many people with diabetes, checking their blood glucose level each day is an important way to manage their diabetes. Monitoring blood glucose levels is most important for anyone taking insulin. The results of blood glucose monitoring can help diabetes sufferers make decisions about food, physical activity, and medicines.



Figure 9.4.2. Measuring Blood Glucose Levels is an important part of managing diabetes. The most common way to check a blood glucose level is at home is with a blood glucose meter. You get a drop of blood by pricking the side of your fingertip with a lancet. Then you apply the blood to a test strip. The meter will show you how much glucose is in your blood at the moment.

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9.5: Cancer

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.

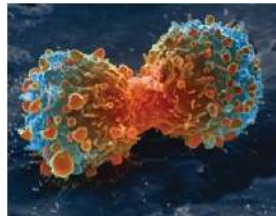


Figure 9.5.1. Cancerous Cells

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.

Key Cancer Terms

- **Neoplasms:** clusters of abnormal cells; aka “tumors.” When the neoplasms or tumors grow out and replace normal cells they are said to be “infiltrating” or “metastasizing” which means traveling to other parts of the body via the blood or lymph.
- **Carcinoma:** most common form; starts in the epithelium.
- **Sarcoma:** forms in connective tissue: bones, muscles, blood vessels.
- **Leukemias:** form in blood-forming tissues: bone marrow, lymph nodes, and the spleen.
- **Lymphomas:** form in the cells of the lymph system (the system that filters out impurities and/or infection).
- Conceptually, cancer is thought to develop via the turning on of genes called “**oncogenes**” or genes that have gone awry. The DNA in these cells replicates at an accelerated rate. “Tumor suppressor genes”, which are present in all of us, fail to stop these cells from dividing thereby allowing a tumor to form.
- A “**malignant**” tumor is a cancerous tumor, whereas a “benign” tumor is not cancerous and of no imminent danger to the body.

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.

Cancer Stages

Cancers are staged 1-3/4, depending on the cancer and the severity. When detected at stage 1, a person suffering from most types of cancer has about a 95% of surviving. The odds go down as you get to stage 3 or 4 (some cancers only have 3 stages, others 4). Doctors will often add an 'A' or 'B' to the staging as well, and this can relate to whether or not the cancer has invaded other tissues.

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.

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:** The most common type of bladder cancer is transitional cell carcinoma, also called urothelial carcinoma. Smoking is a major risk factor for bladder cancer. Bladder cancer is often diagnosed at an early stage.
- **Breast Cancer:** Breast cancer is the second most common cancer in women after skin cancer. Mammograms can detect breast cancer early, possibly before it has spread.
- **Colon and Rectal Cancer:** Colorectal cancer often begins as a growth called a polyp inside the colon or rectum. Finding and removing polyps can prevent colorectal cancer.
- **Endometrial Cancer:** Uterine cancers can be of two types: endometrial cancer (common) and uterine sarcoma (rare). Endometrial cancer can often be cured. Uterine sarcoma is often more aggressive and harder to treat.
- **Kidney Cancer:** Kidney cancer can develop in adults and children. The main types of kidney cancer are renal cell cancer, transitional cell cancer, and Wilms tumor. Certain inherited conditions increase the risk of kidney cancer.

- **Leukemia:** Leukemia is a broad term for cancers of the blood cells. The type of leukemia depends on the type of blood cell that becomes cancer and whether it grows quickly or slowly. Leukemia occurs most often in adults older than 55, but it is also the most common cancer in children younger than 15.
- **Lung Cancer:** Lung cancer includes two main types: non-small cell lung cancer and small cell lung cancer. Smoking causes most lung cancers, but nonsmokers can also develop lung cancer.
- **Melanoma:** Skin cancer is the most common type of cancer. The main types of skin cancer are squamous cell carcinoma, basal cell carcinoma, and melanoma. Melanoma is much less common than the other types but much more likely to invade nearby tissue and spread to other parts of the body. Most deaths from skin cancer are caused by melanoma.
- **Non-Hodgkin Lymphoma:** Lymphoma is a broad term for cancer that begins in cells of the lymph system. The two main types are Hodgkin lymphoma and nonHodgkin lymphoma (NHL). Hodgkin lymphoma can often be cured. The prognosis of NHL depends on the specific type.
- **Pancreatic Cancer:** Pancreatic cancer can develop from two kinds of cells in the pancreas: exocrine cells and neuroendocrine cells, such as islet cells. The exocrine type is more common and is usually found at an advanced stage. Pancreatic neuroendocrine tumors (islet cell tumors) are less common but have a better prognosis.
- **Prostate Cancer:** Prostate cancer is the most common cancer and the second leading cause of cancer death among men in the United States. Prostate cancer usually grows very slowly, and finding and treating it before symptoms occur may not improve men's health or help them live longer.
- **Thyroid Cancer:** Thyroid cancer can be of four main types, which vary in their aggressiveness. Anaplastic thyroid cancer is hard to cure with current treatments, whereas papillary (the most common), follicular, and medullary thyroid cancer can usually be cured.

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:

Table 9.5.1. Cancer Types

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

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:

- Age
- Alcohol
- Cancer-Causing Substances
- Chronic Inflammation
- Diet
- Hormones
- Immunosuppression

- Infectious Agents
- Obesity
- Radiation
- Sunlight
- Tobacco



Figure 9.5.2. CDC Advertisement

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.

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.

Cancer Prevention

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 sunprotective clothing, a hat, and sunglasses.

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. You can learn more about eating healthy and maintaining a healthy weight in chapters 9 and 10.



Figure 9.5.3. Source: National Cancer Institute - <https://www.cancer.gov/about-cancer/treatment/types>

There are many types of cancer treatment. The types of treatment will depend on the type of cancer and how advanced it is. Some people with cancer will have only one treatment. But most people have a combination of treatments, such as surgery with chemotherapy and/or radiation therapy.

Surgery

When used to treat cancer, surgery is a procedure in which a surgeon removes cancer from your body. Learn the different ways that surgery is used against cancer and what you can expect before, during, and after surgery.

Radiation Therapy

Radiation therapy is a type of cancer treatment that uses high doses of radiation to kill cancer cells and shrink tumors. Learn about the types of radiation, why side effects happen, which ones you might have, and more.

Chemotherapy

Chemotherapy is a type of cancer treatment that uses drugs to kill cancer cells. Learn how chemotherapy works against cancer, why it causes side effects, and how it is used with other cancer treatments.

Immunotherapy

Immunotherapy is a type of treatment that helps your immune system fight cancer. Get information about the types of immunotherapy and what you can expect during treatment.

Targeted Therapy

Targeted therapy is a type of cancer treatment that targets the changes in cancer cells that help them grow, divide, and spread. Learn how targeted therapy works against cancer and about common side effects that may occur.

Hormone Therapy

Hormone therapy is a treatment that slows or stops the growth of breast and prostate cancers that use hormones to grow. Learn about the types of hormone therapy and side effects that may happen.

Stem Cell Transplant

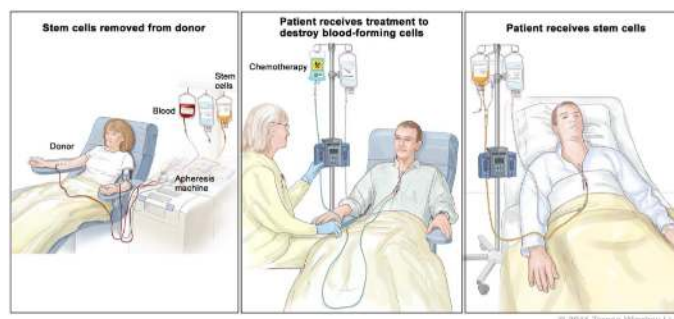


Figure 9.5.4. Stem Cell Transplant

Stem cell transplants are procedures that restore blood-forming stem cells in cancer patients who have had theirs destroyed by very high doses of chemotherapy or radiation therapy. Learn about the types of transplants, side effects that may occur, and how stem cell transplants are used in cancer treatment.

Precision Medicine

Precision medicine helps doctors select treatments that are most likely to help patients based on a genetic understanding of their disease. Learn about the role precision medicine plays in cancer treatment, including how genetic changes in a person's cancer are identified and used to select treatments.

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CHAPTER OVERVIEW

10: Diseases and Disorders

Learning Objectives

- examine and discuss the role of epidemiology in public health
- recognize, examine and formulate the importance of immunization
- identify the major means of transmission for communicable diseases
- identify and examine immunizations in relationship to immunity
- differentiate the major classifications of communicable and non-communicable diseases

[10.1: Introduction to Epidemiology](#)

[10.2: Noncommunicable Diseases and Disorders](#)

[10.3: Communicable \(Infectious\) Diseases](#)

[10.4: Immunity and Immunizations](#)

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10.1: Introduction to Epidemiology

This background lesson provides several working definitions of epidemiology—the basic science of public health; an introduction to the different categories of epidemiology and types of epidemiological studies; and an overview of the disease transmission cycle. First, to set the stage, consider the three incidents that follow, stepping into the shoes of the public health officer who received the initial report and asking yourself the question, “What do I do now?” Some of these examples made national news and may be familiar to you.

First Incident

In March 1985, a nurse epidemiologist in a county health department noted, while reviewing surveillance data, three cases in a single month of hepatitis B of unusual origin. Hepatitis B, or serum hepatitis, is transmitted through sexual contact and by exposure to infected bodily fluids, but these three patients did not seem to have the usual risk factors. All three people did, however, indicate having received injections at the same health care facility.

The nurse’s immediate questions were: “*Is this a coincidence? Did these three cases occur by chance or is there a link?*” In this instance, the nurse decided to pursue an investigation.

Second Incident

At 8:30 in the morning on August 2, 1976, Dr. Robert B. Craven of Centers for Disease Control’s (CDC) Viral Diseases Division received a call from a nurse at a Veterans’ Hospital in Philadelphia, Pennsylvania. The nurse reported two cases of severe respiratory illness, one of which had been fatal. Both people had attended the annual American Legion Convention held July 21-24. By the evening of August 2, 71 more of the people attending the convention had the same illness, with symptoms of acute onset of fever, chills, headache, malaise, dry cough, and myalgia. Further conversations with local and state public health officials revealed that between July 26 and August 2, 18 conventioners had died. Deaths were due primarily to pneumonia.

An intense investigation began immediately. The incident became known as the first outbreak of Legionnaires’ disease and led to the discovery of the gram-negative pathogen, *Legionella pneumophila*.

Third Incident

On October 30, 1989, a New Mexico physician notified the state’s health department of three patients with marked peripheral eosinophilia and severe myalgia. All three patients had been taking oral preparations of L-tryptophan, a nonprescription drug sold as a dietary supplement in health food stores. Despite extensive clinical evaluation and testing, the illness could not be identified.

An investigation followed and resulted in the characterization of eosinophilia-myalgia syndrome, EMS. The investigation implicated a vehicle for exposure—L-tryptophan dietary supplements—before a suspected agent was identified, and the product was taken off the market. Eventually, the problem was traced to a contaminant that had been introduced by changes in the production process at a single manufacturing facility.

These three examples illustrate some of the key reasons for needing applied, or field, epidemiology:

- They were unexpected.
- They demanded a response.
- The investigators had to go out into the field to solve the problem.

Epidemiology Defined

A definition of epidemiology is “the study of the distribution and determinants of health-related states in specified populations, and the application of this study to control health problems.” A look at the key words will help illuminate the meaning:

- Epidemiology is the basic science of public health. It’s a highly quantitative discipline based on principles of statistics and research methodologies.
- Distribution Epidemiologists study the distribution of frequencies and patterns of health events within groups in a population. To do this, they use descriptive epidemiology, which characterizes health events in terms of time, place, and person

- Determinant Epidemiologists also attempt to search for causes or factors that are associated with increased risk or probability of disease. This type of epidemiology, where we move from questions of “who,” “what,” “where,” and “when” and start trying to answer “how” and “why,” is referred to as analytical epidemiology

A comparison between the practice of public health and the more familiar practice of health care helps in describing epidemiology. First, where health care practitioners collect data on an individual patient by taking a medical history and conducting a physical exam, epidemiologists collect data about an entire population through surveillance systems or descriptive epidemiological studies. The health care practitioner uses his or her data to make a differential diagnosis. The epidemiologist’s data is used to generate hypotheses about the relationships between exposure and disease. Both disciplines then test the hypotheses, the health care practitioner by conducting additional diagnostic studies or tests, the epidemiologist by conducting analytical studies such as cohort or case-control studies. The final step is to take action. The health care practitioner prescribes medical treatment, and the epidemiologist, some form of community intervention to end the health problem and prevent its recurrence.

Health Care Professional	Epidemiologist
Collects data on an individual patient by taking a medical history and conducting a physical exam	Collects data about an entire population through surveillance systems or descriptive epidemiological studies
Uses his or her data to make a differential diagnosis	Data is used to generate hypotheses about the relationships between exposure and disease
Tests the hypothesis by conducting additional diagnostic studies or tests	Tests the hypothesis by conducting analytical studies such as cohort or case-control studies
Prescribes medical treatment	Develops community intervention to end the health problem and prevent its recurrence

One way to sum up the task of epidemiologists is to say that they “count things.” Basically, epidemiologists count cases of disease or injury, define the affected population, and then compute rates of disease or injury in that population. Then they compare these rates with those found in other populations and make inferences regarding the patterns of disease to determine whether a problem exists.

For example, in the hepatitis B example earlier, you might ask: Is the rate of disease among people with no known risk factors greater than we would expect? Is the pattern or distribution of the cases suspicious? Once a problem has been identified, the data are used to determine the cause of the health problem; the modes of transmission; any factors that are related to susceptibility, exposure, or risk; and any potential environmental determinants.

Epidemiological Studies

As mentioned earlier, epidemiologists used several different types of studies. Simply speaking, these can be classified as either **experimental**, where the epidemiologists have control over the circumstances from the start, or **observational**, where they do not. Vaccine efficacy trials are a good example of experimental studies because investigators control who gets the vaccine and who doesn’t. Observational studies can be further subdivided into **descriptive** and **analytical** studies. In a descriptive study, the epidemiologist collects information to characterize and summarize the health event or problem. In an analytical study, the epidemiologist relies on comparisons between groups to determine the role of various risk factors in causing the problem. Descriptive epidemiology is the most basic of these categories and is fundamental to the work of an epidemiologists.

Another way of comparing descriptive and analytical epidemiology is to say that in the descriptive process, we are concerned with “person” (Who was affected?), “place” (Where were they affected?), and time (When were they affected?). Once we know the answers to these questions, we can enter the realm of analytical epidemiology and ask how and why these people were affected.

Disease Transmission

In talking about epidemiology, it is important to review how outbreaks occur. First, we’ll look at three commonly used, and often misunderstood, terms: “epidemic,” “outbreak,” and “cluster.” An **epidemic** is the occurrence of more cases of disease than would normally be expected in a specific place or group of people over a given period of time. To an epidemiologist, “**outbreak**” means

basically the same thing. In the public's mind, however, "epidemic" has a far more serious connotation than "outbreak." For this reason, "outbreak" is often used to avoid sensationalism. The third term, "**cluster**," is occasionally used, incorrectly, in place of "epidemic" or "outbreak." A cluster is a group of cases in a specific time and place that may or may not be greater than the expected rate. Often the aim of investigating clusters is to determine the baseline rate of disease for that time and place. Two other terms you will come across are "**endemic**," meaning a high background rate of disease, and "**pandemic**," meaning very widespread, often global, disease.

? Learning Activity

Watch this TED-Ed video: [How Pandemics Spread](#) and take the Quick Quiz.

- Why are epidemics and pandemics a relatively recent phenomenon in human history?

For an outbreak, or epidemic, to occur, the basic elements of disease causation and an adequate chain of transmission must be present. Disease occurs when an outside **agent** capable of causing the disease meets a **host** that is vulnerable to the agent in an **environment** that allows the agent and host to interact. Then, given a chain of transmission from one host to another and a suitable mode of spread, an outbreak can develop. These basic concepts help guide the selection of public health strategies to prevent health problems. Depending on which approach might be most effective, we might direct efforts at the specific agent (e.g., guinea worm), host (e.g., immunization to prevent measles), or environment (e.g., sanitation improvements to prevent salmonella). We can also target a specific point in the chain of transmission. This was the response in the E.coli outbreak in Washington State in the early 1990s, when health officials called for the thorough cooking of hamburgers to interrupt transmission of the bacterium.

The **host** is the person, or in a more generic definition, the organism, that is susceptible to the effect of the agent. The status of the host is quite important and is generally classifiable as susceptible, immune, or infected. Finally, and also quite important, is that the host's response to exposure can vary widely, from showing no effect to manifesting illness.

The **environment** is the conditions or influences that are not part of either the agent or the host, but that influence their interaction. A wide variety of factors, including physical, climatologic, biologic, social, and economic conditions, can come into play. For instance, in a study of motor vehicle injuries, the agent (mechanical energy) and the host (driver) could be affected by the topography, the weather, and the actions of other drivers. In many infectious disease outbreaks, social and economic conditions cause overcrowding and lead to high levels of exposure.

Agent, host, and environment alone are not sufficient to cause an epidemic; an adequate chain of transmission must be present. This process requires a source for the agent, a portal of exit, a mode of transmission, and a portal of entry. The first element, the **source for the agent**, is often the place where the agent originates, where it lives, grows, and multiplies, but this is not always the case. The agent that causes botulism (*Clostridium botulinum*), for example, originates in soil, but the source of most botulism infections is improperly canned food containing *C. botulinum* spores.

The second element, a **portal of exit**, is a pathway by which the agent can leave the source. This pathway is usually related to the place where the agent is localized. For instance, the agents causing tuberculosis and the flu are released through the respiratory tract, whereas agents for many stomach ailments are released through the digestive tract. Agents found in the blood, such as hepatitis B and HIV, can be released through cuts or needles.

Once the agent leaves the source, a **mode of transmission**, or means of carrying it to the host, is needed. This can happen in a number of ways, some of which are direct and some indirect. **Direct transmission** includes contact with soil or plants as well as contact between people. In **indirect transmission**, the agent can be **airborne**, **vector borne**, or **vehicle borne**. In airborne transmission, the agent is carried from the source to the host suspended in air particles. Vector-borne diseases are transmitted indirectly by a live carrier, usually an arthropod, such as mosquitos, fleas, or ticks. Vehicle-borne diseases are carried by inanimate objects, such as food or water, blood, or items like handkerchiefs, bedding, and surgical instruments.

Finally, there must be a pathway into the host, a **portal of entry**, that gives the agent access to tissue where it can multiply or act. Often the agent enters the host in the same way that it left the source. This is the case with the flu virus, which leaves the source through the respiratory tract and enters a new host through the respiratory tract.

? Learning Activity

Your Disease Risk: Here, you can find out your risk of developing five of the most important diseases in the United States and get personalized tips for preventing them.

The Chain of Infection Model

This model explains the spread of a communicable disease from one host (or person) to another. The basic idea represented in the chain of infection is that individuals can break the chain (reduce the risk) at any point, thus the spread of the disease can be stopped.

Table 1. Chain of infection.

Component of the model	Definition	Preventive measures
Communicable disease	Disease caused by an infectious agent	Pasteurization, chlorination, antibiotics, disinfectants, hand washing, etc.
Human reservoir	The human being who is harboring the infectious agent	Isolation, surveillance, treatment with medications, etc.
Portal of exit	The body part through which the infectious agent is exiting from the reservoir, for example the mouth or the anus	Utilization of handkerchiefs, condoms, hair nets, insect repellents, hand washing, etc.
Transmission	The spread of the infectious agent from the reservoir to the host	Isolation, hand washing, mosquito control, sexual abstinence, condom users, etc.
Portal of entry	The body part through which the infectious agent will enter the new host, for example the skin after a mosquito bite, the mouth	Condoms, hair nets, insect repellents, hand washing, etc.
Establishment of disease in new host (susceptible person)	The host develops signs and symptoms of the new disease	Immunizations, health education, nutrition promotion; sexual abstinence, condom use, etc.

Now look at Table 1 carefully again. There are two sets of components that have some similar preventive measures. As a way of helping yourself become familiar with this chart see if you can spot which these are.

The portal of entry and exit both involve preventive measures such as hand washing, condoms, hair nets and insect repellents, while the human reservoir and transmission measures both involve isolation. Be sure you have a clear picture of the definition and prevention of each element before you continue.

With the application of such information, health education can help to create programs that are aimed at breaking the chain and reducing the risks of infection in other people.

The communicable disease model

- The **communicable disease model** presents three elements; infectious agent, host and environment, as the minimal requirements for the presence and spread of a communicable disease in a population.
- The **infectious agent** is the element that must be present for the disease to occur and spread. Bacteria, viruses and parasites are examples of infectious agents.
- The **host** is any susceptible organism. Plants, animals or humans can be invaded by the infectious agent and become the host.
- The **environment** includes all other factors that either promote or prohibit disease transmission.

Communicable disease transmission occurs when a susceptible host and an infectious agent exist in an environment that allows disease transmission.

According to the communicable disease model, the role of health education and health promotion in reducing the occurrence and transmission of diseases can be brought about by specific actions.

Think of tuberculosis (TB), malaria and intestinal infections as examples, and then answer the following questions:

1. Note one way to reduce the susceptibility of hosts.
2. Note one way to destroy infectious agents.
3. Note one way to reduce the contact between the host and the agent.
4. Note one way to modify the environment so that it is not conducive for disease transmission.

You may have answered with the following examples:

1. Good nutrition will build a person's defenses against infection and reduce their risk of developing TB.
2. Cooking food properly destroys infectious agents that could cause intestinal infections.
3. Wearing a mask or holding your hand in front of your mouth while coughing will reduce the contact between the agent that causes TB, and other human beings.
4. Drying swampy and marshy areas will make the environment less easy for mosquitoes to breed in and therefore reduce the incidence of malaria.

Health risk reduction for non-communicable diseases

Both the chain of infection and communicable disease models are helpful in trying to prevent disease caused by an infectious agent. However, these models are *not* applicable to non-communicable diseases, which include many of the chronic diseases such as heart disease and cancers. Most of these diseases become apparent in people over a period of time and are not caused by a single factor, but by a combination of factors. The concept of 'caused by many factors' is often called the **multi causation disease model**. For example, it is known that heart disease is most likely to be a problem for individuals who are older, who smoke, who do not exercise, who are overweight, who have high blood pressure, who have high blood cholesterol and who have a family history of heart disease.

Note that within the list of factors you have just read there are both modifiable and non-modifiable risk factors.

? Learning Activity

Look at the list again and put an "M" against the modifiable factors and an "NM" against the non-modifiable factors.

- Are older:
- Smoke:
- Do not exercise:
- Are overweight:
- Have high blood pressure:
- Have high cholesterol:
- Have a family history of heart disease:

According to this model, health education will be useful in risk reduction and disease prevention if you can create programs that help people control as many of the multi causative risk factors as possible.

[reveal-answer q="126259"]Show Answer[/reveal-answer]

[hidden-answer a="126259"]

- Are older: NM
- Smoke: M
- Do not exercise: M
- Are overweight: M
- Have high blood pressure: M
- Have high cholesterol: M
- Have a family history of heart disease: NM

? Learning Activity

Go to the Cost of Getting Sick webpage then click on the different color pies in the circle to find out the healthcare costs associated with various chronic health conditions.

? Learning Activity: Leading Causes of Death

Go to [10 Leading Causes of Death, United States](#)

- **Choose your Report Options, then click the Submit Request button.**
 - For more information about an option or a category of options, click on the underlined name or phrase.

Go to [10 Leading Causes of Injury](#)

Sources

Source: Centers for Disease Control, EXCITE, www.cdc.gov/excite/classroom/intro_epi.htm

The Chain of Infection Model: [Health Education, Advocacy and Community Mobilization Chapter](#), CC-BY-NC-SA, <http://labspace.open.ac.uk/mod/oucontent/view.php?id=452835&printable=1>

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10.2: Noncommunicable Diseases and Disorders

Diseases are classified as either communicable or noncommunicable. Communicable diseases are spread to other people and they are caused by viral, bacterial, parasitic, or fungal infection. Noncommunicable diseases, also known as non-infectious diseases, are not transferred and are typically caused by heredity, deficiencies in nutrition or factors involving the environment. Some noncommunicable diseases include

- Respiratory disorders
- Diabetes
- Headaches
- Arthritis
- Skin disorders
- Neurological disorders
- Cancer
- Cardiovascular Diseases and Disorders

Respiratory Disorders

Chronic Obstructive Pulmonary Disease

- COPD, or chronic obstructive pulmonary (PULL-mun-ary) disease, is a progressive disease that makes it hard to breathe. “Progressive” means the disease gets worse over time.
- COPD can cause coughing that produces large amounts of mucus (a slimy substance), wheezing, shortness of breath, chest tightness, and other symptoms.
- Cigarette smoking is the leading cause of COPD. Most people who have COPD smoke or used to smoke. Long-term exposure to other lung irritants, such as air pollution, chemical fumes, or dust, also may contribute to COPD.
- COPD, or chronic obstructive pulmonary disease, is a major cause of disability and the third leading cause of death in the United States. More than 12 million people are currently diagnosed with COPD. An additional 12 million likely have the disease and don’t even know it.

? Learning Activity

Download this video titled *COPD Learn More Breathe Better* by clicking on Windows media or Quicktime below.

- Windows media or Quicktime
- Transcript

Profiling the personal experiences of three people diagnosed with COPD, this video answers basic questions about the disease and its risk factors, and demonstrates how real people took steps to manage the disease and breathe easier.

- Could you identify with any of the people in this video?
- What seems to be most helpful to these folks when it comes to managing their COPD?
- What did you learn that you didn’t already know before watching this video?

Overview

To understand COPD, it helps to understand how the lungs work. The air that you breathe goes down your windpipe into tubes in your lungs called bronchial tubes or airways.

The airways and air sacs are elastic (stretchy). When you breathe in, each air sac fills up with air like a small balloon. When you breathe out, the air sacs deflate and the air goes out.

In COPD, less air flows in and out of the airways because of one or more of the following:

- The airways and air sacs lose their elastic quality.
- The walls between many of the air sacs are destroyed.
- The walls of the airways become thick and inflamed.

- The airways make more mucus than usual, which tends to clog them.

In the United States, the term “COPD” includes two main conditions—emphysema and chronic bronchitis.

In emphysema, the walls between many of the air sacs are damaged, causing them to lose their shape and become floppy. This damage also can destroy the walls of the air sacs, leading to fewer and larger air sacs instead of many tiny ones. If this happens, the amount of gas exchange in the lungs is reduced.

In chronic bronchitis, the lining of the airways is constantly irritated and inflamed. This causes the lining to thicken. Lots of thick mucus forms in the airways, making it hard to breathe. Most people who have COPD have both emphysema and chronic obstructive bronchitis. Thus, the general term “COPD” is more accurate.

Outlook

- COPD is a major cause of disability, and it’s the third leading cause of death in the United States. More than 12 million people are currently diagnosed with COPD. Many more people may have the disease and not even know it.
- COPD develops slowly. Symptoms often worsen over time and can limit your ability to do routine activities. Severe COPD may prevent you from doing even basic activities like walking, cooking, or taking care of yourself.
- Most of the time, COPD is diagnosed in middle-aged or older people. The disease isn’t passed from person to person—you can’t catch it from someone else.
- COPD has no cure yet, and doctors don’t know how to reverse the damage to the airways and lungs. However, treatments and lifestyle changes can help you feel better, stay more active, and slow the progress of the disease.

How Can COPD Be Prevented?

You can take steps to prevent COPD before it starts. If you already have COPD, you can take steps to prevent complications and slow the progress of the disease.

Prevent COPD Before It Starts

The best way to prevent COPD is to not start smoking or to quit smoking. Smoking is the leading cause of COPD.

? Learning Activity

Take an [ungraded quiz about COPD](#).

Test your knowledge about the causes and symptoms of COPD. Learn how the disease affects the lungs and how you can prevent its complications.

Chronic Bronchitis

Bronchitis is an inflammation of the bronchial tubes, the airways that carry air to your lungs. It causes a cough that often brings up mucus, as well as shortness of breath, wheezing, and chest tightness. There are two main types of bronchitis: acute and chronic.

Chronic bronchitis is one type of COPD (chronic obstructive pulmonary disease). The inflamed bronchi produce a lot of mucus. This leads to cough and difficulty getting air in and out of the lungs. Cigarette smoking is the most common cause. Breathing in other fumes and dusts over a long period of time may also cause chronic bronchitis. Treatment will help your symptoms, but chronic bronchitis is a long-term condition that keeps coming back or never goes away completely.

Emphysema

Emphysema is a type of chronic obstructive pulmonary disease (COPD) involving damage to the air sacs (alveoli) in the lungs. As a result, your body does not get the oxygen it needs. Emphysema makes it hard to catch your breath. You may also have a chronic cough and have trouble breathing during exercise.

The most common cause is cigarette smoking. If you smoke, quitting can help prevent you from getting the disease. If you already have emphysema, not smoking might keep it from getting worse. Treatment is based on whether your symptoms are mild, moderate or severe. Treatments include inhalers, oxygen, medications and sometimes surgery to relieve symptoms and prevent complications.

Asthma

Asthma is a chronic lung disease that inflames and narrows the airways, making it hard to breathe. The disease affects people of all ages, but it most often starts in childhood. People who have asthma may wheeze, cough, feel short of breath, or have chest tightness.

Asthma can't be cured, but it can be controlled. People who have asthma, or those who have children with asthma, can take an active role in their treatment. For example, they can work with their health care providers to create an asthma action plan. This plan gives guidance on taking medicines properly, avoiding asthma triggers, tracking levels of asthma control, responding to worsening symptoms, and seeking emergency care when needed. When asthma is well controlled, most people who have the disease are able to live normal, active lives.

For more information about living with and managing asthma, go to the Health Topics [Asthma](#) article.

Diabetes

Diabetes is a disease in which your blood glucose, or sugar, levels are too high. Glucose comes from the foods you eat. Insulin is a hormone that helps the glucose get into your cells to give them energy. With Type 1 diabetes, your body does not make insulin. With Type 2 diabetes, the more common type, your body does not make or use insulin well. Without enough insulin, the glucose stays in your blood.

Over time, having too much glucose in your blood can cause serious problems. It can damage your eyes, kidneys, and nerves. Diabetes can also cause heart disease, stroke and even the need to remove a limb. Pregnant women can also get diabetes, called gestational diabetes.

A blood test can show if you have diabetes. Exercise, weight control and sticking to your meal plan can help control your diabetes. You should also monitor your glucose level and take medicine if prescribed.

Diabetes means your blood glucose, or blood sugar, is too high. With Type 1 diabetes, your pancreas does not make insulin. Insulin is a hormone that helps glucose get into your cells to give them energy. Without insulin, too much glucose stays in your blood. Over time, high blood glucose can lead to serious problems with your heart, eyes, kidneys, nerves, and gums and teeth.

Type 1 diabetes happens most often in children and young adults but can appear at any age. Symptoms may include

- Being very thirsty
- Urinating often
- Feeling very hungry or tired
- Losing weight without trying
- Having sores that heal slowly
- Having dry, itchy skin
- Losing the feeling in your feet or having tingling in your feet
- Having blurry eyesight

What are the most important things to do to prevent diabetes?

The Diabetes Prevention Program (DPP), a major federally funded study of 3,234 people at high risk for diabetes, showed that people can delay and possibly prevent the disease by losing a small amount of weight (5 to 7 percent of total body weight) through 30 minutes of physical activity 5 days a week and healthier eating.

What are the risk factors which increase the likelihood of developing diabetes?

- Being overweight or obese.
- Having a parent, brother, or sister with diabetes.
- Being African American, American Indian, Asian American, Pacific Islander, or Hispanic American/Latino heritage.
- Having a prior history of gestational diabetes or birth of at least one baby weighing more than 9 pounds.
- Having high blood pressure measuring 140/90 or higher.
- Having abnormal cholesterol with HDL ("good") cholesterol is 35 or lower, or triglyceride level is 250 or higher.

- Being physically inactive—exercising fewer than three times a week.

How does body weight affect the likelihood of developing diabetes?

Being overweight or obese is a leading risk factor for type 2 diabetes. Being overweight can keep your body from making and using insulin properly, and can also cause high blood pressure. The Diabetes Prevention Program (DPP), a major federally funded study of 3,234 people at high risk for diabetes, showed that moderate diet and exercise of about 30 minutes or more, 5 or more days per week, or of 150 or more minutes per week, resulting in a 5% to 7% weight loss can delay and possibly prevent type 2 diabetes.

Headache

Oh my aching head! Nearly everyone has had a headache. The most common type of headache is a tension headache. Tension headaches are due to tight muscles in your shoulders, neck, scalp and jaw. They are often related to stress, depression or anxiety. You are more likely to get tension headaches if you work too much, don't get enough sleep, miss meals or use alcohol.

Other common types of headaches include migraines, cluster headaches and sinus headaches. Most people can feel much better by making lifestyle changes, learning ways to relax and taking pain relievers.

Headaches can have many causes, but serious causes of headaches are rare. Sometimes headaches warn of a more serious disorder. Let your health care provider know if you have sudden, severe headaches. Get medical help right away if you have a headache after a blow to your head, or if you have a headache along with a stiff neck, fever, confusion, loss of consciousness or pain in the eye or ear.

A migraine is a very painful type of headache. People who get migraines often describe the pain as pulsing or throbbing in one area of the head. During migraines, people are very sensitive to light and sound. They may also become nauseated and vomit.

Migraine is three times more common in women than in men. Some people can tell when they are about to have a migraine because they see flashing lights or zigzag lines or they temporarily lose their vision.

Many things can trigger a migraine. These include

- Stress
- Lack of food or sleep
- Exposure to light
- Hormonal changes (in women)

Doctors used to believe migraines were linked to the opening and narrowing of blood vessels in the head. Now they believe the cause is related to genes that control the activity of some brain cells. Medicines can help prevent migraine attacks or help relieve symptoms of attacks when they happen. For many people, treatments to relieve stress can also help.

Arthritis

If you feel pain and stiffness in your body or have trouble moving around, you might have arthritis. Most kinds of arthritis cause pain and swelling in your joints. Joints are places where two bones meet, such as your elbow or knee. Over time, a swollen joint can become severely damaged. Some kinds of arthritis can also cause problems in your organs, such as your eyes or skin.

One type of arthritis, osteoarthritis, is often related to aging or to an injury. Other types occur when your immune system, which normally protects your body from infection, attacks your body's own tissues. Rheumatoid arthritis is the most common form of this kind of arthritis. Juvenile rheumatoid arthritis is a form of the disease that happens in children. Infectious arthritis is an infection that has spread from another part of the body to the joint.

Osteoarthritis is the most common form of arthritis. It causes pain, swelling and reduced motion in your joints. It can occur in any joint, but usually it affects your hands, knees, hips or spine.

Osteoarthritis breaks down the cartilage in your joints. Cartilage is the slippery tissue that covers the ends of bones in a joint. Healthy cartilage absorbs the shock of movement. When you lose cartilage, your bones rub together. Over time, this rubbing can permanently damage the joint. Factors that may cause osteoarthritis include

- Being overweight
- Getting older

- Injuring a joint

Therapies that manage osteoarthritis pain and improve function include exercise, weight control, rest, pain relief, alternative therapies, and surgery.

Skin Disorders

Did you know that your skin is the largest organ of your body? It is, in terms of both weight, between 6 and 9 pounds, and surface area, about 2 square yards. Your skin separates the inside of your body from the outside world. Skin:

- Protects you from bacteria and viruses that can cause infections
- Helps you sense the outside world, such as whether it is hot or cold, wet or dry
- Regulates your body temperature

Conditions that irritate, clog or inflame your skin can cause symptoms such as redness, swelling, burning and itching. Allergies, irritants, your genetic makeup and certain diseases and immune system problems can cause dermatitis, hives and other skin conditions. Many skin problems, such as acne, also affect your appearance.

Dermatitis

A rash is an area of irritated or swollen skin. It might be red and itchy, bumpy, scaly, crusty or blistered. Rashes are a symptom of many different medical conditions. Things that can cause a rash include other diseases, irritating substances, allergies, and your genetic makeup.

Contact dermatitis is a common cause of rashes. It causes redness, itching and burning where you have touched an irritant, such as a chemical, or something you are allergic to, like poison ivy.

Some rashes develop immediately. Others form over several days. If you scratch your rash, it might take longer to heal. The treatment for a rash usually depends on its cause. Options include moisturizers, lotions, baths, cortisone creams that relieve swelling, and antihistamines, which relieve itching.

Hives

Hives are red and sometimes itchy bumps on your skin. An allergic reaction to a drug or food usually causes them. Allergic reactions cause your body to release chemicals that can make your skin swell up in hives. People who have other allergies are more likely to get hives than other people. Other causes include infections and stress.

Hives are very common. They usually go away on their own, but if you have a serious case, you might need medicine or a shot. In rare cases, allergic reactions can cause a dangerous swelling in your airways, making it hard to breathe – which is a medical emergency.

Acne

Acne is a common skin disease that causes pimples. Pimples form when hair follicles under your skin clog up. Most pimples form on the face, neck, back, chest and shoulders. Anyone can get acne, but it is common in teenagers and young adults. It is not serious, but it can cause scars.

No one knows exactly what causes acne. Hormone changes, such as those during the teenage years and pregnancy, probably play a role. There are many myths about what causes acne. Chocolate and greasy foods are often blamed, but there is little evidence that foods have much effect on acne in most people. Another common myth is that dirty skin causes acne; however, blackheads and pimples are not caused by dirt. Stress doesn't cause acne, but stress can make it worse.

If you have acne

- Clean your skin gently
- Try not to touch your skin
- Avoid the sun

Treatments for acne include medicines and creams.

Scabies

Scabies is an itchy skin condition caused by the microscopic mite *Sarcoptes scabiei*. It is common all over the world, and it affects people of all races and social classes. Scabies spreads quickly in crowded conditions where there is frequent skin-to-skin contact between people. Hospitals, child-care centers and nursing homes are examples. Scabies can easily infect sex partners and other household members. Sharing clothes, towels, and bedding can also spread scabies. You cannot get scabies from a pet. Pets get a different mite infection called mange.

Symptoms are

- Pimple-like irritations or a rash
- Intense itching, especially at night
- Sores caused by scratching

Several lotions are available to treat scabies. The infected person's clothes, bedding and towels should be washed in hot water and dried in a hot dryer.

Psoriasis

Psoriasis is a skin disease that causes itchy or sore patches of thick, red skin with silvery scales. You usually get them on your elbows, knees, scalp, back, face, palms and feet, but they can show up on other parts of your body. A problem with your immune system causes psoriasis. In a process called cell turnover, skin cells that grow deep in your skin rise to the surface. Normally, this takes a month. In psoriasis, it happens in just days because your cells rise too fast.

Psoriasis can last a long time, even a lifetime. Symptoms come and go. Things that make them worse include

- Infections
- Stress
- Dry skin
- Certain medicines

Psoriasis usually occurs in adults. It sometimes runs in families. Treatments include creams, medications and light therapy.

Neurological Disorders

Neurological disorders include:

- Diseases caused by faulty genes, such as Huntington's disease and muscular dystrophy
- Problems with the way the nervous system develops, such as spina bifida
- Degenerative diseases, where nerve cells are damaged or die, such as Parkinson's disease and Alzheimer's disease
- Injuries to the spinal cord and brain
- Seizure disorders, such as epilepsy
- Cancer, such as brain tumors
- Meningitis

Huntington's Disease

Huntington's disease (HD) is an inherited disease that causes certain nerve cells in the brain to waste away. People are born with the defective gene, but symptoms usually don't appear until middle age. Early symptoms of HD may include uncontrolled movements, clumsiness or balance problems. Later, HD can take away the ability to walk, talk or swallow. Some people stop recognizing family members. Others are aware of their environment and are able to express emotions. If one of your parents has Huntington's disease, you have a 50-50 chance of getting it. A blood test can tell if you have the HD gene and will develop the disease. Genetic counseling can help you weigh the risks and benefits of taking the test. There is no cure. Medicines can help manage some of the symptoms, but cannot slow down or stop the disease.

Muscular Dystrophy

Muscular dystrophy (MD) refers to a group of more than 30 inherited diseases that cause muscle weakness and muscle loss. Some forms of MD appear in infancy or childhood, while others may not appear until middle age or later. The different muscular

dystrophies vary in who they affect and the symptoms. All forms of MD grow worse as the person's muscles get weaker. Most people with MD eventually lose the ability to walk.

There is no cure for muscular dystrophy. Treatments include physical and speech therapy, orthopedic devices, surgery and medications. Some people with muscular dystrophy have mild cases that worsen slowly. Other cases are disabling and severe.

Spina Bifida

Spina bifida is the most common disabling birth defect in the United States. It is a type of neural tube defect, which is a problem with the spinal cord or its coverings. It happens if the fetal spinal column doesn't close completely during the first month of pregnancy. There is usually nerve damage that causes at least some paralysis of the legs. Many people with spina bifida will need assistive devices such as braces, crutches or wheelchairs. They may have learning difficulties, urinary and bowel problems or hydrocephalus, a buildup of fluid in the brain.

There is no cure. Treatments focus on the complications, and can include surgery, medicine and physiotherapy. Taking folic acid can reduce the risk of having a baby with spina bifida. It's in most multivitamins. Women who could become pregnant should take it daily.

Parkinson's Disease

Parkinson's disease is a disorder that affects nerve cells, or neurons, in a part of the brain that controls muscle movement. In Parkinson's, neurons that make a chemical called dopamine die or do not work properly. Dopamine normally sends signals that help coordinate your movements. No one knows what damages these cells. Symptoms of Parkinson's disease may include

- Trembling of hands, arms, legs, jaw and face
- Stiffness of the arms, legs and trunk
- Slowness of movement
- Poor balance and coordination

As symptoms get worse, people with the disease may have trouble walking, talking or doing simple tasks. They may also have problems such as depression, sleep problems or trouble chewing, swallowing or speaking.

Parkinson's usually begins around age 60, but it can start earlier. It is more common in men than in women. There is no cure for Parkinson's disease. A variety of medicines sometimes help symptoms dramatically.

Alzheimer's Disease

Alzheimer's disease (AD) is the most common form of dementia among older people. Dementia is a brain disorder that seriously affects a person's ability to carry out daily activities.

AD begins slowly. It first involves the parts of the brain that control thought, memory and language. People with AD may have trouble remembering things that happened recently or names of people they know. A related problem, mild cognitive impairment(MCI), causes more memory problems than normal for people of the same age. Many, but not all, people with MCI will develop AD.

In AD, over time, symptoms get worse. People may not recognize family members or have trouble speaking, reading or writing. They may forget how to brush their teeth or comb their hair. Later on, they may become anxious or aggressive, or wander away from home. Eventually, they need total care. This can cause great stress for family members who must care for them.

AD usually begins after age 60. The risk goes up as you get older. Your risk is also higher if a family member has had the disease.

No treatment can stop the disease. However, some drugs may help keep symptoms from getting worse for a limited time.

Spinal Cord Injury

Your spinal cord is the part of your nervous system that relays messages to and from your brain. It is housed inside your vertebrae, which are the bone disks that make up your spine. Normally, your vertebrae protect your spinal cord. If they don't, you can sustain a spinal cord injury. Besides injuries, the spinal cord can develop

- Tumors
- Infections such as meningitis and poliomyelitis
- Inflammatory diseases

- Autoimmune diseases
- Degenerative diseases such as amyotrophic lateral sclerosis and spinal muscular atrophy

Symptoms vary but might include pain, numbness, loss of sensation and muscle weakness. These symptoms can occur around the spinal cord, and also in other areas such as your arms and legs. Treatments vary but often include medicines and surgery.

Epilepsy

Epilepsy is a brain disorder that causes people to have recurring seizures. The seizures happen when clusters of nerve cells, or neurons, in the brain send out the wrong signals. People may have strange sensations and emotions or behave strangely. They may have violent muscle spasms or lose consciousness.

Epilepsy has many possible causes, including illness, brain injury and abnormal brain development. In many cases, the cause is unknown.

Doctors use brain scans and other tests to diagnose epilepsy. It is important to start treatment right away. There is no cure for epilepsy, but medicines can control seizures for most people. When medicines are not working well, surgery or implanted devices such as vagus nerve stimulators may help. Special diets can help some children with epilepsy.

Meningitis

Meningitis is inflammation of the thin tissue that surrounds the brain and spinal cord, called the meninges. There are several types of meningitis. The most common is viral meningitis, which you get when a virus enters the body through the nose or mouth and travels to the brain. Bacterial meningitis is rare, but can be deadly. It usually starts with bacteria that cause a cold-like infection. It can block blood vessels in the brain and lead to stroke and brain damage. It can also harm other organs. Pneumococcal infections and meningococcal infections can cause bacterial meningitis.

Anyone can get meningitis, but it is more common in people whose bodies have trouble fighting infections. Meningitis can progress rapidly. You should seek medical care quickly if you have

- A sudden fever
- A severe headache
- A stiff neck

Early treatment can help prevent serious problems, including death. Vaccines can prevent some of the bacterial infections that cause meningitis. Parents of adolescents and students living in college dorms should talk to a doctor about the vaccination.

? Learning Activity: What disease are you most afraid to get?

Click on [Most Feared Diseases](#) to compare your answer with others.

Sources

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What are the most important things to do to prevent diabetes?: Prevent Diabetes, Centers for Disease Control, www.cdc.gov/diabetes/consumer/prevent.htm

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Arthritis: NIH: National Institute of Arthritis and Musculoskeletal and Skin Diseases via MedlinePlus.gov

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Spinal Cord Injury: MedlinePlus.gov

Epilepsy: NIH: National Institute of Neurological Disorders and Stroke via MedlinePlus.gov

Meningitis: NIH: National Institute of Neurological Disorders and Stroke via MedlinePlus.gov

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10.3: Communicable (Infectious) Diseases

Introduction

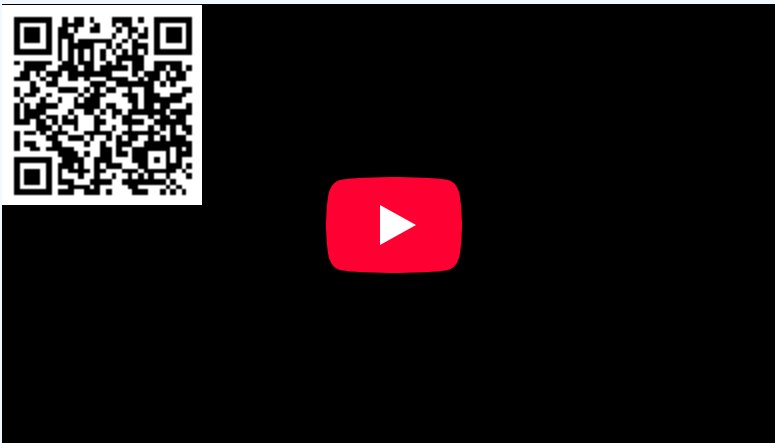
Infectious diseases kill more people worldwide than any other single cause. Infectious diseases are caused by germs. Germs are tiny living things that are found everywhere—in air, soil, and water. You can get infected by touching germs.

There are four main kinds of germs:

- Bacteria—one-celled germs that multiply quickly and may release chemicals which can make you sick
- Viruses—capsules that contain genetic material, and use your own cells to multiply
- Fungi—primitive vegetables, like mushrooms or mildew
- Protozoa—one-celled animals that use other living things for food and a place to live

? Learning Activity

Watch this video about Infectious Diseases Then and Now:



Bacteria

Bacteria are living things that have only one cell. Under a microscope, they look like balls, rods, or spirals. They are so small that a line of 1,000 could fit across a pencil eraser. Most bacteria won't hurt you—less than 1 percent makes people sick. Many are helpful. Some bacteria help to digest food, destroy disease-causing cells and give the body needed vitamins. Bacteria are also used in making healthy foods like yogurt and cheese.

But infectious bacteria can make you ill. They reproduce quickly in your body. Many give off chemicals called toxins, which can damage tissue and make you sick. Examples of bacteria that cause infections include *Streptococcus*, *Staphylococcus*, and *E. coli*.

Antibiotics are the usual treatment. When you take antibiotics, follow the directions carefully. Each time you take antibiotics, you increase the chances that bacteria in your body will learn to resist them. Later, you could get or spread an infection that those antibiotics cannot cure.

Strep Throat

Streptococcal infections (strep for short) cause a variety of health problems. There are two types: group A and group B. Antibiotics are used to treat both.

Group A strep causes

- Strep throat—a sore, red throat, sometimes with white spots on the tonsils
- Scarlet fever—red rash on the body
- Impetigo—a skin infection
- Toxic shock syndrome
- Cellulitis and necrotizing fasciitis (flesh-eating disease)

Group B strep can cause blood infections, pneumonia and meningitis in newborns. A screening test during pregnancy can tell if you have it. If you do, I.V. antibiotics during labor can save your baby's life. Adults can also get group B strep infections, especially if they are elderly or already have health problems. Strep B can cause urinary tract infections, blood infections, skin infections and pneumonia in adults.

Tuberculosis (TB)

In developed countries, such as the United States, many people think TB is a disease of the past. TB, however, is still a leading killer of young adults worldwide. Some 2 billion people—one-third of the world's population—are thought to be infected with TB bacteria, *Mycobacterium tuberculosis* (*Mtb*).

TB is a chronic bacterial infection. It is spread through the air and usually infects the lungs, although other organs and parts of the body can be involved as well. Most people who are infected with *Mtb* harbor the bacterium without symptoms (have latent TB), but some will develop active TB disease. According to World Health Organization estimates, each year 8 million people worldwide develop active TB and nearly 2 million die.

One in 10 people who are infected with *Mtb* may develop active TB at some time in their lives. The risk of developing active disease is greatest in the first year after infection, but active disease often does not occur until many years later.

TB in the United States

In 2006, the Centers for Disease Control and Prevention (CDC) reported 13,799 cases of active TB. While the overall rate of new TB cases continues to decline in the United States since national reporting began in 1953, the annual decrease in TB cases has slowed from an average of 7.1 percent (1993–2000) to the current average of 3.8 percent (2001–2005), according to CDC. In addition to those with active TB, an estimated 10 to 15 million people in the United States have latent TB.

Minorities are affected disproportionately by TB, which occurs among foreign-born individuals nearly nine times as frequently as among people born in the United States. This is partially because they were often exposed to *Mtb* in their country of origin before moving to the United States. In 2004, a very high percentage of Asians (95 percent) and Hispanics (75 percent) who were born outside the United States were reported to have TB.

Tuberculosis (TB) is a bacterial infection caused by a germ called *Mycobacterium tuberculosis*. The bacteria usually attack the lungs, but they can also damage other parts of the body. TB spreads through the air when a person with TB of the lungs or throat coughs, sneezes or talks. If you have been exposed, you should go to your doctor for tests. You are more likely to get TB if you have a weak immune system.

Symptoms of TB in the lungs may include

- A bad cough that lasts 3 weeks or longer
- Weight loss
- Coughing up blood or mucus
- Weakness or fatigue
- Fever and chills
- Night sweats

If not treated properly, TB can be deadly. You can usually cure active TB by taking several medicines for a long period of time. People with latent TB can take medicine so that they do not develop active TB.

Viral Infections

Viruses are capsules with genetic material inside. They are very tiny, much smaller than bacteria. Viruses cause familiar infectious diseases such as the common cold, flu and warts. They also cause severe illnesses such as HIV/AIDS, smallpox and hemorrhagic fevers.

Viruses are like hijackers. They invade living, normal cells and use those cells to multiply and produce other viruses like themselves. This eventually kills the cells, which can make you sick.

Viral infections are hard to treat because viruses live inside your body's cells. They are "protected" from medicines, which usually move through your bloodstream. Antibiotics do not work for viral infections. There are a few antiviral medicines available.

Vaccines can help prevent you from getting many viral diseases.

Influenza

Flu is a respiratory infection caused by a number of viruses. The viruses pass through the air and enter your body through your nose or mouth. Between 5% and 20% of people in the U.S. get the flu each year. The flu can be serious or even deadly for elderly people, newborn babies and people with certain chronic illnesses.

Symptoms of the flu come on suddenly and are worse than those of the common cold. They may include

- Body or muscle aches
- Chills
- Cough
- Fever
- Headache
- Sore throat

Is it a cold or the flu? Colds rarely cause a fever or headaches. Flu almost never causes an upset stomach. And “stomach flu” isn’t really flu at all, but gastroenteritis.

The main way to keep from getting the flu is to get a yearly flu vaccine. If you get the flu, your health care provider may prescribe medicine to help your body fight the infection and lessen symptoms.

? Learning Activity

Watch this video:



Common Cold

Sneezing, sore throat, a stuffy nose, coughing—everyone knows the symptoms of the common cold. It is probably the most common illness. In the course of a year, people in the United States suffer 1 billion colds.

You can get a cold by touching your eyes or nose after you touch surfaces with cold germs on them. You can also inhale the germs. Symptoms usually begin 2 or 3 days after infection and last 2 to 14 days. Washing your hands and staying away from people with colds will help you avoid colds. However, do not give aspirin to children. And do not give cough medicine to children under four.

There is no cure for the common cold. For relief, try

- Getting plenty of rest
- Drinking fluids
- Gargling with warm salt water

- Using cough drops or throat sprays
- Taking over-the-counter pain or cold medicines

Hepatitis B

Hepatitis B is one type of hepatitis—a liver disease—caused by the hepatitis B virus (HBV). Hepatitis B spreads by contact with an infected person’s blood, semen or other body fluid. An infected woman can give hepatitis B to her baby at birth.

If you get HBV, you may feel as if you have the flu, or you may have no symptoms at all. A blood test can tell if you have it. HBV usually gets better on its own after a few months. If it does not get better, it is called chronic HBV, which lasts a lifetime. Chronic HBV can lead to scarring of the liver, liver failure or liver cancer.

There is a vaccine for HBV. It requires three shots. All babies should get the vaccine, but older children and adults can get it too. If you travel to countries where Hepatitis B is common, you should get the vaccine.

? Learning Activity

Are you at risk for viral hepatitis? Take this quick [Hepatitis Risk Assessment](#) test to find out.

Infectious mononucleosis

Infectious mononucleosis, or “mono,” is an infection caused by the Epstein-Barr virus. The virus spreads through saliva, which is why it’s sometimes called “kissing disease.” Mono occurs most often in 15- to 17-year-olds. However, you can get it at any age. Symptoms of mono include

- Fever
- Sore throat
- Swollen lymph glands

Sometimes you may also have a swollen spleen. Serious problems are rare.

A blood test can show if you have mono. Most people get better in two to four weeks. However, you may feel tired for a few months afterward. Treatment focuses on helping symptoms and includes medicines for pain and fever, warm salt water gargles and plenty of rest and fluids.

Fungi

If you have ever had athlete’s foot or a yeast infection, you can blame a fungus. A fungus is actually a primitive vegetable. Mushrooms, mold and mildew are examples. Fungi live in air, in soil, on plants and in water. Some live in the human body. Only about half of all types of fungi are harmful.

Some fungi reproduce through tiny spores in the air. You can inhale the spores or they can land on you. As a result, fungal infections often start in the lungs or on the skin. You are more likely to get a fungal infection if you have a weakened immune system or take antibiotics.

Fungi can be difficult to kill. For skin and nail infections, you can apply medicine directly to the infected area. Oral antifungal medicines are also available for serious infections.

Yeast Infections (or Candida)

Candida is the scientific name for yeast. It is a fungus that lives almost everywhere, including in your body. Usually, your immune system keeps yeast under control. If you are sick or taking antibiotics, it can multiply and cause an infection.

Yeast infections affect different parts of the body in different ways:

- Thrush is a yeast infection that causes white patches in your mouth
- Esophagitis is thrush that spreads to your esophagus, the tube that takes food from your mouth to your stomach. Esophagitis can make it hard or painful to swallow
- Women can get vaginal yeast infections, causing itchiness, pain and discharge
- Yeast infections of the skin cause itching and rashes
- Yeast infections in your bloodstream can be life-threatening

Antifungal medicines eliminate yeast infections in most people. If you have a weak immune system, treatment might be more difficult.

Parasitic Diseases

Parasites are living things that use other living things—like your body—for food and a place to live. You can get them from contaminated food or water, a bug bite, or sexual contact. Parasitic diseases can cause mild discomfort or be deadly.

Parasites range in size from tiny, one-celled organisms called protozoa to worms that can be seen with the naked eye. Some parasitic diseases happen in the United States. Contaminated water supplies can lead to Giardia infections. Cats can transmit toxoplasmosis, which is dangerous for pregnant women. Others, like malaria, are common in other parts of the world.

If you are traveling, it's important to drink only water you know is safe. Prevention is especially important. There are no vaccines for parasitic diseases. Some medicines are available to treat parasitic infections.

Pneumonia

Pneumonia is an inflammation of the lung, usually caused by an infection. Three common causes are bacteria, viruses and fungi. You can also get pneumonia by accidentally inhaling a liquid or chemical. People most at risk are older than 65 or younger than 2 years of age, or already have health problems.

If you have pneumonia, you may have difficulty breathing and have a cough and a fever. A physical exam and history can help determine if you have pneumonia. Chest x-rays and blood tests can help determine what is wrong. Treatment depends on what made you sick. If bacteria are the cause, antibiotics should help. Viral pneumonia may get better with rest and drinking liquids.

Preventing pneumonia is always better than treating it. The best preventive measures include washing your hands frequently, not smoking, and wearing a mask when cleaning dusty or moldy areas. There is a vaccine for pneumococcal pneumonia, a bacterial infection which accounts for up to a quarter of all pneumonias.

Defining Health Disparities

Despite prevention efforts, some groups of people are affected by HIV/AIDS, viral hepatitis, STDs, and TB more than other groups of people. The occurrence of these diseases at greater levels among certain population groups more than among others is often referred to as a health disparity. Differences may occur by gender, race or ethnicity, education, income, disability, geographic location and sexual orientation among others. Social determinants of health like poverty, unequal access to health care, lack of education, stigma, and racism are linked to health disparities.

? Optional Learning Activity

For more information on this topic, see or listen to: What You Need to Know About Infectious Diseases.

Sources

Introduction: NIH: National Institute of Allergy and Infectious Diseases, MedlinePlus, <http://www.nlm.nih.gov/medlineplus/infectiousdiseases.html>

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Influenza: NIH: National Institute of Allergy and Infectious Diseases via MedlinePlus.gov

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Parasitic Diseases: National Library of Medicine, National Institutes for Health via MedlinePlus.gov

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10.4: Immunity and Immunizations

In 2010, a pertussis (whooping cough) outbreak in California sickened 9,143 people and resulted in 10 infant deaths: the worst outbreak in 63 years (Centers for Disease Control 2011b). Researchers, suspecting that the primary cause of the outbreak was the waning strength of pertussis vaccines in older children, recommended a booster vaccination for 11–12-year-olds and also for pregnant women (Zacharyczuk 2011). Pertussis is most serious for babies; one in five needs to be hospitalized, and since they are too young for the vaccine themselves, it is crucial that people around them be immunized (Centers for Disease Control 2011b). Several states, including California, have been requiring the pertussis booster for older children in recent years with the hope of staving off another outbreak.

But what of people who do not want their children to have this vaccine, or any other? That question is at the heart of a debate that has been simmering for years. Vaccines are biological preparations that improve immunity against a certain disease. Vaccines have contributed to the eradication and weakening of numerous infectious diseases, including smallpox, polio, mumps, chicken pox, and meningitis.

However, many people express concern about potential negative side effects from vaccines. These concerns range from fears about overloading the child's immune system to controversial reports about devastating side effects of the vaccines. One misapprehension is that the vaccine itself might cause the disease it is supposed to be immunizing against.

Another commonly circulated concern is that vaccinations, specifically the MMR vaccine (MMR stands for measles, mumps, and rubella), are linked to autism. The autism connection has been particularly controversial. In 1998, a British physician named Andrew Wakefield published a study in Great Britain's *Lancet* magazine that linked the MMR vaccine to autism. The report received a lot of media attention, resulting in British immunization rates decreasing from 91 percent in 1997 to almost 80 percent by 2003, accompanied by a subsequent rise in measles cases (Devlin 2008). A prolonged investigation by the *British Medical Journal* proved that not only was the link in the study nonexistent, but that Dr. Wakefield had falsified data in order to support his claims (CNN 2011). Dr. Wakefield was discredited and stripped of his license, but the doubt still lingers in many parents' minds.

In the United States, many parents still believe in the now discredited MMR-autism link and refuse to vaccinate their children. Other parents choose not to vaccinate for various reasons like religious or health beliefs. In one instance, a boy whose parents opted not to vaccinate returned home to the U.S. after a trip abroad; no one yet knew he was infected with measles. The boy exposed 839 people to the disease and caused 11 additional cases of measles, all in other unvaccinated children, including one infant who had to be hospitalized. According to a study published in *Pediatrics* (2010), the outbreak cost the public sector \$10,376 per diagnosed case. The study further showed that the intentional non-vaccination of those infected occurred in students from private schools, public charter schools, and public schools in upper-socioeconomic areas (Sugerman et al. 2010).

Consider these questions about immunization:

- Should parents be forced to immunize their children?
- How does this story of vaccines in a high-income region compare to that in a low-income region, like sub-Saharan Africa, where populations are often eagerly seeking vaccines rather than refusing them?
- Do you believe all children should receive vaccinations?

Immunity and Immunizations

Shots may hurt a little... but the diseases they can prevent can hurt a lot more! Immunization shots, or vaccinations, are essential. They protect against things like measles, mumps, rubella, hepatitis B, polio, diphtheria, tetanus and pertussis (whooping cough). Immunizations are important for adults as well as for children. Here's why.

Your immune system helps your body fight germs by producing substances to combat them. Once it does, the immune system "remembers" the germ and can fight it again. Vaccines contain germs that have been killed or weakened. When given to a healthy person, the vaccine triggers the immune system to respond and thus build immunity.

Before vaccines, people became immune only by actually getting a disease and surviving it. Immunizations are an easier and less risky way to become immune.

? Optional Learning Activity

Take action to raise awareness of immunizations (e.g., Assist a school nurse to host an immunization education event for parents at a local school)

- Create and distribute an [immunization reminder flyers](#) to all the members of your organization, club or place of worship.

Vaccines

Vaccines are the best defense we have against serious, preventable, and sometimes deadly contagious diseases. Vaccines are some of the safest medical products available, but like any other medical product, there may be risks. Accurate information about the value of vaccines as well as their possible side-effects helps people to make informed decisions about vaccination.

Federal law requires that Vaccine Information Statements explaining vaccine benefits and risks be handed out whenever (before each dose) certain vaccinations are given. Vaccine Information Statements are available in Spanish and many different languages. In addition, more detailed information describing the benefits and risks of a particular vaccine is available in the Prescribing Information from the Food and Drug Administration.

The following sections answer common questions asked about vaccines and how vaccines are tested and monitored to ensure they are safe and effective. These sections are currently available in English only.

Vaccines are held to the highest standard of safety. The United States currently has the safest, most effective vaccine supply in history. Vaccines undergo a rigorous and extensive evaluation program to determine a product's safety and effectiveness. If a vaccine does receive approval, it is continuously monitored for safety and effectiveness.

Many partners work together to make sure vaccines are safe. Government health scientists work with manufacturers, health care providers, academia, and global health groups such as the World Health Organization to build a comprehensive vaccine safety system. At the Department of Health and Human Services, primarily three agencies work on vaccine safety:

- Centers for Disease Control and Prevention (CDC)
- National Institutes of Health (NIH)
- Food and Drug Administration (FDA)

Vaccines undergo rigorous and extensive testing to determine their safety and effectiveness prior to approval. Following approval, FDA carefully monitors the quality of vaccines—all manufactured lots must pass tests before they can be used. Vaccine manufacturers also must follow strict manufacturing standards, and FDA conducts routine inspections of manufacturing sites.

Scientists from FDA and CDC work closely to monitor reports of vaccine side effects (adverse events) after they are approved and used widely. FDA and CDC take all reports seriously, and work together to evaluate and address any potential problems.

? Learning Activity

Watch this video titled Get The Picture: Childhood Immunizations:



After talking with parents across the country, CDC put together this short video to help answer the tough questions that real moms had about childhood immunizations.

Understanding the importance of vaccines is crucial for you to protect your children's health. [Read the script](#)

- Did watching this video help you decide on whether or not to get your child immunized?
- Interview some parents to find out what they think about this issue.

Potential Side Effects

Vaccines, like all medical products, may cause side effects in some people. Most of these side effects are minor, such as redness or swelling at the injection site. Read further to learn about possible side effects from vaccines.

Any vaccine can cause side effects. For the most part these are minor (for example, a sore arm or low-grade fever) and go away within a few days.

Remember, vaccines are continually monitored for safety, and like any medication, vaccines can cause side effects. However, a decision not to immunize a child also involves risk and could put the child and others who come into contact with him or her at risk of contracting a potentially deadly disease.

How Well Do Vaccines Work?

Vaccines work really well. No medicine is perfect, of course, but most childhood vaccines produce immunity about 90–100% of the time.

What about the argument made by some people that vaccines don't work that well . . . that diseases would be going away on their own because of better hygiene or sanitation, even if there were no vaccines?

That simply isn't true. Certainly better hygiene and sanitation can help prevent the spread of disease, but the germs that cause disease will still be around, and as long as they are they will continue to make people sick.

All vaccines must be licensed (approved) by the Food and Drug Administration (FDA) before being used in the United States, and a vaccine must go through extensive testing to show that it works and that it is safe before the FDA will approve it. Among these tests are clinical trials, which compare groups of people who get a vaccine with groups of people who get a control. A vaccine is approved only if FDA makes the determination that it is safe and effective for its intended use.

If you look at the history of any vaccine-preventable disease, you will virtually always see that the number of cases of disease starts to drop when a vaccine is licensed. Vaccines are the most effective tool we have to prevent infectious diseases.

Prevention

Vaccines help the body's immune system prepare for future attacks. Vaccines consist of killed or modified microbes, parts of microbes, or microbial DNA that trick the body into thinking an infection has occurred. A vaccinated person's immune system attacks the harmless vaccine and prepares for invasions against the kind of microbe the vaccine contained. In this way, the person becomes immunized against the microbe: if re-exposure to the infectious microbe occurs, the immune system will quickly recognize how to stop the infection.

This section explains more in detail about how your immune system works to prevent you from getting sick. Knowing how your immune system works may help you understand how vaccines work with your immune system to protect you.

What is the Immune System?

The immune system is a network of cells, tissues, and organs that work together to defend the body against attacks by “foreign” invaders. These are primarily microbes—tiny organisms such as bacteria, parasites, and fungi that can cause infections. Viruses also cause infections, but are too primitive to be classified as living organisms. The human body provides an ideal environment for many microbes. It is the immune system's job to keep them out or, failing that, to seek out and destroy them.

When the immune system hits the wrong target, however, it can unleash a torrent of disorders, including allergic diseases, arthritis, and a form of diabetes. If the immune system is crippled, other kinds of diseases result.

The immune system is amazingly complex. It can recognize and remember millions of different enemies, and it can produce secretions (release of fluids) and cells to match up with and wipe out nearly all of them.

The secret to its success is an elaborate and dynamic communications network. Millions and millions of cells, organized into sets and subsets, gather like clouds of bees swarming around a hive and pass information back and forth in response to an infection. Once immune cells receive the alarm, they become activated and begin to produce powerful chemicals. These substances allow the cells to regulate their own growth and behavior, enlist other immune cells, and direct the new recruits to trouble spots.

In addition, scientists are rapidly unraveling the genetic blueprints that direct the human immune response, as well as those that dictate the biology of bacteria, viruses, and parasites. The combination of new technology and expanded genetic information will no doubt reveal even more about how the body protects itself from disease.

Mounting an Immune Response

Infections are the most common cause of human disease. They range from the common cold to debilitating conditions like chronic hepatitis to life-threatening diseases such as AIDS. Disease-causing microbes (pathogens) attempting to get into the body must first move past the body's external armor, usually the skin or cells lining the body's internal passageways.

The skin provides an imposing barrier to invading microbes. It is generally penetrable only through cuts or tiny abrasions. The digestive and respiratory tracts—both portals of entry for a number of microbes—also have their own levels of protection. Microbes entering the nose often cause the nasal surfaces to secrete more protective mucus, and attempts to enter the nose or lungs can trigger a sneeze or cough reflex to force microbial invaders out of the respiratory passageways. The stomach contains a strong acid that destroys many pathogens that are swallowed with food.

If microbes survive the body's front-line defenses, they still have to find a way through the walls of the digestive, respiratory, or urogenital passageways to the underlying cells. These passageways are lined with tightly packed epithelial cells covered in a layer of mucus, effectively blocking the transport of many pathogens into deeper cell layers.

Mucosal surfaces also secrete a special class of antibody called IgA, which in many cases is the first type of antibody to encounter an invading microbe. Underneath the epithelial layer a variety of immune cells, including macrophages, B cells, and T cells, lie in wait for any microbe that might bypass the barriers at the surface.

Next, invaders must escape a series of general defenses of the innate immune system, which are ready to attack without regard for specific antigen markers. These include patrolling phagocytes, natural killer T cells, and complement.

Microbes cross the general barriers then confront specific weapons of the adaptive immune system tailored just for them. These specific weapons, which include both antibodies and T cells, are equipped with singular receptor structures that allow them to recognize and interact with their designated targets.

Immunity

Long ago, physicians realized that people who had recovered from the plague would never get it again—they had acquired immunity. This is because some of the activated T and B cells had become memory cells. Memory cells ensure that the next time a person meets up with the same antigen, the immune system is already set to demolish it.

Immunity can be strong or weak, short-lived or long-lasting, depending on the type of antigen it encounters, the amount of antigen, and the route by which the antigen enters the body. Immunity can also be influenced by inherited genes. When faced with the same antigen, some individuals will respond forcefully, others feebly, and some not at all.

An immune response can be sparked not only by infection but also by immunization with vaccines. Some vaccines contain microorganisms—or parts of microorganisms—that have been treated so they can provoke an immune response but not full-blown disease.

Immunity can also be transferred from one individual to another by injections of serum rich in antibodies against a particular microbe (antiserum). For example, antiserum is sometimes given to protect travelers to countries where hepatitis A is widespread. The antiserum induces passive immunity against the hepatitis A virus. Passive immunity typically lasts only a few weeks or months.

Vaccines

For many years, healthcare providers have used vaccination to help the body's immune system prepare for future attacks. Vaccines consist of killed or modified microbes, parts of microbes, or microbial DNA that trick the body into thinking an infection has occurred.

A vaccinated person's immune system attacks the harmless vaccine and prepares for invasions against the kind of microbe the vaccine contained. In this way, the person becomes immunized against the microbe. Vaccination remains one of the best ways to prevent infectious diseases, and vaccines have an excellent safety record. Previously devastating diseases such as smallpox, polio, and whooping cough (pertussis) have been greatly controlled or eliminated through worldwide vaccination programs.

Recommended Vaccines for Young Adults

The transition to adulthood is an exciting time in a young person's life. Starting a career, getting an apartment, entering college, or joining the armed forces all offer unique rewards and challenges.

Yet young adults may not know that some vaccines can make this transitional time a healthier one.

Vaccines recommended for young adults ages 19–24 include:

- Meningococcal conjugate vaccine, which helps prevent meningococcal disease
- Tdap vaccine, which protects against tetanus, diphtheria, and pertussis (also known as whooping cough)
- HPV vaccine, which protects against the viruses that cause most cervical cancers, anal cancer, and genital warts
- Seasonal flu vaccine

There may be other vaccines recommended for young adults because their health, job, or lifestyle may put them at higher risk for certain diseases. Young adults should talk to a doctor or nurse to find out if there are other vaccines that they may need.

? Learning Activity

Take this [quiz](#) to find out to find out which vaccines **YOU** may need.

Antibiotic / Antimicrobial Resistance

Antibiotics and similar drugs, together called antimicrobial agents, have been used for the last 70 years to treat patients who have infectious diseases. Since the 1940s, these drugs have greatly reduced illness and death from infectious diseases. Antibiotic use has been beneficial and, when prescribed and taken correctly, their value in patient care is enormous.

However, these drugs have been used so widely and for so long that the infectious organisms the antibiotics are designed to kill have adapted to them, making the drugs less effective. People infected with antimicrobial-resistant organisms are more likely to have longer, more expensive hospital stays, and may be more likely to die as a result of the infection.

Sexually Transmitted Diseases and HIV

Sexually transmitted diseases (STDs) are infections that you can get from having sex with someone who has the infection. The causes of STDs are bacteria, viruses, and parasites. There are more than 20 types of STDs, including:

- Bacterial
 - Gonorrhea
- Viral
 - Genital herpes
 - HIV/AIDS
 - HPV
 - Syphilis
- Parasitic
 - Trichomoniasis

Most STDs affect both men and women, but in many cases the health problems they cause can be more severe for women. If a pregnant woman has an STD, it can cause serious health problems for the baby.

If you have an STD caused by bacteria or parasites, your health care provider can treat it with antibiotics or other medicines. If you have an STD caused by a virus, there is no cure. Sometimes medicines can keep the disease under control. Correct usage of latex condoms greatly reduces, but does not completely eliminate, the risk of catching or spreading STDs.

Gonorrhea

Gonorrhea is a curable [sexually transmitted disease](#). It is most common in young adults. The bacteria that cause gonorrhea can infect the genital tract, mouth or anus.

Gonorrhea does not always cause symptoms, especially in women. In men, gonorrhea can cause pain when urinating and discharge from the penis. If untreated, it can cause epididymitis, which affects the testicles and can lead to infertility. In women, gonorrhea can cause bleeding between periods, pain when urinating and increased discharge from the vagina. If untreated, it can lead to [pelvic inflammatory disease](#), which causes problems with pregnancy and infertility. Gonorrhea can pass from mother to baby during pregnancy.

You can cure gonorrhea with antibiotics prescribed by your health care provider. Correct usage of latex condoms greatly reduces, but does not eliminate, the risk of catching or spreading gonorrhea.

Genital Herpes

Genital herpes is a sexually transmitted disease (STD) caused by a herpes simplex virus (HSV). It can cause sores on your genital or rectal area, buttocks, and thighs. You can get it from having sex, even oral sex. The virus can spread even when sores are not present. Mothers can also infect their babies during childbirth.

Symptoms of herpes are called outbreaks. You usually get sores near the area where the virus has entered the body. They turn into blisters, become itchy and painful, and then heal. Sometimes people do not know they have herpes because they have no symptoms or very mild symptoms. The virus can be more serious in newborn babies or in people with weak immune systems.

Most people have outbreaks several times a year. Over time, you get them less often and the symptoms become milder. The virus stays in your body for life.

Medicines do not cure genital herpes, but they can help your body fight the virus. This can help lessen symptoms, decrease outbreaks, and lower the risk of passing the virus to others. Correct usage of latex condoms can reduce, but not eliminate, the risk of catching or spreading herpes.

? Learning Activity

Watch this video about [Molly's story and herpes](#).

HPV (or genital warts)

Human papillomaviruses (HPV) are common viruses that can cause warts. There are more than 100 types of HPV. Most are harmless, but about 30 types put you at risk for cancer. These types affect the genitals and you get them through sexual contact with an infected partner. They are classified as either low-risk or high-risk. Low-risk HPV can cause genital warts. High-risk HPV can lead to cancers of the cervix, vulva, vagina, and anus in women. In men, it can lead to cancers of the anus and penis.

Although some people develop genital warts from HPV infection, others have no symptoms. Your health care provider can treat or remove the warts. In women, Pap smears can detect changes in the cervix that might lead to cancer.

Correct usage of latex condoms greatly reduces, but does not eliminate, the risk of catching or spreading HPV. A vaccine can protect against several types of HPV, including some that can cause cancer.

Trichomoniasis

Trichomoniasis is a sexually transmitted disease caused by a parasite. It affects both women and men, but symptoms are more common in women. Symptoms in women include a green or yellow discharge from the vagina, itching in or near the vagina and discomfort with urination. Most men with trichomoniasis don't have any symptoms, but it can cause irritation inside the penis.

You can cure trichomoniasis with antibiotics. In men, the infection usually goes away on its own without causing symptoms. But an infected man can continue to infect or reinfect a woman until he gets treated. So it's important that both partners get treated at the same time. Correct usage of latex condoms greatly reduces, but does not eliminate, the risk of catching or spreading trichomoniasis.

AIDS and HIV

AIDS was first reported in the United States in 1981 and has since become a major worldwide epidemic. AIDS is caused by the human immunodeficiency virus, or HIV. By killing or damaging cells of the body's immune system, HIV progressively destroys the body's ability to fight infections and certain cancers. People diagnosed with AIDS may get life-threatening diseases called opportunistic infections. These infections are caused by microbes such as viruses or bacteria that usually do not make healthy people sick.

Since 1981, more than 980,000 cases of AIDS have been reported in the United States to the Centers for Disease Control and Prevention (CDC). According to CDC, more than 1,000,000 Americans may be infected with HIV, one-quarter of whom are unaware of their infection. The epidemic is growing most rapidly among minority populations and is a leading killer of African-American males ages 25 to 44. According to CDC, AIDS affects nearly seven times more African Americans and three times more Hispanics than whites. In recent years, an increasing number of African-American women and children are being affected by HIV/AIDS.

- The U.S. HIV/AIDS epidemic began in 1981 and continues to disproportionately affect minorities, men who have sex with men of all races, women, and youth.
- More than 1 million people in the United States currently are living with HIV/AIDS.
- About 21 percent of those infected with HIV are unaware of their infection.
- Since the U.S. epidemic began, 617,025 people have died of AIDS.
- In 2008, there were approximately 42,439 new HIV infections, with the highest proportion among African Americans despite the fact that they make up only 12 percent of the U.S. population.

HIV

HIV stands for human immunodeficiency virus. It kills or damages the body's immune system cells. AIDS stands for acquired immunodeficiency syndrome. It is the most advanced stage of infection with HIV.

HIV most often spreads through unprotected sex with an infected person. It may also spread by sharing drug needles or through contact with the blood of an infected person. Women can give it to their babies during pregnancy or childbirth.

The first signs of HIV infection may be swollen glands and flu-like symptoms. These may come and go a month or two after infection. Severe symptoms may not appear until months or years later.

A blood test can tell if you have HIV infection. Your health care provider can perform the test.

There is no cure, but there are many medicines to fight both HIV infection and the infections and cancers that come with it. People can live with the disease for many years.

AIDS Prevention

Currently, there is no vaccine to prevent HIV infection nor is there a cure for HIV/AIDS. To reduce your risk of becoming infected with HIV or transmitting the virus to others

- Get tested regularly for HIV
- Practice abstinence
- Remain faithful to your spouse or partner
- Consistently use male latex or female polyurethane condoms
- Do not share needles

Detection and Treatment in HIV Prevention

Testing and treatment of sexually transmitted diseases (STDs) can be an effective tool in preventing the spread of HIV, the virus that causes AIDS. An understanding of the relationship between STDs and HIV infection can help in the development of effective HIV prevention programs for persons with high-risk sexual behaviors.

What is the link between STDs and HIV infection?

Individuals who are infected with STDs are at least two to five times more likely than uninfected individuals to acquire HIV infection if they are exposed to the virus through sexual contact. In addition, if an HIV-infected individual is also infected with another STD, that person is more likely to transmit HIV through sexual contact than other HIV-infected persons (Wasserheit, 1992).

There is substantial biological evidence demonstrating that the presence of other STDs increases the likelihood of both transmitting and acquiring HIV.

- **Increased susceptibility.** STDs appear to increase susceptibility to HIV infection by two mechanisms. Genital ulcers (e.g., syphilis, herpes, or chancroid) result in breaks in the genital tract lining or skin. These breaks create a portal of entry for HIV. Additionally, inflammation resulting from genital ulcers or non-ulcerative STDs (e.g., chlamydia, gonorrhea, and trichomoniasis) increase the concentration of cells in genital secretions that can serve as targets for HIV (e.g., CD4+ cells).
- **Increased infectiousness.** STDs also appear to increase the risk of an HIV-infected person transmitting the virus to his or her sex partners. Studies have shown that HIV-infected individuals who are also infected with other STDs are particularly likely to shed HIV in their genital secretions. For example, men who are infected with both gonorrhea and HIV are more than twice as likely to have HIV in their genital secretions than are those who are infected only with HIV. Moreover, the median concentration of HIV in semen is as much as 10 times higher in men who are infected with both gonorrhea and HIV than in men infected only with HIV. The higher the concentration of HIV in semen or genital fluids, the more likely it is that HIV will be transmitted to a sex partner.

How can STD treatment slow the spread of HIV infection?

Evidence from intervention studies indicates that detecting and treating STDs may reduce HIV transmission.

- **STD treatment reduces an individual's ability to transmit HIV.** Studies have shown that treating STDs in HIV-infected individuals decreases both the amount of HIV in genital secretions and how frequently HIV is found in those secretions (Fleming, Wasserheit, 1999).
- Herpes can make people more susceptible to HIV infection, and it can make HIV-infected individuals more infectious. It is critical that all individuals, **especially those with herpes**, know whether they are infected with HIV and, if uninfected with HIV, take measures to protect themselves from infection with HIV.

- Among individuals with both herpes and HIV, trials are underway studying if treatment of the genital herpes helps prevent HIV transmission to partners.

? Learning Activity

Watch [this video about AIDS](#) from PBS.

Illness, Sickness, and Disease

Discussing the complexities of what constitutes a disease requires careful distinction among related, but distinct concepts. In 1973, Susser, an epidemiologist, proposed some definitions that remain useful. He used “illness” to refer to the subjective sense of feeling unwell; illness does not define a specific pathology, but refers to a person’s subjective experience of it, such as discomfort, tiredness, or general malaise. The way a patient reports symptoms is influenced by his or her cultural background, and Susser applied the term “sickness” to refer to socially and culturally held conceptions of health conditions (e.g., the dread of cancer or the stigma of mental illness), which in turn influence how the patient reacts). The social perceptions of disease that Illich described modify the ways a patient perceives and presents his symptoms.

Cultural conventions likewise affect where the boundary between disease and non-disease is placed: menopause may be considered a health issue in North America, but symptoms are far less commonly reported in Japan. Disease implies a focus on pathological processes that may or may not produce symptoms and that result in a patient’s illness. For example, a patient complains of tiredness and malaise—his illness as he experiences it. He consults a doctor about it—because he believes that he might have a sickness. The doctor might attribute the patient’s symptoms to a thyroid condition—a disease.

This model focuses on pathological processes, and on understanding, diagnosing, and treating the physical and biological aspects of disease. The goal of treatment is to restore the patient’s physiological integrity and function. Diagnosis involves recognizing and applying a label to a pattern of signs and symptoms that is at least partly understood in terms of abnormal structure or function of cells, organs, and systems. This offers a rational basis for the investigation of effective treatments. For instance, a certain pattern of chest pain known as angina pectoris is understood biologically as a disorder of the coronary arteries that causes cardiac ischemia, and the treatments it are geared to the specific causes of restoring cardiac blood flow and reducing cardiac effort.

Early biomedical conceptions supposed that a disease is either present or absent: a bacterium has invaded the body or it has not. However, as medicine increasingly tackled conditions, such as hypertension, which represent deviations from normal values, which themselves have a range and can be debated, it became apparent that there may be no set threshold for defining disease. Thus, instead of being seen as a state that is qualitatively distinct from health, many diseases have to be approached as a quantitative threshold on a continuum of biological variability. Organizations such as the World Health Organization (WHO) and the National Institutes of Health have proposed different classifications of hypertension and have changed how they constitute hypertension over time. Hypertension can be mild, moderate or severe, or defined as pre-hypertension or hypertension stage 1 or stage 2.

✓ Optional: Video Lectures about Epidemics

[Epidemics in Western Society](#) is a course taught Frank Snowden at Yale.

This course consists of video lectures with an international analysis of the impact of epidemic diseases on western society and culture from the bubonic plague to HIV/AIDS and the recent experience of SARS and swine flu.

Leading themes include:

- infectious disease and its impact on society
- the development of public health measures
- the role of medical ethics
- the genre of plague literature
- the social reactions of mass hysteria and violence
- the rise of the germ theory of disease
- the development of tropical medicine
- a comparison of the social, cultural, and historical impact of major infectious diseases

- the issue of emerging and re-emerging diseases

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Recommended Vaccines for Young Adults: College, CDC, www.cdc.gov/vaccines/spec-grps/college.htm

Antibiotic / Antimicrobial Resistance: [Antimicrobial Resistance](http://www.cdc.gov/drugresistance/index.html), CDC, <http://www.cdc.gov/drugresistance/index.html>

Sexually Transmitted Diseases and HIV: [Sexually Transmitted Diseases](http://www.nlm.nih.gov/medlineplus/sexuallytransmitteddiseases.html), Centers for Disease Control and Prevention via MedlinePlus, <http://www.nlm.nih.gov/medlineplus/sexuallytransmitteddiseases.html>

Gonorrhea: [Gonorrhea](http://www.nlm.nih.gov/medlineplus/gonorrhea.html), Centers for Disease Control and Prevention via MedlinePlus, <http://www.nlm.nih.gov/medlineplus/gonorrhea.html>

Genital Herpes: [Genital Herpes](http://www.nlm.nih.gov/medlineplus/herpessimplex.html), Medline, NLM, NIH, <http://www.nlm.nih.gov/medlineplus/herpessimplex.html>

HPV (or genital warts): [HPV](http://www.nlm.nih.gov/medlineplus/hpv.html), NLM, NIH, <http://www.nlm.nih.gov/medlineplus/hpv.html>

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Illness, Sickness, and Disease: AFMC Primer on Population Health, The Association of Faculties of Medicine of Canada, CC-BY-NC-SA, phprimer.afmc.ca/Part1-TheoryThinkingAboutHealth/Chapter1ConceptsOfHealthAndIllness/IllnessSicknessandDisease

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CHAPTER OVERVIEW

11: Weight Management

By Lisa Jellum

Learning Objectives

- Discuss how to manage weight through diet
- Provide steps for starting a weight loss plan
- Reinforce the importance of physical activity in weight management
- Explain how to keep the weight off

The majority of Americans are unhappy with their current weight. Almost everyone would like to lose at least 5 pounds. A growing percentage of Americans are carrying enough excess weight to put them at risk for many diseases and even death. Few people, however, know enough about their own bodies to successfully manage their weight. Anyone planning to start a weight loss program should begin by carefully considering the following factors:

- How many calories are being consumed daily?
- How many calories are being expended?
- How much fluids are being consumed?
- How well are electrolytes being managed?

[11.1: Weight Management Through Diet](#)

[11.2: The Importance of Physical Activity in Maintaining a Healthy Weight](#)

[11.3: Keeping the Weight Off](#)

[11.4: Health Risks of Being Underweight](#)

[11.5: References](#)

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11.1: Weight Management Through Diet

Achieving one's ideal weight can be a real challenge. But like most endeavors in life, knowledge is power. The more people know about their diet, the better equipped they will be to manage their weight. Most people focus on the number of calories consumed. However, it is also important for them to know how many macronutrients are in the foods they eat. The most effective way to do this is performing a 10-day nutritional intake analysis. These analyses are best done on consecutive days to account for the habitual ebb and flow of one's daily food intake.

Remaining healthy during any weight loss program is paramount. Fad diets that promise quick results do not consider the effects of rapid weight loss on the body. Restricting weight loss to 1 to 2 pounds a week is a far healthier approach. Slow weight also prevents the body from burning lean muscle since the body can only burn a certain amount of fat in a week. Dieters who experience steady declines in weight are more likely to keep the weight off. The term "diet" is often synonymous with strict routines that require drastic changes in one's eating habits. In reality, the term "diet" simply describes the intake of food.

To lose weight, dieters need a clear understanding of how weight loss occurs. One pound of fat loss is going to require a reduction in caloric intake of 3,500 calories. When viewed in terms of daily food intake, to lose a pound a week, a dieter needs to reduce their daily food intake by 500 calories a day: $3,500 \text{ calories} / 7 \text{ days} = 500 \text{ calories per day}$. To successfully lose 2 pounds per week, that reduction would have to be doubled to 1,000 calories per day. Attempting to lose 2 pounds or more per week would require a calorie reduction too drastic to be maintained and too restrictive to be healthy. Thus the recommendation of combining diet and exercise is the most effective method for experiencing weight loss. Subtracting 500 calories of food intake and exerting 500 calories in exercise will provide that same 1000 calorie reduction, but in a manner that is far easier to maintain, and certainly more enjoyable.

No matter what your weight loss goal is, even a modest weight loss, such as 5 to 10 percent of your total body weight, is likely to produce health benefits, such as improvements in blood pressure, blood cholesterol, and blood sugars.¹

Getting Started with Weight Loss

The Centers for Disease Control and Prevention (CDC) recommends following the step-by-step guide published on its website, on this page: [Healthy Weight: Losing Weight. Getting Started](#). The same information is also reprinted below:

Step 1: Make a commitment

Making the decision to lose weight, change your lifestyle, and become healthier is a big step to take. Start simply by making a commitment to yourself. Many people find it helpful to sign a written contract committing to the process. This contract may include things like the amount of weight you want to lose, the date you would like to lose the weight by, the dietary changes you will make to establish healthy eating habits, and a plan for getting regular physical activity.

Writing down the reasons why you want to lose weight can also help. It might be because you have a family history of heart disease, or because you want to see your kids get married, or simply because you want to feel better in your clothes. Post these reasons where they serve as a daily reminder of why you want to make this change.

Step 2: Take stock of where you are

Consider talking to your health care provider. He or she can evaluate your height, weight, and explore other weight-related risk factors you may have. Ask for a follow-up appointment to monitor changes in your weight or any related health conditions.

Keep a "food diary" for a few days, in which you write down everything you eat. By doing this, you become more aware of what you are eating and when you are eating. This awareness can help you avoid mindless eating.

Next, examine your current lifestyle. Identify things that might pose challenges to your weight loss efforts. For example, does your work or travel schedule make it difficult to get enough physical activity? Do you find yourself eating sugary foods because that is what you buy for your kids? Do your coworkers frequently bring high-calorie items, such as doughnuts, to the workplace to share with everyone? Think through things you can do to help overcome these challenges.

Finally, think about aspects of your lifestyle that can help you lose weight. For example, is there an area near your workplace where you and some coworkers can take a walk at lunchtime? Is there a place in your community, such as a YMCA, with exercise facilities for you and child care for your kids?

Step 3: Set realistic goals

Set some short-term goals and reward your efforts along the way. If your long-term goal is to lose 40 pounds and to control your high blood pressure, some short-term eating and physical activity goals might be to start eating breakfast, taking a 15-minute walk in the evenings, or having a salad or vegetable with supper.

Focus on two or three goals at a time. Great, effective goals are —

- Specific
- Realistic
- Forgiving (less than perfect)

For example, "Exercise more" is not a specific goal. But if you say, "I will walk 15 minutes, 3 days a week for the first week," you are setting a specific and realistic goal for the first week.

Remember, small changes every day can lead to big results in the long run. Also, remember that realistic goals are achievable goals. By achieving your short-term goals day by day, you will feel good about your progress and be motivated to continue. Setting unrealistic goals, such as losing 20 pounds in 2 weeks, can leave you feeling defeated and frustrated.

Being realistic also means expecting occasional setbacks. Setbacks happen when you get away from your plan for whatever reason—maybe the holidays, longer work hours, or another life change. When setbacks happen, get back on track as quickly as possible. Also, take some time to think about what you would do differently if a similar situation happens, to prevent setbacks.

Keep in mind everyone is different—what works for someone else might not be right for you. Just because your neighbor lost weight by taking up running, doesn't mean running is the best option for you. Try a variety of activities: walking, swimming, tennis, or group exercise classes, to see what you enjoy most and can fit into your life. These activities will be easier to stick with over the long term.

Step 4: Identify resources for information and support

Find family members or friends who will support your weight loss efforts. Making lifestyle changes can feel easier when you have others you can talk to and rely on for support. You might have coworkers or neighbors with similar goals, and together you can share healthful recipes and plan group exercise. Joining a weight loss group or visiting a health care professional, such as a registered dietitian, can help.

Step 5: Continually "check in" with yourself to monitor your progress

Revisit the goals you set for yourself in Step 3, and evaluate your progress regularly. If you set a goal to walk each morning but are having trouble fitting it in before work, see if you can shift your work hours or if you can get your walk in at lunchtime or after work. Evaluate which parts of your plan are working well and which ones need tweaking. Then rewrite your goals and plan accordingly.

If you are consistently achieving a particular goal, add a new goal to help you continue on your pathway to success.

Reward yourself for your successes! Recognize when you are meeting your goals and be proud of your progress. Use non-food rewards, such as a bouquet of freshly picked flowers, a sports outing with friends, or a relaxing bath. Rewards help keep you motivated on the path to better health.²

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11.2: The Importance of Physical Activity in Maintaining a Healthy Weight

On its website, the CDC explains the importance of including physical activity as part of any weight loss program. You can find information about the benefits of physical activity, recommended levels of physical activity, and the number of calories burned during common activities by clicking on this link to webpage: [Healthy Weight: Physical Activity for a Health Weight](#). That same information is reprinted below.

Why is physical activity important?

Regular physical activity is important for good health, and it is especially important if you are trying to lose weight or to maintain a healthy weight.

- When losing weight, more physical activity increases the number of calories your body uses for energy or "burns off." The burning of calories through physical activity, combined with reducing the number of calories you eat, creates a "calorie deficit" that results in weight loss.
- Most weight loss occurs because of decreased caloric intake. However, evidence shows the only way to maintain weight loss is to be engaged in regular physical activity.
- Most importantly, physical activity reduces risks of cardiovascular disease and diabetes beyond that produced by weight reduction alone.

Physical activity also helps to—

- Maintain weight.
- Reduce high blood pressure.
- Reduce risk for type 2 diabetes, heart attack, stroke, and several forms of cancer.
- Reduce arthritis pain and associated disability.
- Reduce risk for osteoporosis and falls.
- Reduce symptoms of depression and anxiety.

How much physical activity do I need?

When it comes to weight management, people vary greatly in how much physical activity they need. Here are some guidelines to follow:

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 is 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 are eating and drinking. Getting to and staying at a healthy weight requires both regular physical activity and a healthy eating plan.

What do moderate- and vigorous-intensity mean?

Moderate: While performing the physical activity, if your breathing and heart rate is noticeably faster but you can still carry on a conversation, it is probably moderately intense.

Examples include:

- Walking briskly (a 15-minute mile).
- Light yard work (raking/bagging leaves or using a lawn mower).
- Light snow shoveling.
- Actively playing with children.

- Biking at a casual pace.

Vigorous: If your heart rate is increased substantially, and you are breathing too hard and fast to have a conversation, it is probably vigorously intense.

Examples include:

- Jogging/running.
- Swimming laps.
- Rollerblading/inline skating at a brisk pace.
- Cross-country skiing.
- Most competitive sports (football, basketball, or soccer).
- Jumping rope.³

The table below provides a list of common physical activities and the average calories expended during those activities.

Calories Used per Hour in Common Physical Activities		
Moderate Physical Activity	Approximate Calories/30 Min. for a 154 lb. Person ¹	Approximate Calories/Hr. for a 154 lb. Person ¹
Hiking	185	370
Light gardening/yard work	165	330
Dancing	165	330
Golf (walking and carrying clubs)	165	330
Bicycling (<10 mph)	145	290
Walking (3.5 mph)	140	280
Weight lifting (general light workout)	110	220
Stretching	90	180
Vigorous Physical Activity	Approximate Calories/30 Min. for a 154 lb. Person ¹	Approximate Calories/Hr. for a 154 lb. Person ¹
Running/jogging (5 mph)	295	590
Bicycling (>10 mph)	295	590
Swimming (slow freestyle laps)	255	510
Aerobics	240	480
Walking (4.5 mph)	230	460
Heavy yard work (chopping wood)	220	440
Weightlifting (vigorous effort)	220	440
Basketball (vigorous)	220	440
1. Calories burned per hour will be higher for persons who weigh more than 154 lbs. (70 kg) and lower for persons who weigh less.		
Source: Adapted from Dietary Guidelines for Americans 2005, page 16, Table 4.		

1. Calories burned per hour will be higher for persons who weigh more than 154 lbs. (70 kg) and lower for persons who weigh less.

Source: Adapted from [Dietary Guidelines for Americans 2005, page 16, Table 4.](#)

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11.3: Keeping the Weight Off

On its website the CDC admonishes that permanent weight loss is a result of making changes to eating habits that become a long-term part of a healthier lifestyle. You may access that section on their website by clicking [Healthy Weight: Improving Your Eating Habits](#). It is also reprinted below.

Reflect, Replace, Reinforce: A process for improving your eating habits

- Create a list of your eating habits. Keeping a food diary for a few days, in which you write down everything you eat and the time of day you ate it, will help you uncover your habits. For example, you might discover that you always seek a sweet snack to get you through the mid- afternoon energy slump. Use this diary to help. It's good to note how you were feeling when you decided to eat, especially if you were eating when not hungry. Were you tired? Stressed out?
- Highlight the habits on your list that may be leading you to overeat. Common eating habits that can lead to weight gain are:
 - Eating too fast
 - Always cleaning your plate
 - Eating when not hungry
 - Eating while standing up (may lead to eating mindlessly or too quickly)
 - Always eating dessert
 - Skipping meals (or maybe just breakfast)
- Look at the unhealthy eating habits you have highlighted. Be sure you have identified all the triggers that cause you to engage in those habits. Identify a few you would like to work on improving first. Don't forget to pat yourself on the back for the things you are doing right. Maybe you almost always eat fruit for dessert, or you drink low-fat or fat- free milk. These are good habits! Recognizing your successes will help encourage you to make more changes.
- Create a list of "cues" by reviewing your food diary to become more aware of when and where you are "triggered" to eat for reasons other than hunger. Note how you are typically feeling at those times. Often an environmental "cue," or a particular emotional state, is what encourages eating for non-hunger reasons.
- Common triggers for eating when not hungry are:
 - Opening up the cabinet and seeing your favorite snack food.
 - Sitting at home watching television.
 - Before or after a stressful meeting or situation at work.
 - Coming home after work and having no idea what's for dinner.
 - Having someone offer you a dish they made "just for you!"
 - Walking past a candy dish on the counter.
 - Sitting in the break room beside the vending machine.
 - Seeing a plate of doughnuts at the morning staff meeting.
 - Swinging through your favorite drive-through every morning.
 - Feeling bored or tired and thinking food might offer a pick-me-up.

Circle the "cues" on your list that you face on a daily or weekly basis. Going home for the Thanksgiving holiday may be a trigger for you to overeat, and eventually, you want to have a plan for as many eating cues as you can. But for now, focus on the ones you face more often.

Ask yourself these questions for each "cue" you have circled:

Is there anything I can do to avoid the cue or situation? This option works best for cues that don't involve others. For example, could you choose a different route to work to avoid stopping at a fast food restaurant on the way? Is there another place in the break room where you can sit so you are not next to the vending machine?

For things I cannot avoid, can I do something differently that would be healthier? Obviously, you cannot avoid all situations that trigger your unhealthy eating habits, like staff meetings at work. In these situations, evaluate your options. Could you suggest or bring healthier snacks or beverages? Could you offer to take notes to distract your attention? Could you sit farther away from the food so it won't be as easy to grab something? Could you plan ahead and eat a healthy snack before the meeting?

Replace unhealthy habits with new, healthy ones. For example, in reflecting upon your eating habits, you may realize that you eat too fast when you eat alone. So, make a commitment to share a lunch each week with a colleague, or have a neighbor over for dinner one night a week. Other strategies might include putting your fork down between bites or minimizing other distractions (i.e., watching the news during dinner) that might keep you from paying attention to how quickly—and how much—you are eating.

Here are more ideas to help you replace unhealthy habits:

Eat more slowly. If you eat too quickly, you may "clean your plate" instead of paying attention to whether your hunger is satisfied.

Eat only when you are truly hungry instead of when you are tired, anxious, or feeling an emotion besides hunger. If you find yourself eating when you are experiencing an emotion besides hunger, such as boredom or anxiety, try to find a non-eating activity to do instead. You may find a quick walk or phone call with a friend helps you feel better.

Plan meals ahead of time to ensure that you eat a healthy well-balanced meal.

Reinforce your new, healthy habits and be patient with yourself. Habits take time to develop. It doesn't happen overnight. When you do find yourself engaging in an unhealthy habit, stop as quickly as possible and ask yourself: Why do I do this? When did I start doing this? What changes do I need to make?

Be careful not to berate yourself or think that one mistake "blows" a whole day's worth of healthy habits. You can do it! It just takes one day at a time!⁴

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11.4: Health Risks of Being Underweight

The 2003–2006 National Health and Nutrition Examination Survey (NHANES) estimated that 1.8 percent of adults and 3.3 percent of children and adolescents in the United States are underweight. Centers for Disease Control and Prevention. “NCHS Health E-Stat. Prevalence of Underweight among Children and Adolescents: United States, 2003–2006.” Accessed October 8, 2011. http://www.cdc.gov/nchs/data/hestat/underweight/underweight_children.htm. Being underweight is linked to nutritional deficiencies, especially iron-deficiency anemia, and to other problems such as delayed wound healing, hormonal abnormalities, increased susceptibility to infection, and increased risk of some chronic diseases such as osteoporosis. In children, being underweight can stunt growth. The most common underlying cause of underweight in America is inadequate nutrition. Other causes are wasting diseases, such as cancer, multiple sclerosis, tuberculosis, and eating disorders. People with wasting diseases are encouraged to seek nutritional counseling, as a healthy diet greatly affects survival and improves responses to disease treatments. Eating disorders that result in underweight affect about eight million Americans (seven million women and one million men).

Anorexia Nervosa

Anorexia nervosa, more often referred to as “anorexia,” is a psychiatric illness in which a person obsesses about their weight and about food that they eat. Anorexia results in extreme nutrient inadequacy and eventually to organ malfunction. Anorexia is relatively rare—the National Institute of Mental Health (NIMH) reports that 0.9 percent of females and 0.3 percent of males will have anorexia at some point in their lifetime, The National Institute of Mental Health. “Eating Disorders among Adults: Anorexia Nervosa.” Accessed October 8, 2011. http://mentalhealth.gov/statistics/1EAT_ADULT_ANX.shtml. but it is an extreme example of how an unbalanced diet can affect health. Anorexia frequently manifests during adolescence and it has the highest rate of mortality of all mental illnesses. People with anorexia consume, on average, fewer than 1,000 kilocalories per day and exercise excessively. They are in a tremendous caloric imbalance. Moreover, some may participate in binge eating, self-induced vomiting, and purging with laxatives or enemas. The very first time a person starves him- or herself may trigger the onset of anorexia. The exact causes of anorexia are not completely known, but many things contribute to its development including economic status, as it is most prevalent in high-income families. It is a genetic disease and is often passed from one generation to the next. Pregnancy complications and abnormalities in the brain, endocrine system, and immune system may all contribute to the development of this illness.

The primary signs of anorexia are fear of being overweight, extreme dieting, an unusual perception of body image, and depression. The secondary signs and symptoms of anorexia are all related to the caloric and nutrient deficiencies of the unbalanced diet and include excessive weight loss, a multitude of skin abnormalities, diarrhea, cavities and tooth loss, osteoporosis, and liver, kidney, and heart failure. There is no physical test that can be used to diagnose anorexia and distinguish it from other mental illnesses. Therefore, a correct diagnosis involves eliminating other mental illnesses, hormonal imbalances, and nervous system abnormalities. Eliminating these other possibilities involves numerous blood tests, urine tests, and x-rays. Coexisting organ malfunction is also examined. Treatment of any mental illness involves not only the individual, but also family, friends, and a psychiatric counselor. Treating anorexia also involves a dietitian, who helps to provide dietary solutions that often have to be adjusted over time. The goals of treatment for anorexia are to restore a healthy body weight and significantly reduce the behaviors associated with causing the eating disorder. Relapse to an unbalanced diet is high. Many people do recover from anorexia, however most continue to have a lower-than-normal bodyweight for the rest of their lives (see [Note 11.33 "Video 11.3"](#)).

What I Gained in Recovery from Anorexia

On a more positive note, watch this personal account of what can be gained from anorexia recovery.



Bulimia

Bulimia, like anorexia, is a psychiatric illness that can have severe health consequences. The NIMH reports that 0.5 percent of females and 0.1 percent of males will have bulimia at some point in their lifetime. The National Institute of Mental Health. “Eating Disorders among Adults: Bulimia Nervosa.” Accessed October 8, 2011. http://mentalhealth.gov/statistics/1EAT_ADULT_RBUL.shtml. Bulimia is characterized by episodes of eating large amounts of food followed by purging, which is accomplished by vomiting and with the use of laxatives and diuretics. Unlike people with anorexia, those with bulimia often have a normal weight, making the disorder more difficult to detect and diagnose. The disorder is characterized by signs similar to anorexia such as fear of being overweight, extreme dieting, and bouts of excessive exercise. Secondary signs and symptoms include gastric reflux, severe erosion of tooth enamel, dehydration, electrolyte imbalances, lacerations in the mouth from vomiting, and peptic ulcers. Repeated damage to the esophagus puts people with bulimia at an increased risk for esophageal cancer. The disorder is also highly genetic, linked to depression and anxiety disorders, and most commonly occurs in adolescent girls and young women. Treatment often involves antidepressant medications and, like anorexia, has better results when both the family and the individual with the disorder participate in nutritional and psychiatric counseling.

Binge-Eating Disorder

Similar to those who experience anorexia and bulimia, people who have a binge-eating disorder have lost control over their eating. Binge-eating disorder is not currently diagnosed as a distinct psychiatric illness, although there is a proposal from the American Psychiatric Association to categorize it more specifically. People with binge-eating disorder will periodically overeat to the extreme, but their loss of control over eating is not followed by fasting, purging, or compulsive exercise. As a result, people with this disorder are often overweight or obese, and their chronic disease risks are those linked to having an abnormally high body weight such as hypertension, cardiovascular disease, and Type 2 diabetes. Additionally, they often experience guilt, shame, and depression. Binge-eating disorder is commonly associated with depression and anxiety disorders. According to the NIMH, binge-eating disorder is more prevalent than anorexia and bulimia, and affects 3.5 percent of females and 2.0 percent of males at some point during their lifetime. The National Institute of Mental Health. “Eating Disorders among Adults: Binge Eating Disorder.” Accessed October 8, 2011. http://www.nimh.nih.gov/statistics/1EAT_ADULT_RB.shtml. Treatment often involves antidepressant medication as well as nutritional and psychiatric counseling.

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 2. CDC's step by step guide. https://www.cdc.gov/healthyweight/lo...g_started.html.
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 4. CDC's page on improving your eating habits. https://www.cdc.gov/healthyweight/lo...ng_habits.html
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CHAPTER OVERVIEW

12: Relationships and Communication

Love and intimacy go hand in hand. Love is the physical, emotional, sexual, intellectual, or social affection one person holds for another. Concepts related to love include: adoration, desire, prefer, possess, care for, serve, and even worship. Intimacy, on the other hand, is a close relationship where mutual acceptance, nurturance, and trust are shared at some level. In order to understand love in human relationships, you must first understand how the socialized self either enhances or inhibits your capacity to love.

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12.1: Intro to Relationships and Communication

Love and intimacy go hand in hand. Love is the physical, emotional, sexual, intellectual, or social affection one person holds for another. Concepts related to love include: adoration, desire, prefer, possess, care for, serve, and even worship. Intimacy, on the other hand, is a close relationship where mutual acceptance, nurturance, and trust are shared at some level. In order to understand love in human relationships, you must first understand how the socialized self either enhances or inhibits your capacity to love.

Your socialized self develops under the supervision of your caregiver or parent(s). When you were a newborn, you were totally dependent upon the adults in your life to take care of your needs and raise you in a safe environment. You had to be fed and clothed, bathed and held, and loved and appreciated. Your caregivers provided these basic needs in your early development, and during this time, attachments were formed. An attachment is an emotional and social bond that forms between one person and another. Humans are considered highly motivated to form attachments throughout their lives.

Attachments are crucial to human existence and are essentially the emotional context of those relationships we form in life. As an infant you learned to trust those who cared for you; you learned that they returned once they were out of view and were dependable. Eventually, as your cognitive development matures, your brain allows you to love the person you are attached to and to care for them—whether or not they are caring for you. You learn then that your attachments begin to facilitate your needs and wants being met. How you attached as an infant and young child shape (at least in theory) how you will likely attach as an adult. For example, if you had strong attachments in childhood, then forming adult relationships should be easier for you; if you had weak or interrupted attachments in childhood, then forming adult relationships would be more difficult.

As adults, one of the very first symptoms that you are falling in love is that you begin to feel better about yourself when you are with the other person. It can be argued that you can only be in love as much as your self will allow you to be. Why? Because intimacy develops along with love, and intimacy requires that you have the ability to be your true self with the other person.

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12.2: Theories of Love

Love is a multidimensional concept and psychologists and sociologists have defined it in a variety of ways over the years. John Lee is perhaps the most quoted researcher on love with his six love types. Lee assumed that we all shared six core components of love and that our current loving relationship can be assessed and measured. Lee also claimed that there are qualities of love types—some more long-lasting and supportive of relationships and some pathological and defective which inhibit relationships. Lee's love types are widely used to help people understand their love styles. Lee claimed that six types of love comprised our loving experiences.

Eros

Eros is the love of sensuality: sex, taste, touch, sight, hearing, and smell. Eros love is often what we feel when turned on. Eros love is neither good nor bad; it is simply part of the overall love composite we experience with another person.

Storgé

Storgé is the love of your best friend in a normal casual context of life. Storgé is calm and peaceful, surprising to some who might have simply hung out together at one point but suddenly discovered that their friendship deepened and became more important than other friendships. “We started needing to be together, talking on the phone for hours, and missing each other when apart,” are common descriptions of Storgé love.

Pragma

Pragma is the love of details and qualities in the other person. Pragma lovers are satisfied and attracted by the other because of their characteristics (e.g., athleticism, intelligence, wealth). Pragma lovers feel love at a rational level—thinking to a certain degree about the good deal.

Agapé

Agapé is the love that is selfless, other-focused, and seeks to serve others rather than receive from others. In Christian theology it's the love of God for mankind.

Ludis

Ludis is an immature love that is more of a tease than a legitimate loving relationship. Ludic lovers trick their mates into believing that they are sincerely in love, while grooming 1, 2, or even 3 other lovers at the same time. Ludic lovers typically artificially stroke their sense of self-worth by playing a cruel game on their lovers who end up feeling used and betrayed.

Mania

Mania is an insecure love that is a mixture of conflict and artificially romantic Eros expressions. Manic lovers fear abandonment and are simultaneously terrified by the vulnerabilities they feel when intimate with their lover. Thus, their daily routines typically involve extreme highs and lows including arguing, making love, sweet-talking, and fighting with their lovers.

Abraham Maslow, addressed love in terms of how our needs are met by the other person. His basic premise is that we pair-off with those whose love styles fill an unmet childhood need. In other words, Maslow said that if our childhood needs were not met in the basics of survival, safety, food, shelter, love, belonging, and even self-esteem, then we look for an adult companion that can fill those needs for us. It's like an empty cup from our childhood that our adult partner fills for us. Maslow also said that when all those basic needs are met in childhood, we are attracted to an adult partner who complements our full development into our psychological potential.² If in your childhood, your survival, safety, food, shelter, love, belonging, and even self-esteem needs were unmet then you will be attracted to a deficiency lover. Deficiency lovers are lovers who provide the basic level of needs for their partner while having their needs reciprocally met in a similar way. Being lovers meet their partner's aesthetic, intellectual, and physical needs while reciprocally having their needs met.

Sternberg's Triangular Theory of Love

Robert Sternberg was the “Geometry of Love” psychologist who triangulated love using intimacy, passion, and commitment by measuring the intensity of each and how intense the triangulation was for the couple. To Sternberg it was important to consider how each partner's triangle matched the other partner's. He said that a couple with all three types of love balanced, and in sufficient

magnitude, would have a rare yet rewarding type of love that encompassed much of what couples seek in a loving relationship. Sternberg's consummate love is a love type that had equal measures of passion, intimacy, and commitment that is satisfactory to both lovers.

In modern day applications of love, various components have been found as the ingredients of love: commitment, passion, friendship, trust, loyalty, affections, intimacy, acceptance, caring, concern, care, selflessness, infatuation, and romance. There is a love type identified that many people are aware of called unconditional love. Unconditional love is the sincere love that does not vary regardless of the actions of the person who is loved. You often hear it expressed in greater measure among parents of children whose misbehaviors embarrass or disappoint them. The love types and patterns discussed below are taken from many sources, but fit neatly into the Lee, Maslow, Sternberg, or Chapman paradigms.

Romance

Romantic love is based on continual courtship and physical intimacy. Romantic lovers continue to date long after they marry or move in together. They often express the strong sexual attraction to each other that was there from the beginning. Romantic lovers are idealistic about their relationship and often feel that it was destined to be. They often define mundane activities such as grocery shopping or commuting to work as escapades of two lovers.

Infatuation

What happens when very young people feel love for the first time? What is puppy love or infatuation? Infatuation is a temporary state of love where the other person is overly idolized and seen in narrow and extremely positive terms. An infatuated person might think obsessively about the other, may feel a strong emotional response when they are together, may see their entire world as revolving around the other, may see them being together for the rest of their lives, may find one or two qualities of the other as being near perfect, or may be seen by others as having a crush on the other person. Regardless of the details infatuations rarely last very long. This love develops quickly much like a firework launches quickly into the night sky, puts on an emotional light show, then burns out quickly. Many define puppy love or infatuation as an immature love experienced by those who are younger and perhaps a bit credulous.

Commitment

Committed love is a love that is loyal and devoted. Two lovers may share committed love with or without: physical affection, romance, friendship, trust, loyalty, acceptance, caring, concern, care, selflessness, and or infatuation. Committed lovers have a long-term history with one another and typically combine care-giving, concern for one another's well-being, and spending much time thinking of the other. Committed lovers are there when needed by the other person.

Altruism

Altruism is a selfless type of love that serves others while not serving the one who is altruistic. True altruism is hard to find according to some. Mothers who tend their sick child throughout the night; fathers who work 3-4 decades in a job they don't love to provide for their family; and even fire fighters who sacrifice their safety to save the lives of others are all considered to be altruistic in their actions. Because so much of what we do in our relationships is considered in the larger overall equation of the fairness in a relationship, selfless acts can be seen as acts which either build a reservoir of goodwill which will later be repaid or creating a debt of sorts in which the other person owes you some selfless service in return.

Passion

Sexual or passionate lovers are focused on the intensely sensual pleasures that are found with the senses of taste, smell, touch, feel, hear, and sight. Sexual lovers lust one another and feel closest when together and being physical. Sexual lovers can be together for five minutes, five days, five weeks, or five years, but sexual love, by itself is typically short-lived. There is closeness during sex and activities leading up to sex, but not much thereafter. Sexual love when combined with other love types can be very beneficial to the couple. Sexual love is almost always the love type experienced by those having an extra-marital affair.

Friendship

Friendship love includes intimacy and trust among close friends. Today, most long-burning or enduring love types form among people who were first close friends. Friendship lovers tend to enjoy each other's company, conversation, and daily interactions. They consider one another to be "go-to" friends when advice is needed or when problems need to be talked about together. Not all

friendship lovers become a couple. Many are just close or best friends. Yet many who spend the rest of their lives together will start out their relationship as friends.

Realistic Love

Criteria or realistic love is the love feelings you have when your list of a potential mate's personal traits is met in the other person. For example, women often desire their male love companions to be taller. Men and women often desire to find a partner with homogenous traits (e.g., same religion, political leanings, hobbies, etc.).

Obsession

Obsessive love is an unhealthy love type where conflict and dramatic extremes in the relationship are both the goal and the theme of the couple's love. Obsessive lovers live for storms and find peace while they rage. They are often violent or overly aggressive at different levels. Sometimes couples bring complimentary traits to the relationship which light the other's fire of madness. In other words, she may be angry and violent with him, but not with some other males. He may feel simultaneously drawn to her and repulsed, but not with other females. Their personality-chemistry contributes to the insanity and lack of peace. These couples most likely need professional counseling and would probably be better off if they broke up. At the same time, why would they seek help or leave the person whose entanglements bring them such an occupation with drama and conflict that they are freed from their boredom and entertained at the same time?

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12.3: Theories of Mate Selection

The Social Exchange Theory and its rational choice formula clarify the selection process even further. We strive to maximize rewards and minimize costs in our choices of a mate.

Rewards – Costs = Choice

When we interact with potential dates and mates, we run a mental balance sheet in our heads. She might think, “He’s tall, confident, funny, and friends with my friends.” As she talks a bit more she might say, “But, he chews tobacco, only wants to party, and just flirted with another woman while we were talking.” The entire time we interact with potential dates and mates we evaluate them on their appearance, disposition, goals and aspirations, and other traits. This while simultaneously remembering how we rate and evaluate ourselves. Rarely do we seek out the best looking person at the party unless we define ourselves as an even match for him or her. More often we rank and rate ourselves compared to others and as we size up and evaluate potentials we define the overall exchange rationally or in an economic context where we try to maximize our rewards while minimizing our losses.

The overall evaluation of the deal also depends to a great extent on how well we feel matched on racial and ethnic traits, religious background, social economic class, and age similarities. The complexity of the date and mate selection process includes many obvious and some more subtle processes that you can understand for yourself. If you are single you can apply them to the date and mate selection processes you currently pursue.

How do strangers transition from not even knowing one another to eventually cohabiting or marrying together? From the very first encounter, two strangers begin a process that either excludes one another as potential dates or mates or includes them and begins the process of establishing intimacy. Intimacy is the mutual feeling of acceptance, trust, and connection to another person, even with the understanding of personal faults of the individual. In other words, intimacy is the ability to become close to one another, to accept one another as is, and eventually to feel accepted by the other. Intimacy is not sexual intercourse, although sexual intercourse may be one of many expressions of intimacy. When two strangers meet they have a stimulus that alerts one or both to take notice of the other.

Effective Communication

Effective communication is critical to successful relationships. Researchers and therapists have found at least nine skills that can help couples learn to talk effectively about important issues (Gottman 1994; Markman, Stanley, and Blumberg 2010; Schramm and Harris 2011). How we interact about issues such as time spent together/apart, money, health, gender differences, children, family, friends, commitment, trust, and intimacy affects our ability to develop and maintain lasting marital friendships. If learned well, these nine skills can help put our relationships on a positive trajectory for success. (Note: The word “marriage” is interchangeable with “relationship,” if you are not married.)

What Do Couples Talk About?

- Time Together/Apart. Both the quantity and quality of time we spend together influence the wellbeing of our marital friendships. Spending time apart participating in other activities also influences the well-being of our relationships.
- Money. How we think and talk about money, our spending habits, and our ability to budget, invest, and plan for the future impact couple financial management processes and practices.
- Health. Couples must talk about many health-related issues, including nutrition, exercise, illness, disease, accidents, health care, mortality, and death.
- Men/Women. Because men tend to be more task-oriented in their communication styles and women tend to be more process-oriented, men tend to want to solve issues immediately, while women tend to want to talk about them more and come to a consensus about what should be done.
- Children. How children develop physically, socially, emotionally, intellectually, and spiritually are often topics of discussion. Focusing on the best ways to consistently meet children's needs is considered being child-centered.
- Family/In-Laws/Friends. Couples often talk about situations and circumstances surrounding the interactions they have with their closest relationships.

What do couples communicate when they are communicating?

- Commitment. How we "hang in there" and contribute to our marital friendship, even when things aren't going particularly well, is a sign of how committed we are to our relationship. Loyalty and fidelity are aspects of commitment and trust.
- Trust. Trusting relationships are relationships in which both partners are dependable, available to support each other, and responsive to each other's needs. An ability to negotiate conflict and a positive outlook about the future of the relationship are also components of trust.
- Intimacy. The social, intellectual, emotional, spiritual, and physical connections we make with each other determine the levels of intimacy we experience in our relationships.

What do couples argue about?

Because the items listed above are some of the major topics couples talk about, it follows that they are also the same topics that can spur disagreements. For instance, it is a familiar joke that people can have difficulties in their relationships with in-laws. Take for example, "What is the difference between in-laws and outlaws? Answer: One is 'Wanted!'" Sayings such as these underscore the importance of knowing how your relationships with others can affect your marriage and could potentially become the topic of a marital conflict.

Learning and Practicing New Habits

Effective communication isn't easy. Teaching and learning new communication skills take patience, patience, patience, as well as practice, practice, practice. Taking the time to talk is important. Your relationship provides a safe place to share feelings, thoughts, fears, dreams, and hopes. Make a special effort to find time to talk to your partner more frequently. In tough times, people feel overwhelmed with worries and responsibilities.

Time together as a couple is often the last thing on our minds as we deal with the hassles of daily life. Although you may be busy, stressed, and worried, take the time to focus on your partners' needs and spend quality time together without interruption. Even a few minutes a day talking about what has occurred can be a relief from stress. Be thoughtful by considering whether those difficult or problem-solving discussions could be reserved for other times when you and your partner are not tired or distracted.

You may need to be the one who starts conversations. It is worth it to be the one who initiates conversations. You can find many ways to open the door for communication if you are sensitive to changes in your partner's feelings and needs. Taking the time to listen keeps the lines of communication open and improves your relationship.

Finding Time to Talk

- Spend time talking with limited interruptions.
- Make a date to talk to your partner.
- Plan at least one routine family time each week.
- Talk instead of watching TV.
- Talk when you take a walk together.
- Talk while you work together on household chores.
- Talk in the car while traveling to activities.

Summing It Up

In good times and bad, couples need each other. Good communication does not mean that your family won't have any problems, or that your partner will always like what you have to say. Good communication means the chances of solving problems are much higher if you and your partner can express yourselves openly and freely with each other.

For couples today, there is an abundance of information on how to sustain healthy, happy marital relationships. From how-to books to advice given on television and radio, couples are bombarded with strategies, tips, and techniques focused on "what to do" in their relationships. Most of this information assumes that if couples follow a few short rules, then they can have happy relationships. What most fail to realize is that these new, positive practices won't work without recognizing and addressing what has been done and what is not working. Most information available to couples falls short on giving examples of "what not to do" in a relationship. Communication is the key, but it is difficult to apply effective strategies to harmful interactions.

Four negative patterns of interaction have been demonstrated as major destroyers of marital relationships:

- Criticism
- Contempt
- Defensiveness
- Stonewalling

Criticism

Criticism is using hurtful or judgmental comments aimed at your partner's character or personality. With criticism, the blame is placed on the person and not the problematic behavior. Criticism tends to be a repetitive cycle—a single critical moment can end up in a continued exchange. Most critical statements can be recognized by the phrases, “you always” or “you never.” The following are some examples of criticism:

- You never finish any project that you start. You're so lazy.
- When we go out to eat, you always embarrass me with your table manners.

Contempt

Contempt is a more complex negative interaction. It is an effort to psychologically abuse your partner through disrespectful statements and actions. Contempt has both verbal and non-verbal deliveries. Verbal examples of contempt include sarcasm, hostile humor, and mockery. For example, nonverbal displays of contempt include rolling of the eyes and sucking of the teeth during conflict. Contempt sends your partner a message of scorn—that they are inferior and worthless.

Defensiveness

Defensiveness is often a natural response to receiving criticism and contempt. When faced with criticism and contempt, most people find a need to defend themselves. However, couples can be defensive even when criticism is constructive. Defensiveness may be a response to previous, current, and/or future attacks. If one or both persons are acting defensively, it is most likely the case they are not listening. Defensiveness may take many forms including:

- Making excuses for behavior
- Repeating a statement for effect
- Denying responsibility for actions
- Answering a complaint with another complaint

Stonewalling

The final negative pattern of interaction is stonewalling. As the name implies, this occurs when partners “put a wall” around themselves, either physically or psychologically. Stonewalling is often used to decrease conflict, and when delivered in moderation, can be healthy. On the other hand, continual failure to respond and/or engage in conversation escalates rather than reduces conflict. Examples of stonewalling include:

- Leaving the room
- Putting a physical barrier between you and your partner (newspaper, book, child)
- Focusing intently on something other than your partner during a discussion
- Failure to actively listen
- Responding with a blank stare

What can be done?

All of the above can become patterns of interaction within a relationship. One negative interaction leads to another, often in a repetitive cycle. The following suggestions can be used to break the cycle and promote a healthy relationship:

1. Eliminate criticism. Use complaints. It is okay to complain about troublesome behaviors. Discussing your feelings about the behavior is okay as long as there are no personal attacks. Use the word I instead of you and describe how the behavior makes you feel. Talk about the behavior and not the person.
 - Example: “When we go out to eat, you always embarrass me,” becomes “I feel hurt and ashamed when you make fun of me in public.”
2. Build on your friendship base. Validate your partner and his/her feelings, thoughts, needs, and desires, etc.

- Example: "I recognize that you need to talk more about our relationship. What is on your mind?"
- 3. Take accountability and responsibility for your own actions. Do not make excuses. Apologize and correct the behavior (if possible).
 - Example: "I'm sorry that I yelled at you earlier. I've been under a lot of pressure at work, but it is unfair to take it out on you."
- 4. Use reflective listening. Repeat what your partner has stated and then respond. Show them that you are listening and hearing them.
 - Example: Partner 1: "I would appreciate it if you would talk to me before you discipline the kids. That way we can be a united front." Partner 2: "What I'm hearing is that you would like for us to talk about disciplining the kids before I make any decisions. I think that is a good idea."
- 5. Continue dating. Make a point to rekindle the dating aspect of your relationship.
 - Example: Go for walks, hold hands, act silly, etc. Find ways to show appreciation to your partner throughout the day (i.e., e-mails, notes, phone calls, etc.)
- 6. Seek help if needed. If you can identify these negative interactions in your relationship or you think you may need help, see a licensed marriage and family therapist or other professional. Do not try and fix everything on your own.
 - Example: Talk to a trusted family member, friend, or your local extension agent in order to find resources in your area.

Before a couple can learn and/or practice new routines in their relationship, they must rid themselves of the old ways that aren't working. It is important to first identify negative patterns and destructive behaviors and target them for change. At that point, the couple can begin rebuilding their relationship.

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12.4: Marriage

Marriage is very popular among U.S. adults, in part because it does offer many rewards that unmarried people don't enjoy. Marriage has become socially controversial in part because of the intense political efforts to legalize marriage for same-sex couples. Regardless of your moral position on the issue of same-sex marriage, you can see the political quest for it as an indicator of just how rewarding it is to be legally a “married couple.”

There are numerous studies and books on the benefits of marriage to married individuals. Below are the Top Ten Benefits of Being Married in Contrast to Being Single:

1. Better physical and emotional health
2. More wealth and income
3. Positive social status
4. More and safer sex
5. Life-long continuity of intimate relationships
6. Safer circumstances for children
7. Longer life expectancy
8. Lower odds of being crime victims
9. Enhanced legal and insurance rights and benefits (tax, medical, and inheritance)
10. Higher self-reported happiness

Marriage is a legal union between a man and a woman as recognized by most of the United States. Internationally, and in certain U.S. political regions, a man and another man or a woman and another woman can be legally recognized as a married couple. What are typical marriage structures? The U.S. and world-wide culturally preferred marriage type today is monogamy. Monogamy is the marriage form permitting only one spouse at a time. Almost all who have married in the U.S. have done so monogamously since the original colonies in the 1600s. Monogamy implies a 1:1 relationship and is typically desired both by married couples and by opposite and same-sex cohabiters.

Polygyny is a form of marriage permitting more than one wife at the same time. Polygyny is still common and legal in many African, Middle Eastern, Muslim, and Indian nations. It was a deep part of China's history and prior to World War II it was common for a Chinese man to have multiple wives and many children.

Polyandry is a marriage form permitting more than one husband at the same time. This is historically and currently rare, and, if or when it was practiced, it often includes the marriage of one wife to a set of brothers with all husbands having sexual access to the wife. Polyandry was found among some Pacific Island cultures and among the pre-Taliban Afghans.

What if a person marries, divorces, marries, divorces, etc.? Serial Monogamy or Serial Polygamy is the process of establishing intimate marriage or cohabiting relationships that eventually dissolve and are followed by another intimate marriage or cohabiting relationship that eventually dissolve, etc. in a series. Thus polygamists have simultaneous multiple spouses while serial monogamists or serial polygamists have multiple spouses in a sequence of relationships. Millions of U.S. adults will experience serial marriages and divorces. Many marry then divorce, yet still want to be married again. Many others who suffered through their parents' unhealthy marriages and divorces also want to marry, knowing firsthand how risky that might be.

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12.5: Cohabitation

Cohabitation is the heterosexual, bisexual, and homosexual moving in together of two partners without going through the formalities of legal marriage. Although similar in form and function, cohabitating couples live differently in many significant day-to-day aspects when compared to married couples. Also, many cohabiting couples eventually choose to marry, but their risk of divorce is higher than among couples that never cohabited.

Cohabitation has been studied extensively for the last three decades, especially in contrast between cohabiting and married couples. Clear findings consistently show that cohabiting and marriage are two different creatures. Those who cohabit have less clarity on the intention and direction of the relationship than married couples. Further, people who cohabit, then later marry, are more likely to divorce than those who never cohabited. In 2010 the U.S. Center for Disease Control reported that cohabitation is very common “Among both men and women aged 15-44 who had ever cohabited and or married, the largest proportion cohabited before their first marriage. Approximately 28% of men and women cohabited before their first marriage, whereas 23% of women and 18% of men married without ever cohabiting. About 15% of men and women had only cohabited (without ever marrying), and less than seven percent of men and women first cohabited after their first marriages ended.” This report also stated that some of the cohabitation relationships dissolved while others transitioned to marriage. Less educated cohabiters cohabited longer while college-graduated cohabiters transitioned to marriage more.

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12.6: Marrieds and Non-Marrieds

There are known benefits to being married and in a long-term relationship rather than being single, divorced, or cohabiting. The list below shows health benefits from the cohabitation and marriage study of the National Survey of Family Growth. Better mental and physical health with better medical insurance coverage prove to be crucial qualities for marrieds. As far as children are concerned, having better care and better adult outcomes are crucial factors.

Health Benefits Known to be an Advantage among Married Persons in the U.S.

1. Generally better mental and physical health outcomes
2. Longer lives
3. Higher rates of health insurance coverage
4. Lower prevalence of cardiovascular disease
5. Better health and well-being of children
6. Children born to unmarried mothers are at greater risk for poverty, teen childbearing, poor school achievement, and marital disruption in adulthood than children born to married mothers

There are also known financial benefits when comparing marrieds to non-marrieds. More wealth accumulation, higher assets, and higher monthly income are consistent among marrieds. The first thing you notice is that marrieds have consistently higher annual incomes. In 2007 specifically, marrieds had \$28,231 more income than single men and \$42,293 more than single women. The difference is even more pronounced if both incomes are taken into consideration for dual income marrieds (i.e., in 2007 dual income couples had \$86,435 which is \$42,077 higher than single men and \$56,139 more than single women).

Married people are also safer and less prone to get into trouble than others. There is a buffering effect that accompanies having a life-long devoted spouse who helps deflect stress and hardships on a daily basis. Thus some of the health benefits of longer life, less suicide, more stable health coverage, and less illness and addiction. Also, marrieds have more social support, more continuity in long-term relationships, and especially more closeness for men in intimate family relationships. Husbands are less likely to abuse and be violent toward their wives than are boyfriends and partners. Married people have clear life-long goals and tend to buy homes, invest, and plan for retirement more than others. The government and military recognize spouses and reward them with tax breaks, benefits, and other sources of coverage and support more than others. In later life, many elderly report that their family relationships are very supportive and important to them. Studies show that the elderly enjoy their human investment in their children and grandchildren that yields emotional and social rewards throughout their golden years.

Known Benefits Enjoyed by Married Couples in Comparison to Non-Married Persons.

1. Less likely to become victims of crime
2. Less likely to commit crimes
3. Less addiction
4. Fewer accidents (especially among men)
5. Less suicide
6. Better stress management because spouse is a buffer to life's stresses
7. More social and emotional support (less loneliness)
8. More intimate connections to family members
9. Long-term continuity in family relationships of children, in-laws, grandchildren, etc.
10. Lower risk of domestic violence for women
11. Longer life expectancies
12. More and better self-rated sex
13. More emotional and financial security (for both spouses)
14. Less uncertainty about direction of life and goals
15. More cost effective to live in married versus single circumstances
16. Tax deductions
17. More military benefits
18. More accumulated belongings and investments

19. More medical benefits

20. More legal rights

To legally marry in the United States today, one simply goes to the local county or state office and applies for a state marriage license. The state also claims authority in granting divorce rights to couples. Divorce is the legal dissolution of a previously granted marriage. Most marriages still endure, and the odds are that divorce won't happen to most marriages. It is a myth that one in two marriages eventually ends in divorce. There are a few myths about U.S. divorce trends that will be dispelled in this chapter. You might have heard the myth of the Seven Year Itch where divorce happens prior to or shortly after the 7th year. Current government estimates indicate that about 75% of couples make their ten-year anniversary in their first marriage. The myths are false, but divorce does happen more today than it did 50 years ago and more people today are currently divorced than were currently divorced 50 years ago.

Ten Actions to Minimize the Risk of Divorce:

1. Wait until at least 20 years old to marry, 25 is better.
2. Avoid premarital pregnancy and don't marry just because of a pregnancy.
3. Become proactive in maintaining your marriage (books, seminars, counseling).
4. Understand risks of cohabitation (cohabitation $\neq$ divorce).
5. Once married, leave the marriage market; don't keep an eye open for something better.
6. Learn to compromise with each other. Work around those irreconcilable differences.
7. Keep a positive outlook and look beyond today.
8. Take your time in selecting a mate. Don't rush into marriage.
9. Take the media with a grain of salt. Don't assume your marriage will be like the headlines.
10. Focus on the positive benefits of being married and don't dwell on the negatives.

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12.7: Violence in Relationships

Violence is a serious public health problem in the United States. From infants to the elderly, it affects people in all stages of life. In the United States, violence accounts for approximately 51,000 deaths annually. In 2007, more than 18,000 people were victims of homicide and more than 34,000 took their own life. Estimating the size of this economic burden is helpful in understanding the resources that could be saved if cost-effective violence prevention efforts were applied. The cost of these deaths totaled to \$47.2 billion (\$47 billion in work loss costs and \$215 million in medical treatment). The number of violent deaths tells only part of the story. Many more survive violence and are left with permanent physical and emotional scars. Violence also erodes communities by reducing productivity, decreasing property values, and disrupting social services.

Understanding Violence

Interpersonal violence is defined as the actual or threatened intentional use of force— physical, sexual, or emotional—against another person, group, or community. It may result in physical injury, psychological harm, or even death. Violence also includes suicide and nonfatal acts of self-harm.

Unfortunately, violence is a part of our daily life. It exists in all corners of our nation. It affects us all regardless of our age, gender, race, ethnicity, or socio-economic status. More than 50,000 violent deaths occur each year in the United States. The deaths only tell part of the story. Millions of others are left with debilitating physical and emotional injuries. These injuries negatively affect the health of victims for the rest of their lives.

Violence also erodes the fabric of our communities. It can threaten productivity in the workplace, decrease the value of our homes and businesses, and disrupt essential public and social services. The economic cost of violence is staggering. In 2000, the medical costs and productivity losses associated with nonfatal violence-related injuries and deaths were estimated at more than \$70 billion each year. The total burden to society is far greater.

The good news is that violence is a problem with a solution. It can be prevented by using a thoughtful and systematic approach. While the field of violence prevention is still developing, our knowledge of “what works” increases every day.

Types of Violence

- Child Maltreatment (e.g., child abuse and neglect)
- Intimate Partner Violence (e.g., violence by a current or former spouse, boy/girlfriend)
- Sexual Violence (e.g., rape, sexual assault, sexual harassment)
- Suicide (e.g., fatal and nonfatal suicide behavior)
- Youth Violence (e.g., bullying, gang violence, peer violence)

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12.8: Sexual Violence

Sexual Violence (SV) refers to sexual activity where consent is not obtained or freely given. Anyone can experience SV, but most victims are female. The person responsible for the violence is typically male and is usually someone known to the victim. The person can be, but is not limited to, a friend, coworker, neighbor, or family member.

There are many types of SV. Not all include physical contact between the victim and the perpetrator (person who harms someone else) – for example, sexual harassment, threats, and peeping. Other SV, including unwanted touching and rape, includes physical contact.

SV can impact health in many ways. Some ways are serious and can lead to long-term health problems. These include chronic pain, headaches, stomach problems, and sexually transmitted diseases.

SV can have an emotional impact as well. Victims often are fearful and anxious. They may replay the attack over and over in their minds. They may have problems with trust and be wary of becoming involved with others. The anger and stress that victims feel may lead to eating disorders and depression. Some even think about or attempt suicide.

SV is also linked to negative health behaviors. For example, victims are more likely to smoke, abuse alcohol, use drugs, and engage in risky sexual activity.

Why is sexual violence a public health problem?

SV is a significant problem in the United States:

- Among high school students surveyed nationwide, about 8% reported having been forced to have sex. The percentage of those having been forced to ever have sex was higher among female (11%) than male (5%) students.
- An estimated 20% to 25% of college women in the United States have experienced an attempted or complete rape during their college career
- Nearly 1 in 5 women and 1 in 71 men in the United States have been raped at some time in their lives.

These numbers underestimate the problem. Many cases are not reported because victims are afraid to tell the police, friends, or family about the abuse. Victims also think that their stories of abuse will not be believed and that police cannot help them. They may be ashamed or embarrassed. Victims may also keep quiet because they have been threatened with further harm if they tell anyone.

Certain factors can increase the risk for SV. However, the presence of these factors does not mean that SV will occur.

Risk factors for perpetration (harm to someone else):

- Being male
- Having friends that are sexually aggressive
- Witnessing or experiencing violence as a child
- Alcohol or drug use
- Being exposed to social norms, or shared beliefs, that support sexual violence.

It is important to understand what factors protect people or put them at risk for experiencing or perpetrating violence. Why are risk and protective factors useful? They help identify where prevention efforts need to be focused.

Risk factors do not cause violence. The presence of a risk factor does not mean that a person will always experience violence. Victims are never responsible for the harm inflicted upon them.

- Risk Factor - Characteristic that increases the likelihood of a person becoming a victim or perpetrator of violence.
- Protective Factor - Characteristic that decreases the likelihood of a person becoming a victim or perpetrator of violence because it provides a buffer against risk.

How can we prevent sexual violence?

The ultimate goal is to stop SV before it begins. Efforts at many levels are needed to accomplish this. Some examples include:

- Engaging high school students in mentoring programs or other skill-based activities that address healthy sexuality and dating relationships.
- Helping parents identify and address violent attitudes and behaviors in their kids.
- Creating policies at work, at school, and in other places that address sexual harassment.
- Developing mass media (e.g., radio, TV, magazines, newspapers) messages that promote norms, or shared beliefs, about healthy sexual relationships.

Sexual Violence: Risk and Protective Factors

Risk factors are associated with a greater likelihood of sexual violence (SV) perpetration. They are contributing factors and may or may not be direct causes. Not everyone who is identified as "at risk" becomes a perpetrator of violence.

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

Risk Factors for Perpetration

Individual Risk Factors

- Alcohol and drug use
- Coercive sexual fantasies
- Impulsive and antisocial tendencies
- Preference for impersonal sex
- Hostility towards women
- Hypermasculinity
- Childhood history of sexual and physical abuse
- Witnessed family violence as a child

Relationship Factors

- Association with sexually aggressive and delinquent peers
- Family environment characterized by physical violence and few resources
- Strong patriarchal relationship or familial environment
- Emotionally unsupportive familial environment

Community Factors

- Lack of employment opportunities
- Lack of institutional support from police and judicial system
- General tolerance of sexual violence within the community
- Weak community sanctions against sexual violence perpetrators

Societal Factors

- Poverty
- Societal norms that support sexual violence
- Societal norms that support male superiority and sexual entitlement
- Societal norms that maintain women's inferiority and sexual submissiveness
- Weak laws and policies related to gender equity
- High tolerance levels of crime and other forms of violence

Sexual Violence: Prevention Strategies

Sexual violence is a serious problem that can have lasting, harmful effects on victims and their family, friends, and communities. The goal of sexual violence prevention is simple-to stop it from happening in the first place. However, the solutions are just as complex as the problem.

Prevention efforts should ultimately decrease the number of individuals who perpetrate sexual violence and the number of individuals who are sexual violence victims. Many prevention approaches aim to reduce risk factors and promote protective factors

for sexual violence. In addition, comprehensive prevention strategies should address factors at each of the levels that influence sexual violence -the individual, relationship, community, and society.

The most common prevention strategies currently focus on the victim, the perpetrator, or bystanders.

- Strategies that aim to equip the victim with knowledge, awareness, or self-defense skills are referred to as risk reduction techniques.
- Strategies targeting the perpetrator attempt to change risk and protective factors for sexual violence in order to reduce the likelihood that an individual will engage in sexually violent behavior.
- The goal of bystander prevention strategies is to change social norms supporting sexual violence and empower men and women to intervene with peers to prevent an assault from occurring.
- Other prevention strategies may target social norms, policies, or laws in communities to reduce the perpetration of sexual violence across the population.

Effective and Promising Programs

Unfortunately, little is known about what works to prevent sexual violence. To date, only one prevention program, Safe Dates, has been shown in a randomized controlled trial to prevent or interrupt sexual violence perpetration. Other programs are accumulating evidence for effectiveness and are moving towards or are currently conducting rigorous evaluations. Until more is known about what works and for whom, program planners can use prevention principles to strengthen their approach and evaluation to determine the effectiveness of new or existing programs.

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12.9: Intimate Partner Violence

Figure 12.9.1 Couple

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:

1. **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.
2. **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.
 1. **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.
 2. **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.
 3. **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.
 4. **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
 5. **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.
3. **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.
4. **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., namecalling, 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).

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.

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)

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?

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.

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 (1-800-799-SAFE).

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

If you feel confused about your relationship, a mental health professional can help.

Remember, you deserve to be treated with respect.

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CHAPTER OVERVIEW

13: Gender and Sexuality

By far, sex and gender have been two of the most socially significant factors in the history of the world and the United States. Sex is one's biological classification as male or female, which is biologically determined at the moment the sperm fertilizes the egg. Sex can be precisely defined at the genetic level with females having two X chromosomes (XX), while males possess an XY pairing. The female's eggs contain only an X chromosome, while the male's sperm contains half X and half Y chromosomes. Therefore, the sperm that fertilizes the egg determines whether a person has XX (female) or XY (male) pairing of chromosomes. The main difference between sexes is the reproductive body parts assigned to each (including their functions and corresponding hormones).

Gender is culturally-based and varies in a thousand subtle ways across the many diverse cultures of the world. Gender has been shaped by social norms, politics, religion, philosophy, language, tradition and other cultural forces for many years. Gender identity is our personal internal sense of our own maleness or femaleness. Every society has a slightly different view of what it means to be male/masculine and female/feminine. Masculine traits are those we associate with being male, such as aggressiveness, directness, independence, objectiveness, and leadership. Feminine traits are being talkative, submissive, nurturing, emotional, and illogical. Androgyny is when a person shares both masculine and feminine traits. They fit their behavior to the situation; so an androgynous person might cry at a wedding or funeral, but can also change the tire on a car.

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Thumbnail: Gender symbols intertwined. The red (left) is the female Venus symbol. The blue (right) represents the male Mars symbol. (CC BY-SA 2.0 unported; [pschemp](#)).

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13.1: Sexual Scripts

A script is what actors read or study and what guides their behavior in a certain role. A script is a blueprint for what we “should do” in our roles. Sexual scripts are blueprints and guidelines for what we define as our role in sexual expression, sexual orientation, sexual behaviors, sexual desires, and the sexual component of our self-definition. All of us are sexual beings, yet none of us is exactly identical to another in our sexual definitions and script expectations. Having said that, keep in mind that we are not just born with sexual scripts in place; they are learned. Sexual socialization is the process by which we learn how, when, where, with whom, why, and with which motivations we are sexual beings.

We are all born with drives, which are biological needs that demand our attention and behavioral responses to them. The most powerful drives are circulation, breathing, voiding our urine and other waste, eating, drinking, sleeping, and sexual involvement. Sexual drives are biological urges to participate in sexual activity and in certain sexual roles. Sexual scripts, once learned, will shape how that drive is answered. Sexuality is learned via culture and socialization. There are as many unique sexual scripts as there are people, yet some of these scripts have common themes and can be viewed as a collective pattern or trend in the larger social level.

Many of us learn our sexual scripts in a passive way. In other words, we don’t learn from experience, but from a synthesis of concepts, images, ideals, and sometimes misconceptions. For example, the commonly held belief that men and women are two different creatures, perhaps even from different planets, was a very successful fad in recent years that led an entire generation to believe that men might be from “Mars” while women might be from “Venus.”

Today more and more people living in the U.S. have less religious values and more diverse experiences with sexuality. Further, much of the younger generations’ focus on sex is on the orgasm. An orgasm is the sexual climax that accompanies sexual intercourse and includes muscle tightening in the genital area, electrical sensations radiating from the genitals, and a surge of a variety of pleasure-producing hormones throughout the body. Many cultures have records of sexual expression and some even have records of sexual pleasure maximization.

Some traditional sexual scripts that have been studied include a number of problematic assumptions. Some of these assumptions include but are not limited to: the man must be in charge, the woman must not enjoy (or let on that she enjoys) the sexual experience, the man is a performer whose skills are proven effective upon arrival of his partner’s orgasm, men are sexual while women are not, women can’t talk about it and turn to men for sexual interests and direction, and finally sex always leads to a female orgasm (her orgasm being proof of his sexual capacity). Numerous studies have shown that most of these traditional scripts are not realistic, healthy, conducive to open communication, nor negotiation of sexual needs and desires for couples. In sum, rather, these traditional notions can be an undermining influence in a couple’s intimacy. Scripts that are more contemporary include these simple ideas:

1. Both partners need to learn to take ownership of the couple’s sexual experiences.
2. Both partners need to learn to communicate openly and honestly about their feelings.
3. Both partners need to learn to meet one another’s desires, needs, and wishes while making sure that their own needs are being met.

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13.2: Genital Development

Many people think of male versus female reproductive and sexual body parts in terms of opposites. In sexual matters, men and women are very much alike from a physiological and biological point of view. We are even alike in our fetal development with our genitals developing from identical tissues, regardless of being male or female. Have you ever wondered why a pregnant woman can't get an accurate ultrasound until the second month to determine the fetus's sex being male or female? In part, technicians want to give the fetus enough time to develop genitals that coincide with the particular sex of the baby. More importantly, the fetus has identical genitals until about the 5th-6th week. That means it would require a DNA test to distinguish which sex the fetus is up until that point.

Sexually, males and females start with identical genital buds that usually form into the male or female reproductive organs. Please note that sexual development is a natural yet extremely complex process that yields a mostly predictable outcome among newborns. That means most females are born with nearly identical sexual parts. Likewise most males are born with nearly identical parts.

With an XY male genetic configuration, the glans area will develop into the penis. The urethral fold will form the urethral meatus or opening in the penis. The urethral groove and lateral buttress will fold onto itself and fuse into the shaft of the penis with the urethra connecting the bladder to the urethral meatus or opening of the penis. The anal tubercle will form into the anus and external sphincter. The male glands (prostate, cowper's, and seminal vesicles) develop in another process as do the testicles, which develop inside the abdomen then drop into the scrotum.

For the XX female genetic configuration, the glans becomes the clitoral glans; the urethral fold becomes the urethral meatus; the urethral groove and lateral buttress become the labia minora and majora (labia means lips); and the anal tubercle becomes the anus and external sphincter. The vagina, cervix, ovaries, and uterus form from other tissues.

Interestingly, ovaries develop inside the abdomen. These basic fetal tissues differentiate because of the X or Y. In adult sexual partners these sexual parts function in very similar ways even though their placement and structure differ.

There are some variations when the actual physical sexual development does not follow expected patterns. Hermaphroditism is found among those variations and is reported in two forms. First, true hermaphroditism is an extremely rare condition wherein both reproductive organs of both males and females are in one person's body and functioning to some degree or another (this includes, penis, testicles, prostate gland, vagina, uterus, and ovaries). Second, pseudohermaphroditism (false or near Hermaphroditism) is a rare condition wherein some of both reproductive organs for males or females are present in one person's body, but neither male nor female organs are completely present and/or fully functioning.

As is mentioned earlier, not all fetal sexual development occurs uniformly. Though not discussed here in great detail, there are five common sexual development variations reported among newborns: Turner's syndrome, Klinefelter's Syndrome; Androgen Insensitivity Syndrome; Fetally Androgenized Females; and DHT-deficient Males. In most cases of fetal development, sexual development is predictable and follows the above mentioned pattern of originating from nearly identical tissues.

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13.3: The Importance of Sexuality

Sexuality is important to us because it represents an activity that is a rite of passage into adulthood, because it is very pleasurable, and because it reinforces our roles and aspirations as males and females. Yet sexuality is truly a passive part of our daily lives.

Samuel and Cynthia Janus published The Janus Report on Sexual Behavior in 1993. They studied a scientific sample of 2,765 men and women and reported some general trends in U.S. sexual practices and patterns. They found that age-based estimates indicate a great deal of similarity in sexual frequency between age groups with 2-3 sexual encounters per week.

Sex is a minor (yet important) part of our daily time allocation. People with a sexual partner available have sex about 3 times per week, taking about 25 minutes per experience. That means about 75 minutes per week or 3,900 minutes per year is spent having sex. Divide 3,900 by 60 minutes, and it equals about 65 hours per year having sex. At first glance that sounds like a great deal of time allocation, but keep in mind that in comparison, most of us spend most of our lives doing nonsexual things.

Consider these estimates: if the average person sleeps about eight hours in a 24 hour period, works 8.5 hours, eats 1.5 hours, commutes .5 hour, watches TV for three hours, and spends about 2.5 hours for miscellaneous activities, then compared to routine non-sexual activities, sexual intercourse comprises a relatively small portion of our time.

Relatively speaking sexual intercourse is a passive part of the average person's life accounting for only 65 yearly hours of involvement per year. Many people refrain from regular sexual intercourse until their twenties and are less likely to participate in it if they are not married than are married people. These estimations don't take into account those with no sexual partner and those who abstain from sexual intercourse. The average would be much lower if those categories of people were averaged into the equation.

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13.4: Sexual Anatomy

To understand our own bodies and also understand enough about sexuality to teach our children, we must understand the basics of female and male anatomy. Figure 3 shows an artist's depiction of a cross section of female reproductive and sexual anatomy. The clitoris is extremely sensitive and is protected by the clitoral hood (not shown here). It sits above the vagina. In females, urine exits the body at the external urethral orifice (also called meatus). The vaginal orifice simply means the opening to the vagina itself. The labia are in two places, closer to the vaginal orifice (labia minora) and further away from the vaginal orifice (labia majora).

The urinary bladder sits behind the pubic bone and during urination travels an inch or two out of the body via the external urethral orifice. In the back and top of the vagina sits the cervix. The cervix is simply the window into the uterus. It is round, muscular and thick and has a small opening in it. The cervix is the bottom portion of the uterus (the uterus is where a fetus or baby would grow and develop during pregnancy).

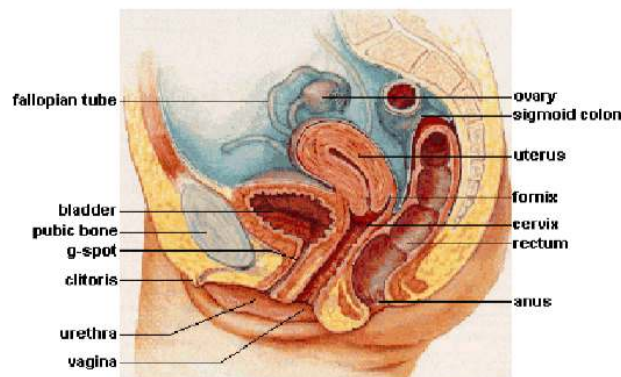


Figure 13.4.1. Diagram of a Woman's reproductive Organs

The uterus leans forward toward the pubic bone. Inside the uterus on the left and the right sides are two small openings where the fallopian tube connects the ovaries to the uterus. There are two ovaries that have thousands of eggs in them at birth. A woman may release as many as 450 eggs during her reproductive years. After an egg is released from the ovary (ovulation), the fallopian tube carries the egg from the ovary down to the uterus. When pregnancy occurs it is often because sperm met the egg in the fallopian tube and fertilized it. Later, if the fertilized egg travels down the fallopian tube and implants into the uterus, then conception has taken place.

The vagina is approximately three inches long and is made of tissues that are epithelial and mucosal. This means that when blood flow increases to the pelvis the vagina produces a lubricant in the form of moisture. The vagina is not hollow in the sense that a tube is round and hollow. The vagina is relatively flat and has potential space rather than constantly open space. The vagina has a band of pelvic floor muscles that surround it. One set of muscles is called the pubococcygeus muscle (PC muscle) which is located approximately 1 inch inside the vagina and which also plays a role in sexual pleasure for both partners.

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13.5: The Sexual Response

To truly understand how these parts function during sexual intercourse, we need to consider a research-based paradigm developed by Masters and Johnson years ago which they called the sexual response cycle. The sexual response cycle is a model that explains how most people experience three phases when they engage in sexual intercourse: excitement, plateau, and then orgasm.

Masters and Johnson are quick to point out that each individual has a unique and varied sexual response so much so that no two sexual encounters would be expected to be perfectly identical between the same people. Nevertheless, these three phases are very common among most people.

As sexual intercourse begins both males and females pass through three phases. Excitement phase is when blood flows to the pelvis bringing, more lymphatic fluid and plasma to the region. Because of hormonal and psychological stimuli there is generally swelling in the sexual parts. While this is happening, the plateau phase begins which is when more hormones are released, moisture increases, heart rate increases, intensity of sensory perception increases (touch, smell, sight, hearing, and taste). In the orgasm phase an electrical build up of energy is released that is associated with a rhythmic contraction of the pelvic floor muscles, the urinary and anal sphincters, and of various glands for males. This is called an orgasm. After the orgasm finishes, resolution eventually allows the sexual parts to return to pre-excitement conditions. These are almost identical in every way between males and females, except that there are differing sexual parts for each.

Thus, a sexual response in a typical female would typically follow a pattern similar to this one.

In the excitement phase, blood and lymphatic fluids increase swelling inside the vagina. Hormones are secreted which lead to a mild uterine contractions which raise the uterus away from the pubic bone. The labia swell and the clitoris becomes hard. The vaginal tissues secrete moisture and the vagina itself lengthens and expands slightly inward. The plateau phase begins as excitement continues. This causes the labia to become fully swollen, the clitoris to recede under the clitoral hood, and the uterus to become fully elevated (the hormone is called Oxytocin). The vagina is fully lengthened into the body, and, just before orgasm, lubrication ceases. During orgasm, the pelvis of the female experiences a series of contractions which occur every 8/10ths of second and can number anywhere from 1-20 or more in the sequence. The contractions include anal and urinary sphincter contractions, the smooth muscles in the inward portion of the vagina contraction, the pubococcygeus muscle contraction, the uterine contractions which cause the uterus and cervix to dip down into the vagina, and general muscles contractions in the body.

Further, an electrical sensation surges from the clitoris radiating throughout the body and stimulates the pleasure centers of the brain and a release of the hormone called Oxytocin. When the orgasm ends, the body eventually returns to its pre-excitement state. In general, females have more capacity to experience more contractions over a longer period of time than do males.

Females have been found to have much more capacity for sexual intercourse than males. This means females can have more sexual intercourse, more often, and with more orgasms than can the average male.

The male anatomy is presented in Figure 4. The male has a penis which is comprised of 3 spongy-like tissue columns that engorges with blood during excitement. A cross-section of the penis shows two outer columns and one column on the underneath side. The average male penis is just that—average. About 4-6 inches reported by Masters and Johnson. Since the vagina is 3 inches in length and has very sensitive regions near the outside of the vagina and not so sensitive regions deeper inside, the average male can satisfy the average female in heterosexual intercourse. Urine passes from the urinary bladder and exits at the external urethral orifice at the tip of the penis. The penis is attached inside the body to the pubic bone.

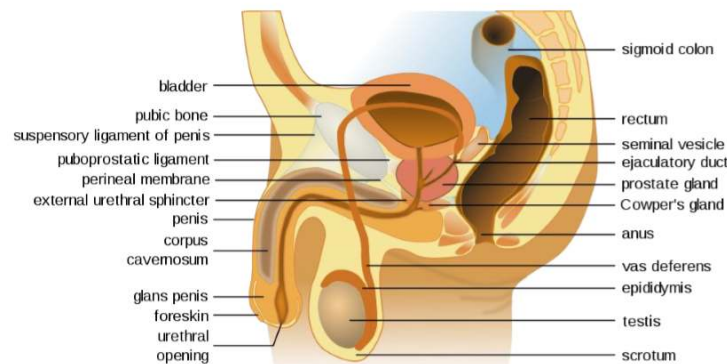


Figure 13.5.1. Male Reproductive and Sexual Anatomy, Cross-sectional View

There are two testicles inside a pouch called the scrotum. One testicle sits higher than the other. On the back of the testicle is a storage compartment where mature sperm end up before ejaculation. This is called the epididymis. There is a muscle called the dartos muscle (not shown) which elevates and lowers the testicle based on temperature and sexual pleasure. Sperm grow best at about 91 degrees Fahrenheit and most males are at about 98 degrees, so the dartos will raise and lower the testicles if in colder or warmer temperatures.

The testicles produce about 125-250,000,000 sperm every 3-4 days. More importantly, the testicles produce the sex-drive hormone called Testosterone. In males and females, higher levels of testosterone typically mean a higher sex drive (another similarity). The vas deferens will eventually carry the sperm from the epididymis out of the body during the orgasm. The prostate gland swells during excitement and fills with prostatic fluid. The seminal vesicle located above the prostate gland also swells and produces a fluid filled with natural sugars.

For males, in the excitement phase, blood and lymphatic fluids increase swelling inside the prostate, seminal vesicle, testicle, scrotum, and the penis. Hormones are secreted which lead to a higher volume of blood flowing into the spongy tissue columns of the penis than flow out. The penis erects this way (sometimes the penis will leak fluid and/or sperm before the orgasm, regularly referred to as pre-ejaculate or “pre-cum”). The scrotum and dartos muscle draw both testicles up toward the pubic bone pressing the epididymis upward. As stimulation continues the swelling and fluid production continues to increase.

The plateau continues until just before the orgasm. When orgasm begins for males the penis is most erect. Males reach a point of no return in their orgasms (females do not). The ejaculation of sperm and fluids will continue in males, regardless of continued or interrupted stimulation.

Females would experience an interruption of the orgasm when stimulation is interrupted. For males, the orgasm also includes a series of contractions which occur every 8/10ths of second and can number anywhere from 1-10. Most males will have 5-6.

The contraction includes: anal and urinary sphincter contractions; prostate and seminal vesicle contractions, dartos and scrotum contractions, pelvic floor muscle contractions; penile contractions; and a rhythmic sequence of these in such a way that the ejaculate is expelled from the body out through the penis. The sperm are released from the epididymis and travel through the vas deferens up and around the bladder then through the ejaculatory duct (where it picks up prostate and seminal fluids) and finally out of the penis. An electrical sensation surges from the prostate gland throughout the body and stimulates the pleasure centers of the brain and a release of the hormone called Oxytocin. For males and females Oxytocin brings a feeling of emotional connection.

After an orgasm, males may continue to experience an erection, but will have to wait a while for the central nervous system to reset before they can ejaculate or orgasm again. Most males wait less time when younger and more time when older. For males, an ejaculation during orgasm would be expected, but sometimes ejaculations happen with or without orgasms, and orgasms may happen without ejaculations.

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13.6: The Sexual Experience

Even though the physiological component of sexuality is common between males and females, the male and female sex drives are NOT identical. Studies consistently show that sexual desire for women is more sensitive to the context (meaningful or intimate connection) and the social and cultural environment (quality of relationships, stresses of the day, etc.). Generally speaking most men seek more sex than most women throughout most of the life span. Also, most men are more easily aroused by visual stimulation than are most women.

The Janus Report reported that 65% of men have an orgasm every time during love-making while females reported a much lower 15% every time. About 46% of women report “often” having an orgasm during love-making, compared to only 28% of men. These sex drive differences also emerged in self-reported masturbation frequencies. About 55% of men and 38% of women masturbate on a daily-monthly basis.

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.

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13.7: Sex and Gender

“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 genitalia) 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.

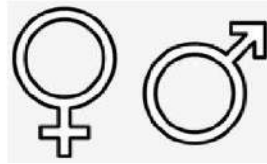


Figure 13.7.1 Female and Male Sex Symbols

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.



Figure 13.7.2 The Transgender Sex Symbol

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.

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13.8: Sexuality

Numerous studies show that men and women enjoy sex most in a meaningful relationship, typically long-term committed ones. These studies indicate that the pleasure is more meaningful and enjoyable in long-term committed relationships. Those who abstain from all sexual activity are in the lower left corner with no intimacy and no pleasure. Those who solo masturbate (by themselves) derive pleasure without intimacy. Those who purchase prostitution services derive pleasure, yet have very little intimacy. Finally, those who have one-time sexual encounters in a “one-night stand” also derive pleasure with little intimacy over time.

For married or cohabiting couples, sexual intercourse includes both pleasure and intimacy. Newlyweds typically have their honeymoon night, and sex becomes a rite of passage that marks the beginning of their full emersion into the marital relationship. Sometimes one spouse has sex to meet the needs or wants of their partners. At other times sex is a healthy and fun stress relief. Sometimes sex is a convenient way to be affectionate as a giver and a receiver. In relationships, sexual intercourse has many functions including reinforcing commitment and loyalty with one another. To give and receive is pleasurable and bonding during sexual intercourse.

Some couples seeking parenthood will have sex to pleasure themselves while getting pregnant. Many report enhancements of intimacy with less focus on pleasure at moments such as these. Others get distracted because sex becomes goal-oriented rather than simply expressive while trying to make a baby. For long-term relationships that have endured challenges such as hardship, betrayals, offenses, anger, arguments and ultimately forgiveness, sexual intercourse takes on a profoundness of its own. Those who have short-term relationships miss out on the intimacy payoff that sex provides to those in long-term relationships. Sex becomes a unique way of enhancing trust and closeness while sometimes providing sexual healing to wounded egos and feelings.

Extramarital affairs are intimate relationships with a person other than one’s spouse that may be sexual or nonsexual. Most U.S. extramarital affairs are sexual and non-consented to by one’s spouse. In spite of a variety of estimates on how many married people were ever unfaithful to their spouse, all scientific studies have found that men were more likely than women to have an extramarital affair and that most men and women do NOT ever have an affair.

Marital infidelity has been and continues to be disapproved of by the general public. Many in the U.S. who disapprove of affairs, simultaneously understand the frailties of the human experience and sympathize to some degree with those who make this “mistake.” Such was found to be true with politicians, movie and TV stars, and sports celebrities (you can pick any one from the online list available on the Internet when you search “celebrity affairs”). Affairs don’t always lead to marital or relational dissolution, but in most cases it is better if the offending spouse or partner confesses the infidelity rather than simply gets caught.

Sexual Identity and Orientation

Human beings are socialized into their adult roles and learn their sexual identities along with their gender roles, work roles, and family roles. Sexual orientation is the sexual preference one has for their partner: male, female, both, or neither. There are a few common sexual orientations that can be seen at the societal and personal level. Heterosexuality is the sexual attraction between a male and a female. Homosexuality is a sexual attraction between a male to another male or a female to another female. Bisexuality is a sexual attraction to both male and female sexual partners.

There is a difference in these three dimensions of sexuality: sexual orientation, sexual desire, and sexual behaviors. Sexual desire is the attractions we have for sexual partners and experience that exist independent of our behaviors. Sexual behaviors are our actual sexual actions and interactions. It is important to note that orientations, desires, and behaviors are not always the same thing. They do overlap at times. For example, a heterosexual male may have had a homosexual experience in the past, or not. He may at times desire males and females regardless of his actual sexual activities. A lesbian female may have had a short-term heterosexual relationship, yet define herself as a lesbian.

Edward O. Laumann et al. wrote the largest sociological study of U.S. sexuality ever published. In this book he wrote about the prevalence of self-identified sexual orientations. Laumann and the other researchers surveyed about 3,400 respondents. By far, most members of U.S. society are heterosexual. Laumann avoided the use of the words “heterosexual” or “homosexual.” He found that 7.1% of males and 3.8% of females have had sex with a partner of the same sex. Laumann also reported that over 96% of males and 98% of females identified themselves as heterosexual. Only two percent of males and 0.9% of females identified themselves as homosexual, while 0.8% of males and 0.5% of females reported bisexuality.

The Janus Report also reported their findings on sexual behaviors and sexual orientation. Their sample reported 22% of men and 17% of women said yes to the question, “Have you had a homosexual experience?” Janus also reported that 91% of men and 95% of women claimed to be heterosexual; four percent of men and two percent of women claimed to be homosexual; and five percent of men and three percent of women claimed to be bisexual. Heterosexuality is by far the most common identification in studies where respondents are asked to identify their sexual orientation. Yet, heterosexuals may have had a variety of sexual experiences in a variety of context and still consider themselves to be heterosexual in spite of dimensional discontinuity or continuity. Generally speaking Janus and Laumann found that the U.S. is a very sexual nation. They reported that very few men and women reported never having had vaginal sexual intercourse (less than five percent). They reported that men typically have sex sooner than women and that most had sex by age 20. Janus specifically reported that only nine percent of men and 17% of women had NO sexual experience before marriage.

Sexuality and Politics

Sexual orientation, desires, and behaviors have become extremely politicized. The largest sexual political action committee is the Human Rights Campaign, which emerged in the 1980s as a Gay Community Rights organization. LGBT and LGBTQ have replaced Gay Community as the collective acronym. LGBT stands for Lesbian, Gay, Bisexual, and Transgender (occasionally Queer is added by some interest groups). The Human Rights Campaign has become the central political action organization for LGBTQ interest groups. Marriage between same-sex couples became an emotionally charged political issue during the California Proposition 8 referendum and constitutional amendment that Passed November 2008.

Because it passed, the California Section 7.5 of the Declaration of Rights to the State Constitution read, “Only marriage between a man and a woman is valid or recognized in California.” This set a strong national precedence against rights to same-sex couples to have legally recognized marriage on par with heterosexual married couples. Estimates are that over \$80 million was spent on this proposition alone on both the for and against efforts.

The Prop 8 initiative originated from a political action committee called ProtectMarriage.com. It self-describes as a “...broad-based coalition of California families, community leaders, religious leaders, pro-family organizations and individuals...to restore the definition of marriage as between a man and a woman.” Proposition 8 was ultimately ruled unconstitutional by a federal court in 2010, although the court decision did not go into effect until June 26, 2013, following the conclusion of proponents' appeals.

In the past same-sex marriage in the United States was established on a state-by-state basis, expanding from 1 state in 2004 to 36 states in 2015, when, on June 26, 2015, same-sex marriage was established in all 50 states as a result of the ruling of the Supreme Court of the United States in the landmark civil rights case *Obergefell v. Hodges*, in which it was held that the right of same-sex couples to marry on the same terms and conditions as opposite-sex couples, with all the accompanying rights and responsibilities, was guaranteed by both the Due Process Clause and the Equal Protection Clause of the Fourteenth Amendment to the United States Constitution.

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13.9: Contraception

In 2008, there were 6.4 million pregnancies to the 62 million women of reproductive age (15–44) in the United States. Sixty-six percent of these pregnancies resulted in live births and 19% in induced abortions. And, nearly half of pregnancies among American women—more than three million each year—are unintended.

—Guttmacher Institute

Unintended Pregnancy

An unintended pregnancy is a pregnancy that is either mistimed or unwanted at the time of conception. It is a core concept in understanding the fertility of populations and the unmet need for contraception. Unintended pregnancy is associated with an increased risk of morbidity for women, and with health behaviors during pregnancy that are associated with adverse effects. For example, women with an unintended pregnancy may delay prenatal care, which may affect the health of the infant. Women of all ages may have unintended pregnancies, but some groups, such as teens, are at a higher risk.

Efforts to decrease unintended pregnancy include finding better forms of contraception, and increasing contraceptive use and adherence.

What is contraception?

Contraception, also known as birth control, is designed to prevent pregnancy. Some types of birth control include (but are not limited to):

- Barrier methods, such as condoms, the diaphragm, and the cervical cap, are designed to prevent the sperm from reaching the egg for fertilization. Intrauterine device, or IUD, is a small device that is inserted into the uterus by a health care provider. The IUD prevents a fertilized egg from implanting in the uterus. An IUD can stay in the uterus for up to 10 years until it is removed by a health care provider.
- Hormonal birth control, such as birth control pills, injections, skin patches, and vaginal rings, release hormones into a woman's body that interfere with fertility by preventing ovulation, fertilization, or implantation.
- Sterilization is a method that permanently prevents a woman from getting pregnant or a man from being able to get a woman pregnant. Sterilization involves surgical procedures that must be done by a health care provider and usually cannot be reversed.

The choice of birth control depends on factors such as a person's overall health, age, frequency of sexual activity, number of sexual partners, desire to have children in the future, and family history of certain diseases. A woman should talk to her health care provider about her choice of birth control method.

It is important to remember that even though birth control methods can prevent pregnancy, they do not all protect against sexually transmitted diseases or HIV.

Contraception Methods

There is no “best” method of birth control. Each method has its pros and cons.

All women and men can have control over when, and if, they become parents. Making choices about birth control, or contraception, isn't easy. There are many things to think about. To get started, learn about birth control methods you or your partner can use to prevent pregnancy. You can also talk with your doctor about the choices.

Before choosing a birth control method, think about:

- Your overall health
- How often you have sex
- The number of sex partners you have
- If you want to have children someday
- How well each method works to prevent pregnancy
- Possible side effects
- Your comfort level with using the method

What are the different types of birth control?

You can choose from many methods of birth control. They are grouped by how they work:

Continuous abstinence

This means not having sex (vaginal, anal, or oral) *at any time*. It is the only sure way to prevent pregnancy and protect against sexually transmitted infections (STIs), including HIV.

Natural family planning/rhythm method

This method is when you do not have sex or use a barrier method on the days you are most fertile (most likely to become pregnant). You can read about barrier methods in the following chart.

A woman who has a regular menstrual cycle has about 9 or more days each month when she is able to get pregnant. These fertile days are about 5 days before and 3 days after ovulation, as well as the day of ovulation.

To have success with this method, you need to learn about your menstrual cycle. Then you can learn to predict which days you are fertile or “unsafe.” To learn about your cycle, keep a written record of:

- When you get your period
- What it is like (heavy or light blood flow)
- How you feel (sore breasts, cramps)

This method also involves checking your cervical mucus and recording your body temperature each day. Cervical mucus is the discharge from your vagina. You are most fertile when it is clear and slippery like raw egg whites. Use a basal thermometer to take your temperature and record it in a chart. Your temperature will rise 0.4 to 0.8° F on the first day of ovulation. You can talk with your doctor or a natural family planning instructor to learn how to record and understand this information.

Barrier methods—put up a block, or barrier, to keep sperm from reaching the egg

Contraceptive Sponge

Before having sex, you wet the sponge and place it, loop side down, inside your vagina to cover the cervix. The sponge is effective for more than one act of intercourse for up to 24 hours. It needs to be left in for at least 6 hours after having sex to prevent pregnancy. It must then be taken out within 30 hours after it is inserted.

Only one kind of contraceptive sponge is sold in the United States. It is called the Today Sponge. Women who are sensitive to the spermicide nonoxynol-9 should not use the sponge.

Diaphragm, cervical cap, and cervical shield

These barrier methods block the sperm from entering the cervix (the opening to your womb) and reaching the egg.

- The diaphragm is a shallow latex cup.
- The cervical cap is a thimble-shaped latex cup. It often is called by its brand name, FemCap.
- The cervical shield is a silicone cup that has a one-way valve that creates suction and helps it fit against the cervix. It often is called by its brand name, Lea’s Shield.

The diaphragm and cervical cap come in different sizes, and you need a doctor to “fit” you for one. The cervical shield comes in one size, and you will not need a fitting.

Before having sex, add spermicide (to block or kill sperm) to the devices. Then place them inside your vagina to cover your cervix. You can buy spermicide gel or foam at a drug store.

All three of these barrier methods must be left in place for 6 to 8 hours after having sex to prevent pregnancy. The diaphragm should be taken out within 24 hours. The cap and shield should be taken out within 48 hours.

Female condom

This condom is worn by the woman inside her vagina. It keeps sperm from getting into her body. It is made of thin, flexible, manmade rubber and is packaged with a lubricant. It can be inserted up to 8 hours before having sex. Use a new condom each time you have intercourse. And don’t use it and a male condom at the same time.

Male condom

Male condoms are a thin sheath placed over an erect penis to keep sperm from entering a woman's body. Condoms can be made of latex, polyurethane, or "natural/lambskin". The natural kind do not protect against STIs. Condoms work best when used with a vaginal spermicide, which kills the sperm. And you need to use a new condom with each sex act.

Condoms are either:

- Lubricated, which can make sexual intercourse more comfortable
- Non-lubricated, which can also be used for oral sex. It is best to add lubrication to non-lubricated condoms if you use them for vaginal or anal sex. You can use a water-based lubricant, such as K-Y jelly. You can buy them at the drug store. Oil-based lubricants like massage oils, baby oil, lotions, or petroleum jelly will weaken the condom, causing it to tear or break.

Keep condoms in a cool, dry place. If you keep them in a hot place (like a wallet or glove compartment), the latex breaks down. Then the condom can tear or break.

Hormonal methods

These methods prevent pregnancy by interfering with ovulation, fertilization, and/or implantation of the fertilized egg.

Oral contraceptives—combined pill ("The pill")

The pill contains the hormones estrogen and progestin. It is taken daily to keep the ovaries from releasing an egg. The pill also causes changes in the lining of the uterus and the cervical mucus to keep the sperm from joining the egg.

Some women prefer the "extended cycle" pills. These have 12 weeks of pills that contain hormones (active) and 1 week of pills that don't contain hormones (inactive). While taking extended cycle pills, women only have their period three to four times a year.

Many types of oral contraceptives are available. Talk with your doctor about which is best for you.

Your doctor may advise you not to take the pill if you:

- Are older than 35 and smoke
- Have a history of blood clots
- Have a history of breast, liver, or endometrial cancer

Antibiotics may reduce how well the pill works in some women. Talk to your doctor about a backup method of birth control if you need to take antibiotics.

Women should wait three weeks after giving birth to begin using birth control that contains both estrogen and progestin. These methods increase the risk of dangerous blood clots that could form after giving birth. Women who delivered by cesarean section or have other risk factors for blood clots, such as obesity, history of blood clots, smoking, or preeclampsia, should wait six weeks.

The patch

Also called by its brand name, Ortho Evra, this skin patch is worn on the lower abdomen, buttocks, outer arm, or upper body. It releases the hormones progestin and estrogen into the bloodstream to stop the ovaries from releasing eggs in most women. It also thickens the cervical mucus, which keeps the sperm from joining with the egg. You put on a new patch once a week for 3 weeks. You don't use a patch the fourth week in order to have a period.

Women should wait three weeks after giving birth to begin using birth control that contains both estrogen and progestin. These methods increase the risk of dangerous blood clots that could form after giving birth. Women who delivered by cesarean section or have other risk factors for blood clots, such as obesity, history of blood clots, smoking, or preeclampsia, should wait six weeks.

Shot/injection

The birth control shot often is called by its brand name Depo-Provera. With this method you get injections, or shots, of the hormone progestin in the buttocks or arm every 3 months. A new type is injected under the skin. The birth control shot stops the ovaries from releasing an egg in most women. It also causes changes in the cervix that keep the sperm from joining with the egg.

Vaginal ring

This is a thin, flexible ring that releases the hormones progesterin and estrogen. It works by stopping the ovaries from releasing eggs. It also thickens the cervical mucus, which keeps the sperm from joining the egg.

It is commonly called NuvaRing, its brand name. You squeeze the ring between your thumb and index finger and insert it into your vagina. You wear the ring for 3 weeks, take it out for the week that you have your period, and then put in a new ring.

Women should wait three weeks after giving birth to begin using birth control that contains both estrogen and progesterin. These methods increase the risk of dangerous blood clots that could form after giving birth. Women who delivered by cesarean section or have other risk factors for blood clots, such as obesity, history of blood clots, smoking, or preeclampsia, should wait six weeks.

Implantable devices

These devices are inserted into the body and left in place for a few years.

Implantable rod

This is a matchstick-size, flexible rod that is put under the skin of the upper arm. It is often called by its brand name, Implanon. The rod releases a progesterin, which causes changes in the lining of the uterus and the cervical mucus to keep the sperm from joining an egg. Less often, it stops the ovaries from releasing eggs. It is effective for up to 3 years.

Intrauterine devices or IUDs

An IUD is a small device shaped like a “T” that goes in your uterus. There are two types:

- **Copper IUD** The copper IUD goes by the brand name ParaGard. It releases a small amount of copper into the uterus, which prevents the sperm from reaching and fertilizing the egg. If fertilization does occur, the IUD keeps the fertilized egg from implanting in the lining of the uterus. A doctor needs to put in your copper IUD. It can stay in your uterus for 5 to 10 years.
- **Hormonal IUD** The hormonal IUD goes by the brand name Mirena. It is sometimes called an intrauterine system, or IUS. It releases progesterin into the uterus, which keeps the ovaries from releasing an egg and causes the cervical mucus to thicken so sperm can't reach the egg. It also affects the ability of a fertilized egg to successfully implant in the uterus. A doctor needs to put in a hormonal IUD. It can stay in your uterus for up to 5 years.

Sterilization implant (essure)

Essure is the first non-surgical method of sterilizing women. A thin tube is used to thread a tiny spring-like device through the vagina and uterus into each fallopian tube. The device works by causing scar tissue to form around the coil. This blocks the fallopian tubes and stops the egg and sperm from joining.

It can take about 3 months for the scar tissue to grow, so it's important to use another form of birth control during this time. Then you will have to return to your doctor for a test to see if scar tissue has fully blocked your tubes.

Surgical sterilization

For women, surgical sterilization closes the fallopian tubes by being cut, tied, or sealed. This stops the eggs from going down to the uterus where they can be fertilized. The surgery can be done a number of ways. Sometimes, a woman having cesarean birth has the procedure done at the same time, so as to avoid having additional surgery later.

For men, having a vasectomy keeps sperm from going to his penis, so his ejaculate never has any sperm in it. Sperm stays in the system after surgery for about 3 months. During that time, use a backup form of birth control to prevent pregnancy. A simple test can be done to check if all the sperm is gone; it is called a semen analysis.

Emergency contraception

Used if a woman's primary method of birth control fails. It should *not* be used as a regular method of birth control. Emergency contraception (Plan B One-Step or Next Step. It is also called the “morning after pill.”)

Emergency contraception keeps a woman from getting pregnant when she has had unprotected vaginal intercourse. “Unprotected” can mean that no method of birth control was used. It can also mean that a birth control method was used but it was used

incorrectly, or did not work (like a condom breaking). Or, a woman may have forgotten to take her birth control pills. She also may have been abused or forced to have sex. These are just some of the reasons women may need emergency contraception.

Emergency contraception can be taken as a single pill treatment or in two doses. A single dose treatment works as well as two doses and does not have more side effects. It works by stopping the ovaries from releasing an egg or keeping the sperm from joining with the egg. For the best chances for it to work, take the pill as soon as possible after unprotected sex. It should be taken within 72 hours after having unprotected sex.

A single-pill dose or two-pill dose of emergency contraception is available over-the-counter (OTC) for women ages 17 and older.

Can all types of birth control prevent sexually transmitted infections (STIs)?

No. The male latex condom is the *only* birth control method proven to help protect you from STIs, including HIV. Research is being done to find out how effective the female condom is at preventing STIs and HIV. For more information, see [Will birth control pills protect me from sexually transmitted infections \(STIs\), including HIV/AIDS?](#)

How well do different kinds of birth control work? Do they have side effects?

All birth control methods work the best if used correctly and every time you have sex. Be sure you know the right way to use them. Sometimes doctors don't explain how to use a method because they assume you already know. Talk with your doctor if you have questions. They are used to talking about birth control. So don't feel embarrassed about talking to him or her.

Some birth control methods can take time and practice to learn. For example, some people don't know you can put on a male condom "inside out." Also, not everyone knows you need to leave a little space at the tip of the condom for the sperm and fluid when a man ejaculates, or has an orgasm.

Where to Get Birth Control

Where you get birth control depends on what method you choose.

You can buy these forms over the counter:

- Male condoms
- Female condoms
- Sponges
- Spermicides
- Emergency contraception pills (girls younger than 17 need a prescription)

You need a prescription for these forms:

- Oral contraceptives: the pill, the mini-pill
- Skin patch
- Vaginal ring
- Diaphragm (your doctor needs to fit one to your shape)
- Cervical cap
- Cervical shield
- Shot/injection (you get the shot at your doctor's office)
- IUD (inserted by a doctor)
- Implantable rod (inserted by a doctor)

You will need surgery or a medical procedure for:

- Sterilization, female and male

Spermicides

You can buy spermicides over the counter. They work by killing sperm. They come in many forms:

- Foam
- Gel
- Cream

- Film
- Suppository
- Tablet

Spermicides are put in the vagina no more than 1 hour before having sex. If you use a film, suppository, or tablet, wait at least 15 minutes before having sex so the spermicide can dissolve. Do not douche or rinse out your vagina for at least 6 to 8 hours after having sex. You will need to use more spermicide each time you have sex.

Spermicides work best if used along with a barrier method, such as a condom, diaphragm, or cervical cap. Some spermicides are made just for use with the diaphragm and cervical cap. Check the package to make sure you are buying what you need.

All spermicides contain sperm-killing chemicals. Some contain nonoxynol-9, which may raise your risk of HIV if you use it a lot. It irritates the tissue in the vagina and anus, so it can cause the HIV virus to enter the body more freely. Some women are sensitive to nonoxynol-9 and need to use spermicides without it. Medications for vaginal yeast infections may lower the effectiveness of spermicides. Also, spermicides do not protect against sexually transmitted infections.

Withdrawal

Withdrawal is when a man takes his penis out of a woman's vagina (or "pulls out") before he ejaculates, or has an orgasm. This stops the sperm from going to the egg. "Pulling out" can be hard for a man to do. It takes a lot of self-control.

Even if you use withdrawal, sperm can be released *before* the man pulls out. When a man's penis first becomes erect, pre-ejaculate fluid may be on the tip of the penis. This fluid has sperm in it. So you could still get pregnant.

Withdrawal does not protect you from STIs or HIV.

Dental Dams

The dental dam is a square piece of rubber that is used by dentists during oral surgery and other procedures. It is not a method of birth control. But it can be used to help protect people from STIs, including HIV, during oral-vaginal or oral-anal sex. It is placed over the opening to the vagina or the anus before having oral sex. You can buy dental dams at surgical supply stores.

? Learning Activity

For a handy summary of birth control information, see this [Frequently Asked Questions Fact Sheet](#).

? Learning Activity

Find out the Real Cost of Contraceptives: *"Choosing the most money-smart method isn't as easy as crunching numbers because costs depend on a variety of factors, including how long you want the birth control to last, how often you need it, and how generous your insurance policy is."*

- Which birth control methods are the most affordable? Why?

Sources

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13.10: Reproduction

Reproductive Health

Both the male and female reproductive systems play a role in pregnancy. Problems with these systems can affect fertility and the ability to have children. There are many such problems in men and women.

Reproductive health problems can also be harmful to overall health and impair a person's ability to enjoy a sexual relationship.

Your reproductive health is influenced by many factors. These include your age, lifestyle, habits, genetics, use of medicines and exposure to chemicals in the environment. Many problems of the reproductive system can be corrected.

What is reproductive health?

Reproductive health includes a variety of topics, such as:

- Menstruation and menopause
- Pregnancy and preconception care
- Fertility/Infertility
- Contraception

More information on some of these issues is provided below.

Menstrual Cycle

The menstrual cycle is the process by which a woman's body gets ready for the chance of a pregnancy each month. The average menstrual cycle is 28 days from the start of one to the start of the next, but it can range from 21 days to 35 days.

Most menstrual periods last from three to five days. In the United States, most girls start menstruating at age 12, but girls can start menstruating between the ages of 8 and 16.

Menstruation and the menstrual cycle fact sheet

Menstruation is a woman's monthly bleeding. When you menstruate, your body sheds the lining of the uterus (womb). Menstrual blood flows from the uterus through the small opening in the cervix and passes out of the body through the vagina (see how the menstrual cycle works below). Most menstrual periods last from 3 to 5 days.

What is the menstrual cycle?

When periods (menstruations) come regularly, this is called the menstrual cycle. Having regular menstrual cycles is a sign that important parts of your body are working normally. The menstrual cycle provides important body chemicals, called hormones, to keep you healthy. It also prepares your body for pregnancy each month. A cycle is counted from the first day of 1 period to the first day of the next period. The average menstrual cycle is 28 days long. Cycles can range anywhere from 21 to 35 days in adults and from 21 to 45 days in young teens.

What happens during the menstrual cycle?

In the first half of the cycle, levels of estrogen (the female hormone) start to rise. Estrogen plays an important role in keeping you healthy, especially by helping you to build strong bones and to help keep them strong as you get older. Estrogen also makes the lining of the uterus (womb) grow and thicken. This lining of the womb is a place that will nourish the embryo if a pregnancy occurs. At the same time the lining of the womb is growing, an egg, or ovum, in one of the ovaries starts to mature. At about day 14 of an average 28-day cycle, the egg leaves the ovary. This is called ovulation.

After the egg has left the ovary, it travels through the fallopian tube to the uterus. Hormone levels rise and help prepare the uterine lining for pregnancy. A woman is most likely to get pregnant during the 3 days before or on the day of ovulation. Keep in mind, women with cycles that are shorter or longer than average may ovulate before or after day 14.

A woman becomes pregnant if the egg is fertilized by a man's sperm cell and attaches to the uterine wall. If the egg is not fertilized, it will break apart. Then, hormone levels drop, and the thickened lining of the uterus is shed during the menstrual period.

The Menstrual Cycle

- **Day 1** starts with the first day of your period. This occurs after hormone levels drop at the end of the previous cycle, signaling blood and tissues lining the uterus (womb) to break down and shed from the body. Bleeding lasts about 5 days.
- Usually by **Day 7**, bleeding has stopped. Leading up to this time, hormones cause fluid-filled pockets called follicles to develop on the ovaries. Each follicle contains an egg.
- Between **Day 7 and 14**, one follicle will continue to develop and reach maturity. The lining of the uterus starts to thicken, waiting for a fertilized egg to implant there. The lining is rich in blood and nutrients.
- Around **Day 14** (in a 28-day cycle), hormones cause the mature follicle to burst and release an egg from the ovary, a process called ovulation.
- Over the next few days, the egg travels down the fallopian tube towards the uterus. If a sperm unites with the egg here, the fertilized egg will continue down the fallopian tube and attach to the lining of the uterus.
- If the egg is not fertilized, hormone levels will drop around **Day 25**. This signals the next menstrual cycle to begin. The egg will break apart and be shed with the next period.

What is a typical menstrual period like?

During your period, you shed the thickened uterine lining and extra blood through the vagina. Your period may not be the same every month. It may also be different than other women's periods. Periods can be light, moderate, or heavy in terms of how much blood comes out of the vagina. This is called menstrual flow. The length of the period also varies. Most periods last from 3 to 5 days. But, anywhere from 2 to 7 days is normal.

For the first few years after menstruation begins, longer cycles are common. A woman's cycle tends to shorten and become more regular with age. Most of the time, periods will be in the range of 21 to 35 days apart.

What kinds of problems do women have with their periods?

Women can have a range of problems with their periods, including pain, heavy bleeding, and skipped periods.

Amenorrhea—the lack of a menstrual period. This term is used to describe the absence of a period in:

- Young women who haven't started menstruating by age 15
- Women and girls who haven't had a period for 90 days, even if they haven't been menstruating for long

Causes can include:

- Pregnancy
- Breastfeeding
- Extreme weight loss
- Eating disorders
- Excessive exercising
- Stress
- Serious medical conditions in need of treatment

As above, when your menstrual cycles come regularly, this means that important parts of your body are working normally. In some cases, not having menstrual periods can mean that your ovaries have stopped producing normal amounts of estrogen. Missing these hormones can have important effects on your overall health. Hormonal problems, such as those caused by polycystic ovary syndrome (PCOS) or serious problems with the reproductive organs, may be involved. It's important to talk to a doctor if you have this problem.

Dysmenorrhea (dis-men-uh-REE-uh)—painful periods, including severe cramps. Menstrual cramps in teens are caused by too much of a chemical called prostaglandin (pros-tuh-GLAN-duhn). Most teens with dysmenorrhea do not have a serious disease, even though the cramps can be severe. In older women, the pain is sometimes caused by a disease or condition such as uterine fibroids or endometriosis.

For some women, using a heating pad or taking a warm bath helps ease their cramps. Some over-the-counter pain medicines can also help with these symptoms. They include:

- Ibuprofen (for instance, Advil, Motrin, Midol Cramp>
- Ketoprofen (for instance, Orudis KT)
- Naproxen (for instance, Aleve)

If these medicines don't relieve your pain or the pain interferes with work or school, you should see a doctor. Treatment depends on what's causing the problem and how severe it is. Report vaginal bleeding that's different from normal menstrual periods. It includes:

- Bleeding between periods
- Bleeding after sex
- Spotting anytime in the menstrual cycle
- Bleeding heavier or for more days than normal
- Bleeding after menopause

Abnormal bleeding can have many causes. Your doctor may start by checking for problems that are most common in your age group. Some of them are not serious and are easy to treat. Others can be more serious. Treatment for abnormal bleeding depends on the cause.

In both teens and women nearing menopause, hormonal changes can cause long periods along with irregular cycles. Even if the cause is hormonal changes, you may be able to get treatment. You should keep in mind that these changes can occur with other serious health problems, such as uterine fibroids, polyps, or even cancer. See your doctor if you have any abnormal bleeding.

When does a girl usually get her first period?

In the United States, the average age for a girl to get her first period is 12. This does not mean that all girls start at the same age. A girl can start her period anytime between the ages of 8 and 15. Most of the time, the first period starts about 2 years after breasts first start to develop. If a girl has not had her first period by age 15, or if it has been more than 2 to 3 years since breast growth started, she should see a doctor.

Menopause

Women usually have periods until menopause. Menopause occurs between the ages of 45 and 55, usually around age 50. Menopause means that a woman is no longer ovulating (producing eggs) or having periods and can no longer get pregnant. Like menstruation, menopause can vary from woman to woman and these changes may occur over several years.

The time when your body begins its move into menopause is called the menopausal transition. This can last anywhere from 2 to 8 years. Some women have early menopause because of surgery or other treatment, illness, or other reasons. If you don't have a period for 90 days, you should see your doctor. He or she will check for pregnancy, early menopause, or other health problems that can cause periods to stop or become irregular.

When to Consult a Doctor about Your Period

See your doctor about your period if:

- You have not started menstruating by the age of 15.
- You have not started menstruating within 3 years after breast growth began, or if breasts haven't started to grow by age 13.
- Your period suddenly stops for more than 90 days.
- Your periods become very irregular after having had regular, monthly cycles.
- Your period occurs more often than every 21 days or less often than every 35 days.
- You are bleeding for more than 7 days.
- You are bleeding more heavily than usual or using more than 1 pad or tampon every 1 to 2 hours.
- You bleed between periods.
- You have severe pain during your period.
- You suddenly get a fever and feel sick after using tampons.

You should change a pad before it becomes soaked with blood. Each woman decides for herself what works best. You should change a tampon at least every 4 to 8 hours. Make sure to use the lowest absorbency tampon needed for your flow. For example, use junior or regular tampons on the lightest day of your period. Using a super absorbency tampon on your lightest days increases

your risk for toxic shock syndrome (TSS). TSS is a rare but sometimes deadly disease. TSS is caused by bacteria that can produce toxins. If your body can't fight the toxins, your immune (body defense) system reacts and causes the symptoms of TSS (see below).

Young women may be more likely to get TSS. Using any kind of tampon puts you at greater risk for TSS than using pads. The Food and Drug Administration (FDA) recommends the following tips to help avoid tampon problems:

- Follow package directions for insertion.
- Choose the lowest absorbency for your flow.
- Change your tampon at least every 4 to 8 hours.
- Consider switching between pads and tampons.
- Know the warning signs of TSS (see below).
- Don't use tampons between periods.

If you have any of these symptoms of TSS while using tampons, take the tampon out, and contact your doctor right away:

- Sudden high fever (over 102 degrees)
- Muscle aches
- Diarrhea
- Vomiting
- Dizziness and/or fainting
- Sunburn-like rash
- Sore throat
- Bloodshot eyes

Preconception Care

Why preconception health matters

Preconception health is a woman's health before she becomes pregnant. It means knowing how health conditions and risk factors could affect a woman or her unborn baby if she becomes pregnant. For example, some foods, habits, and medicines can harm your baby—even before he or she is conceived. Some health problems, such as diabetes, also can affect pregnancy.

Every woman should be thinking about her health whether or not she is planning pregnancy. One reason is that about half of all pregnancies are not planned. Unplanned pregnancies are at greater risk of preterm birth and low birth weight babies. Another reason is that, despite important advances in medicine and prenatal care, about 1 in 8 babies is born too early. Researchers are trying to find out why and how to prevent preterm birth. But experts agree that women need to be healthier before becoming pregnant. By taking action on health issues and risks before pregnancy, you can prevent problems that might affect you or your baby later.

Five most important things to boost your preconception health

Women and men should prepare for pregnancy before becoming sexually active—or at least three months before getting pregnant. Some actions, such as quitting smoking, reaching a healthy weight, or adjusting medicines you are using, should start even earlier.

The five most important things a woman can do for preconception health are:

1. Take 400 to 800 micrograms (400 to 800 mcg or 0.4 to 0.8 mg) of folic acid every day if you are planning or capable of pregnancy to lower your risk of some birth defects of the brain and spine, including spina bifida. All women need folic acid every day. Talk to your doctor about your folic acid needs. Some doctors prescribe prenatal vitamins that contain higher amounts of folic acid.
2. Stop smoking and drinking alcohol.
3. If you have a medical condition, be sure it is under control. Some conditions that can affect pregnancy or be affected by it include asthma, diabetes, oral health, obesity, or epilepsy.
4. Talk to your doctor about any over-the-counter and prescription medicines you are using. These include dietary or herbal supplements. Be sure your vaccinations are up to date.
5. Avoid contact with toxic substances or materials that could cause infection at work and at home. Stay away from chemicals and cat or rodent feces.

Talk to your doctor before you become pregnant

Did you know?

It's best to be at a healthy weight when you become pregnant. Being overweight or underweight puts you at increased risk for problems during pregnancy. Learn how healthy food choices and physical fitness, together, can help you reach or maintain a healthy weight.

Preconception care can improve your chances of getting pregnant, having a healthy pregnancy, and having a healthy baby. If you are sexually active, talk to your doctor about your preconception health now.

Preconception care should begin at least three months before you get pregnant. But some women need more time to get their bodies ready for pregnancy. Be sure to discuss your partner's health too. Ask your doctor about:

- Family planning and birth control.
- Taking folic acid.
- Vaccines and screenings you may need, such as a [Pap test](#) and screenings for [sexually transmitted infections](#) (STIs), including HIV.
- Managing health problems, such as diabetes, high blood pressure, thyroid disease, obesity, depression, eating disorders, and asthma. Find out how pregnancy may affect, or be affected by, health problems you have.
- Medicines you use, including over-the-counter, herbal, and prescription drugs and supplements.
- Ways to improve your overall health, such as reaching a healthy weight, making healthy food choices, being physically active, caring for your teeth and gums, reducing stress, quitting smoking, and avoiding alcohol.
- How to avoid illness.
- Hazards in your workplace or home that could harm you or your baby.
- Health problems that run in your or your partner's family.
- Problems you have had with prior pregnancies, including preterm birth.
- Family concerns that could affect your health, such as domestic violence or lack of support.

Bring a list of talking points to be sure you don't forget anything. If you run out of time at your visit, schedule a follow-up visit to make sure everything is covered.

Your partner's role in preparing for pregnancy

Your partner can do a lot to support and encourage you in every aspect of preparing for pregnancy. Here are some ways:

- Make the decision about pregnancy together. When both partners intend for pregnancy, a woman is more likely to get early prenatal care and avoid risky behaviors such as smoking and drinking alcohol.
- Screening for and treating sexually transmitted infections (STIs) can help make sure infections are not passed to female partners.
- Male partners can improve their own reproductive health and overall health by limiting alcohol, quitting smoking or illegal drug use, making healthy food choices, and reducing stress. Studies show that men who drink a lot, smoke, or use drugs can have problems with their sperm. These might cause you to have problems getting pregnant. If your partner won't quit smoking, ask that he not smoke around you, to avoid harmful effects of secondhand smoke.
- Your partner should also talk to his doctor about his own health, his family health history, and any medicines he uses.
- People who work with chemicals or other toxins can be careful not to expose women to them. For example, people who work with fertilizers or pesticides should change out of dirty clothes before coming near women. They should handle and wash soiled clothes separately.

Genetic counseling

Did you know?

Some companies offer genetic tests that you can do yourself through the mail. These tests may not provide true or meaningful information. These tests might provide harmful information. Talk to your doctor before using this type of test.

The genes your baby is born with can affect your baby's health in these ways:

- Single gene disorders are caused by a problem in a single gene. Genes contain the information your body's cells need to function. Single gene disorders run in families. Examples of single gene disorders are [cystic fibrosis](#) and [sickle cell anemia](#).
- Chromosome disorders occur when all or part of a chromosome is missing or extra, or if the structure of one or more chromosomes is not normal. Chromosomes are structures where genes are located. Most chromosome disorders that involve whole chromosomes do not run in families.

Talk to your doctor about your and your partner's family health histories before becoming pregnant. This information can help your doctor find out any genetic risks you might have.

Depending on your genetic risk factors, your doctor might suggest you meet with a genetic professional. Some reasons a person or couple might seek genetic counseling are:

- A family history of a genetic condition, birth defect, chromosomal disorder, or cancer
- Two or more pregnancy losses, a stillbirth, or a baby who died
- A child with a known inherited disorder, birth defect, or intellectual disability
- A woman who is pregnant or plans to become pregnant at 35 years or older
- Test results that suggest a genetic condition is present
- Increased risk of getting or passing on a genetic disorder because of one's ethnic background
- People related by blood who want to have children together

During a consultation, the genetics professional meets with a person or couple to discuss genetic risks or to diagnose, confirm, or rule out a genetic condition. Sometimes, a couple chooses to have genetic testing. Some tests can help couples to know the chances that a person will get or pass on a genetic disorder. The genetics professional can help couples decide if genetic testing is the right choice for them.

? Learning Activity

Find out about [direct-to-consumer genetic testing kits](#).

- Would you use a genetic test that you can do yourself through the mail? Why or why not?

What is pregnancy?

Pregnancy is the term used to describe when a woman has a growing fetus inside of her. In most cases, the fetus grows in the uterus.

Human pregnancy lasts about 40 weeks, or just more than 9 months, from the start of the last menstrual period to childbirth.

What are prenatal and preconception care and why are they important?

Prenatal care is the care woman gets during a pregnancy. Getting early and regular prenatal care is important for the health of both mother and the developing baby.

In addition, health care providers are now recommending a woman see a health care provider for preconception care, even before she considers becoming pregnant or in between pregnancies.

Knowing if you are pregnant

A missed period is often the first clue that a woman might be pregnant. Sometimes, a woman might suspect she is pregnant even sooner. Symptoms such as headache, fatigue, and breast tenderness, can occur even before a missed period. The wait to know can be emotional. These days, many women first use home pregnancy tests (HPT) to find out. Your doctor also can test you.

All pregnancy tests work by detecting a special hormone in the urine or blood that is only there when a woman is pregnant. It is called human chorionic gonadotropin (kohr-ee-ON-ihk goh-NAD-uh-TROH-puhn), or hCG. hCG is made when a fertilized egg implants in the uterus. hCG rapidly builds up in your body with each passing day you are pregnant. Read on to learn when and how to test for pregnancy.

Home pregnancy tests

Reading a home pregnancy test

HPTs are inexpensive, private, and easy to use. Most drugstores sell HPTs over the counter. The cost depends on the brand and how many tests come in the box. They work by detecting hCG in your urine. HPTs are highly accurate. But their accuracy depends on many things. These include:

- **When you use them**—The amount of hCG in your urine increases with time. So, the earlier after a missed period you take the test the harder it is to spot the hCG. Some HPTs claim that they can tell if you are pregnant one day after a missed period or even earlier. But a recent study shows that most HPTs don't give accurate results this early in pregnancy. Positive results are more likely to be true than negative results. Waiting one week after a missed period will usually give a more accurate result. You can take the test sooner. But just know that a lot of pregnant women will get negative test results during the first few days after the missed period. It's a good idea to repeat the test again after a week has passed. If you get two negative results but still think you're pregnant, call your doctor.
- **How you use them**—Be sure to check the expiration date and follow the directions. Many involve holding a test stick in the urine stream. For some, you collect urine in a cup and then dip the test stick into it. Then, depending on the brand, you will wait a few minutes to get the results. Research suggests waiting 10 minutes will give the most accurate result. Also, testing your urine first thing in the morning may boost the accuracy. You will be looking for a plus sign, a change in color, or a line. A change, whether bold or faint, means the result is positive. New digital tests show the words "pregnant" or "not pregnant." Most tests also have a "control indicator" in the results window. This line or symbol shows whether or not the test is working. If the control indicator does not appear, the test is not working properly. You should not rely on any results from a HPT that may be faulty.
- **Who uses them**—The amount of hCG in the urine is different for every pregnant woman. So, some women will have accurate results on the day of the missed period while others will need to wait longer. Also, some medicines affect HPTs. Discuss the medicines you use with your doctor before trying to become pregnant.
- **The brand of test**—Some HPT tests are better than others at spotting hCG early on.

The most important part of using any HPT is to follow the directions exactly as written. Most tests also have toll-free phone numbers to call in case of questions about use or results.

If a HPT says you are pregnant, you should call your doctor right away. Your doctor can use a more sensitive test along with a pelvic exam to tell for sure if you're pregnant. Seeing your doctor early on in your pregnancy can help you and your baby stay healthy.

Unplanned Pregnancy

Unplanned pregnancy is common. About 1 in 2 pregnancies in America are unplanned. Ideally, a woman who is surprised by an unplanned pregnancy is in good [preconception health](#) and is ready and able to care for a new child. But this sometimes isn't the case.

If you have an unplanned pregnancy, you might not know what to do next. You might worry that the father won't welcome the news. You might not be sure you can afford to care for a baby. You might worry if past choices you have made, such as drinking or drug use, will affect your unborn baby's health. You might be concerned that having a baby will keep you from finishing school or pursuing a career.

If you are pregnant after being raped, you might feel ashamed, numb, or afraid. Unplanned pregnancy is common among abused women. Research has found that some abusers force their partners to have sex without birth control and/or sabotage the birth control their partners are using, leading to unplanned pregnancy.

You might wonder what options you have. Here are some next steps to help you move forward:

- Start taking care of yourself right away. Take 400 to 800 micrograms (400 to 800 mcg or 0.4 to 0.8 mg) folic acid every. Stop alcohol, tobacco, and drug use.
- Make a doctor's visit to confirm your pregnancy. Discuss your health and issues that could affect your pregnancy. Ask for help quitting smoking. Find out what you can do to take care of yourself and your unborn baby.
- Ask your doctor to recommend a counselor who you can talk to about your situation.

- Seek support in someone you trust and respect.

Trying to Get Pregnant

How do you figure out when you're fertile and when you're not? Wondering if you or your partner is infertile? Read on to boost your chances of conception and get help for fertility problems.

Fertility awareness

The menstrual cycle

Being aware of your menstrual cycle and the changes in your body that happen during this time can help you know when you are most likely to get pregnant.

The average menstrual cycle lasts 28 days. But normal cycles can vary from 21 to 35 days. The amount of time before ovulation occurs is different in every woman and even can be different from month to month in the same woman, varying from 13 to 20 days long. Learning about this part of the cycle is important because it is when ovulation and pregnancy can occur. After ovulation, every woman (unless she has a health problem that affects her periods or becomes pregnant) will have a period within 14 to 16 days.

Charting your fertility pattern

Knowing when you're most fertile will help you plan pregnancy. There are three ways you can keep track of your fertile times. They are:

1. **Basal body temperature method**—Basal body temperature is your temperature at rest as soon as you awake in the morning. A woman's basal body temperature rises slightly with ovulation. So by recording this temperature daily for several months, you'll be able to predict your most fertile days.

Basal body temperature differs slightly from woman to woman. Anywhere from 96 to 98 degrees Fahrenheit orally is average before ovulation. After ovulation most women have an oral temperature between 97 and 99 degrees Fahrenheit. The rise in temperature can be a sudden jump or a gradual climb over a few days.

Usually a woman's basal body temperature rises by only 0.4 to 0.8 degrees Fahrenheit. To detect this tiny change, women must use a basal body thermometer. These thermometers are very sensitive. Most pharmacies sell them for about \$10. You can then record your temperature on our special Basal Body Temperature Chart.

The rise in temperature doesn't show exactly when the egg is released. But almost all women have ovulated within three days after their temperatures spike. Body temperature stays at the higher level until the woman's period starts.

A woman is most fertile and most likely to get pregnant:

- Two to three days before your temperature hits the highest point (ovulation)
- 12 to 24 hours after ovulation

A man's sperm can live for up to three days in a woman's body. The sperm can fertilize an egg at any point during that time. So if you have unprotected sex a few days before ovulation, you could get pregnant.

Many things can affect basal body temperature. For your chart to be useful, make sure to take your temperature every morning at about the same time. Things that can alter your temperature include:

- Drinking alcohol the night before
- Smoking cigarettes the night before
- Getting a poor night's sleep
- Having a fever
- Doing anything in the morning before you take your temperature—including going to the bathroom and talking on the phone

2. **Calendar method**—This involves recording your menstrual cycle on a calendar for eight to 12 months. The first day of your period is Day 1. Circle Day 1 on the calendar. The length of your cycle may vary from month to month. So write down the total number of days it lasts each time. Using this record, you can find the days you are most fertile in the months ahead:

- To find out the first day when you are most fertile, subtract 18 from the total number of days in your shortest cycle. Take this new number and count ahead that many days from the first day of your next period. Draw an X through this date on your calendar. The X marks the first day you're likely to be fertile.
- To find out the last day when you are most fertile, subtract 11 from the total number of days in your longest cycle. Take this new number and count ahead that many days from the first day of your next period. Draw an X through this date on your calendar. The time between the two Xs is your most fertile window.

This method always should be used along with other fertility awareness methods, especially if your cycles are not always the same length.

? Optional Learning Activity

Use this Ovulation and due date calculator to find out when you (or a woman you know) are most likely to become pregnant and to estimate your due date should conception occur.

Did you know?

The cervical mucus method is less reliable for some women. Women who are breastfeeding, taking hormonal birth control (like the pill), using feminine hygiene products, have vaginitis or sexually transmitted infections (STIs), or have had surgery on the cervix should not rely on this method.

3. **Cervical mucus method** (also known as the ovulation method)—This involves being aware of the changes in your cervical mucus throughout the month. The hormones that control the menstrual cycle also change the kind and amount of mucus you have before and during ovulation. Right after your period, there are usually a few days when there is no mucus present or “dry days.” As the egg starts to mature, mucus increases in the vagina, appears at the vaginal opening, and is white or yellow and cloudy and sticky. The greatest amount of mucus appears just before ovulation. During these “wet days” it becomes clear and slippery, like raw egg whites. Sometimes it can be stretched apart. This is when you are most fertile. About four days after the wet days begin the mucus changes again. There will be much less and it becomes sticky and cloudy. You might have a few more dry days before your period returns. Describe changes in your mucus on a calendar. Label the days, “Sticky,” “Dry,” or “Wet.” You are most fertile at the first sign of wetness after your period or a day or two before wetness begins. To most accurately track your fertility, use a combination of all three methods. This is called the symptothermal method. You can also purchase over-the-counter ovulation kits or fertility monitors to help find the best time to conceive. These kits work by detecting surges in a specific hormone called luteinizing hormone, which triggers ovulation.

Infertility

Some women want children but either cannot conceive or keep miscarrying. This is called *infertility*. Lots of couples have infertility problems. About one-third of the time, it is a female problem. In another one-third of cases, it is the man with the fertility problem. For the remaining one-third, both partners have fertility challenges or no cause is found.

Causes of infertility

Some common reasons for infertility in women include:

Age—Women generally have some decrease in fertility starting in their early 30s. And while many women in their 30s and 40s have no problems getting pregnant, fertility especially declines after age 35. As a woman ages, normal changes that occur in her ovaries and eggs make it harder to become pregnant. Even though menstrual cycles continue to be regular in a woman's 30s and 40s, the eggs that ovulate each month are of poorer quality than those from her 20s. It is harder to get pregnant when the eggs are poorer in quality. As a woman nears menopause, the ovaries may not release an egg each month, which also can make it harder to get pregnant. Also, as a woman and her eggs age, she is more likely to miscarry, as well as have a baby with genetic problems, such as Down syndrome.

Health problems—Some women have diseases or conditions that affect their hormone levels, which can cause infertility. Women with polycystic ovary syndrome (PCOS) rarely or never ovulate. Failure to ovulate is the most common cause of infertility in women.

- With primary ovarian insufficiency (POI), a woman's ovaries stop working normally before she is 40. It is not the same as early menopause. Some women with POI get a period now and then. But getting pregnant is hard for women with POI.
- A condition called luteal phase defect (LPD) is a failure of the uterine lining to be fully prepared for pregnancy. This can keep a fertilized egg from implanting or result in miscarriage.

Common problems with a woman's reproductive organs, like [uterine fibroids](#), [endometriosis](#), and [pelvic inflammatory disease](#) can worsen with age and also affect fertility. These conditions might cause the fallopian tubes to be blocked, so the egg can't travel through the tubes into the uterus.

Lifestyle factors—Certain lifestyle factors also can have a negative effect on a woman's fertility. Examples include smoking, alcohol use, weighing much more or much less than an ideal body weight, a lot of strenuous exercise, and having an eating disorder. Stress also can affect fertility.

Unlike women, some men remain fertile into their 60s and 70s. But as men age, they might begin to have problems with the shape and movement of their sperm. They also have a slightly higher risk of sperm gene defects. Or they might produce no sperm, or too few sperm. Lifestyle choices also can affect the number and quality of a man's sperm. Alcohol and drugs can temporarily reduce sperm quality. And researchers are looking at whether environmental toxins, such as pesticides and lead, also may be to blame for some cases of infertility. Men also can have health problems that affect their sexual and reproductive function. These can include sexually transmitted infections (STIs), diabetes, surgery on the prostate gland, or a severe testicle injury or problem.

When to see your doctor

You should talk to your doctor about your fertility if:

- You are younger than 35 and have not been able to conceive after one year of frequent sex without birth control.
- You are age 35 or older and have not been able to conceive after six months of frequent sex without birth control.
- You believe you or your partner might have fertility problems in the future (even before you begin trying to get pregnant).
- You or your partner has a problem with sexual function or libido.

Happily, doctors are able to help many infertile couples go on to have babies.

If you are having fertility issues, your doctor can refer you to a fertility specialist, a doctor who treats infertility. The doctor will need to test both you and your partner to find out what the problem is. Depending on the problem, your doctor might recommend treatment. About 9 in 10 cases of infertility are treated with drugs or surgery. *Don't delay seeing your doctor as age also affects the success rates of these treatments.* For some couples, adoption or foster care offers a way to share their love with a child and to build a family.

Infertility treatment

Some treatments include:

- **Drugs**—Various fertility drugs may be used for women with ovulation problems. It is important to talk with your doctor about the drug to be used. You should understand the drug's benefits and side effects. Depending on the type of fertility drug and the dosage of the drug used, multiple births (such as twins) can occur.
- **Surgery**—Surgery is done to repair damage to a woman's ovaries, fallopian tubes, or uterus. Sometimes a man has an infertility problem that can be corrected by surgery.
- **Intrauterine insemination (IUI), also called artificial insemination**—Male sperm is injected into part of the woman's reproductive tract, such as into the uterus or fallopian tube. IUI often is used along with drugs that cause a woman to ovulate.
- **Assisted reproductive technology (ART)**—ART involves stimulating a woman's ovaries; removing eggs from her body; mixing them with sperm in the laboratory; and putting the embryos back into a woman's body. Success rates of ART vary and depend on many factors.
- **Third party assistance**—Options include donor eggs (eggs from another woman are used), donor sperm (sperm from another man are used), or surrogacy (when another woman carries a baby for you).

Finding the cause of infertility is often a long, complex, and emotional process. And treatment can be expensive. Many health insurance companies do not provide coverage for infertility or provide only limited coverage. Check your health insurance contract

carefully to learn about what is covered. Some states have laws that mandate health insurance policies to provide infertility coverage.

Birth Control Methods

Birth Control Methods: Reversible and Permanent

In the United States, **almost half of all pregnancies are unintended**. Yet, several safe and highly effective methods of contraception (birth control) are available to prevent unintended pregnancy. Since 2000, several new methods of birth control have become available in the United States, including

- the levonorgestrel-releasing intrauterine system,
- the hormonal contraceptive patch,
- the hormonal contraceptive ring,
- the hormonal implant, a 91-day regimen of oral contraceptives, two new barrier methods, and
- a new form of female sterilization.

Most women of reproductive age in the United States use birth control. Between 2006–2008, 99% of women who had ever had sexual intercourse had used at least one method of birth control; however, 7.3% of women who were currently at risk of unintended pregnancy were not using a contraceptive method. The **most popular method of birth control was the oral contraceptive pill**, used by 10.7 million women in the United States, followed by female sterilization, condoms, male sterilization, and other methods of birth control. Approximately **10% of women had ever used emergency contraception**.

Types of Birth Control

The effectiveness of birth control methods is critically important for reducing the risk of unintended pregnancy. Intrauterine contraception and the contraceptive implant remain effective for years once correctly in place. The effectiveness of hormonal, barrier, and fertility awareness-based methods depends on correct and consistent use. For each of these methods, a range of effectiveness estimates is provided; lower estimates are based on typical use and higher estimates are based on perfect use.

Reversible Methods of Birth Control

Intrauterine Contraception* Copper T intrauterine device (IUD) —An IUD is a small device that is shaped in the form of a “T.” Your doctor places it inside the uterus to prevent pregnancy. It can stay in your uterus for up to 10 years. This IUD is more than 99% effective at preventing pregnancy.

- **Levonorgestrel intrauterine system (IUS)**—The IUS is a small T-shaped device like the IUD. It is placed inside the uterus by a doctor. It releases a small amount of progestin each day to keep you from getting pregnant. The IUS stays in your uterus for up to 5 years. The IUS is more than 99% effective at preventing pregnancy.

Hormonal Methods

- **Implant**—The implant is a single, thin rod that is inserted under the skin of a woman’s upper arm. The rod contains a progestin that is released into the body over 3 years. It is 99% effective at preventing pregnancy.
- **Injection or “shot”**—Women get shots of the hormone progestin in the buttocks or arm every three months from their doctor. It is 94–99% effective at preventing pregnancy.
- **Combined oral contraceptives**—Also called “the pill,” combined oral contraceptives contain the hormones estrogen and progestin. It is prescribed by a doctor. A pill is taken at the same time each day. If you are older than 35 years and smoke, have a history of blood clots or breast cancer, your doctor may advise you not to take the pill. The pill is 91–99% effective at preventing pregnancy.
- **Progestin only pill**—Unlike the combined pill, the progestin-only pill (sometimes called the mini-pill) only has one hormone, progestin, instead of both estrogen and progestin. It is prescribed by a doctor. It is taken at the same time each day. It is a good option for women who can’t take estrogen. They are 91–99% effective at preventing pregnancy.
- **Patch**—This skin patch is worn on the lower abdomen, buttocks, or upper body (but not on the breasts). This method is prescribed by a doctor. It releases hormones progestin and estrogen into the bloodstream. You put on a new patch once a week for three weeks. During the fourth week, you do not wear a patch, so you can have a menstrual period. The patch is 91–99% effective at preventing pregnancy, but it appears to be less effective in women who weigh more than 198 pounds.

- **Hormonal vaginal contraceptive ring**—The ring releases the hormones progestin and estrogen. You place the ring inside your vagina. You wear the ring for three weeks, take it out for the week you have your period, and then put in a new ring. It is 91–99% effective at preventing pregnancy.
- **Emergency contraception**—Emergency contraception is NOT a regular method of birth control. Emergency contraception can be used after no birth control was used during sex, or if the birth control method failed, such as if a condom broke.
 - Women can take emergency contraceptive pills up to 5 days after unprotected sex, but the sooner the pills are taken, the better they will work. There are three different types of emergency contraceptive pills available in the United States. Some emergency contraceptive pills are available over the counter for women 17 years of age or older. If younger than 17 years, emergency contraceptive pills are available by prescription.
 - Another type of emergency contraception is having your doctor insert the Copper T IUD into your uterus within seven days of unprotected sex. This method is 99% effective at preventing pregnancy.

Barrier Methods

- **Male condom**—Worn by the man, a male condom keeps sperm from getting into a woman's body. Latex condoms, the most common type, help prevent pregnancy and HIV and other STDs as do the newer synthetic condoms. "Natural" or "lambskin" condoms also help prevent pregnancy, but may not provide protection against STDs, including HIV. Male condoms are 82–98% effective at preventing pregnancy. Condoms can only be used once. You can buy condoms, KY jelly, or water-based lubricants at a drug store. Do not use oil-based lubricants such as massage oils, baby oil, lotions, or petroleum jelly with latex condoms. They will weaken the condom, causing it to tear or break.
- **Female condom**—Worn by the woman, the female condom helps keep sperm from getting into her body. It is packaged with a lubricant and is available at drug stores. It can be inserted up to eight hours before sexual intercourse. Female condoms are 79–95% effective at preventing pregnancy, and also may help prevent STDs.
- **Diaphragm or cervical cap**—Each of these barrier methods are placed inside the vagina to cover the cervix to block sperm. The diaphragm is shaped like a shallow cup. The cervical cap is a thimble-shaped cup. Before sexual intercourse, you insert them with spermicide to block or kill sperm. The diaphragm is 84–94% effective at preventing pregnancy. Visit your doctor for a proper fitting because diaphragms and cervical caps come in different sizes.
- **Spermicides**—These products work by killing sperm and come in several forms—foam, gel, cream, film, suppository, or tablet. They are placed in the vagina no more than one hour before intercourse. You leave them in place at least six to eight hours after intercourse. You can use a spermicide in addition to a male condom, diaphragm, or cervical cap. Spermicides alone are about 72–82% effective at preventing pregnancy. They can be purchased at drug stores.

Fertility Awareness-Based Methods

- **Natural family planning or fertility awareness**—Understanding your monthly fertility pattern can help you plan to get pregnant or avoid getting pregnant. Your fertility pattern is the number of days in the month when you are fertile (able to get pregnant), days when you are infertile, and days when fertility is unlikely, but possible. If you have a regular menstrual cycle, you have about nine or more fertile days each month. If you do not want to get pregnant, you do not have sex on the days you are fertile, or you use a barrier method of birth control on those days. These fertility awareness-based methods are 75–96% effective at preventing pregnancy.

Permanent Methods of Birth Control

Contraceptive sterilization is a permanent, safe, and highly effective approach for birth control. These methods are meant for people who are sure that they do not desire a pregnancy in the future.

The following methods are more than 99% effective at preventing pregnancy.

- **Female Sterilization—Tubal ligation or "tying tubes"**—A woman can have her fallopian tubes tied (or closed) so that sperm and eggs cannot meet for fertilization. The procedure can be done in a hospital or in an outpatient surgical center. You can go home the same day of the surgery and resume your normal activities within a few days. This method is effective immediately.
- **Transcervical Sterilization**—A thin tube is used to thread a tiny device into each fallopian tube. It irritates the fallopian tubes and causes scar tissue to grow and permanently plug the tubes. It can take about three months for the scar tissue to grow, so use another form of birth control during this time. Return to your doctor for a test to see if scar tissue has fully blocked your fallopian tubes.

- **Male Sterilization—Vasectomy**—This operation is done to keep a man’s sperm from going to his penis, so his ejaculate never has any sperm in it that can fertilize an egg. The procedure is done at an outpatient surgical center. The man can go home the same day. Recovery time is less than one week. After the operation, a man visits his doctor for tests to count his sperm and to make sure the sperm count has dropped to zero; this takes about 12 weeks. Another form of birth control should be used until the man’s sperm count has dropped to zero.

Although most women and men who undergo contraceptive sterilization do not regret having had the procedure, the permanence of the method is an important consideration, as regret has been documented in studies. For example, the U.S. Collaborative Review of Sterilization (CREST) study found that women who were younger at the time of the procedure were more likely to experience regret.

An additional issue addressed by the CREST study was the question of whether women who underwent contraceptive sterilization developed a “post-tubal ligation syndrome” of menstrual abnormalities, something that had been debated for years. Results indicated that menstrual abnormalities were no more common among women who had undergone tubal sterilization than among women who had not.

When considering a vasectomy, it’s important to understand that failures can occur. CDC research has estimated there is a probability of 11 failures per 1,000 procedures over 2 years; half of the failures occurred in the first three months after the vasectomy, and no failures occurred after 72 weeks. CDC research also examined regret among women whose partner underwent a vasectomy. In interviews with female partners of men who received vasectomies, CDC found that while most women did not regret their husband’s vasectomies, the probability of regret over 5 years was about 6%. This is why it is important to know facts about this and other permanent forms of birth control before making a decision.

Sources

Reproductive Health: [Reproductive Health, Medline Plus, NLM, NIH, http://www.nlm.nih.gov/medlineplus/reproductivehealth.html](http://www.nlm.nih.gov/medlineplus/reproductivehealth.html)

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CHAPTER OVERVIEW

14: Sexually Transmitted Diseases/Infections (STDs/STIs)

By Althea Moser

Learning Objectives

- Define STDs, explain how they are transmitted, and identify the most common STDs/STIs
- Identify the incidence, prevalence, and cost of STIs in the United States
- Learn prevention techniques and treatment options
- Develop a personal plan for STI prevention

[14.1: What are STDs?](#)

[14.2: What are the Most Common Types of STIs?](#)

[14.3: Prevention Techniques for STIs/STDs](#)

[14.4: What is the Incidence, Prevalence, and Cost of STIs?](#)

[14.5: STI Treatment Options-](#)

[14.6: Developing a Personal Plan for STI Prevention](#)

[14.7: Helpful Resources](#)

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14.1: What are STDs?

The following information about STDs is published by the Office of Disease Prevention and Health Promotion on the website Healthy People.gov., and is found on the page “[Sexually Transmitted Diseases](#)”:

STDs refer to more than 25 infectious organisms that are transmitted primarily through sexual activity. STD prevention is an essential primary care strategy for improving reproductive health.¹

Despite their burdens, costs, and complications, and the fact that they are largely preventable, STDs remain a significant public health problem in the United States. This problem is largely unrecognized by the public, policymakers, and health care professionals. STDs cause many harmful, often irreversible, and costly clinical complications, such as:

- Reproductive health problems
- Fetal and perinatal health problems
- Cancer
- Facilitation of the sexual transmission of HIV infection²

How are STDs Transmitted?

Ejaculation does not have to occur for an STD/STI to be passed from person to person. Sharing contaminated needles used to inject drugs or using contaminated body piercing and tattooing equipment also can transmit some infections, such as HIV or hepatitis B and C

Anyone who has had or is having sexual intercourse or oral sex, or who has participated or is participating in sex play, is at risk for acquiring an STD/STI

Fortunately, it is possible for a person to decrease his or her risk by having protected sex and knowing his or her STD/STI status and that of his or her partner.

Still, the Centers for Disease Control and Prevention (CDC) estimates nearly 20 million new cases of these reportable STDs/STIs (gonorrhea, chlamydia, syphilis) occur each year in the United States— almost half of them among young people 15 to 24 years of age.¹

While not the most common STD/STI, HIV/AIDS is one of the most devastating and most well known. Recent data from the CDC indicate that 1.1 million Americans have HIV²:

- One in five is unaware that they have the virus.
- Approximately 50,000 Americans become infected with HIV each year.
- 15,529 people with AIDS died in 2010.

Click on the following link to learn more about reported STDs in the United States:

[CDC Fact Sheet](#)

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14.2: What are the Most Common Types of STIs?

The following information about the most common STIs is published by the US Department of Health and Human Services and found on the NIH's website on the page "[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

Chlamydia¹ (pronounced *kla-MID-ee-uh*) 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

Gonorrhea² (pronounced *gon-uh-REE-uh*) 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.³

Genital Herpes

Genital herpes⁴ 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-2.⁵ 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.⁶

HIV/AIDS

HIV, or the human immunodeficiency virus,⁷ 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, the body's ability to fight off and recover from infections is compromised. This advanced stage of HIV infection is known as AIDS.

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)

HPV⁸ 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.⁹

Syphilis

Syphilis¹⁰ 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.¹⁰ 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.³ 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 vaginosis¹¹ 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

Trichomoniasis¹² (pronounced *trik-uh-muh- NAHY-uh-sis*) 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.

NICHHD-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.¹³

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.¹³
- 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.¹
- 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.¹⁵ [2]

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14.3: Prevention Techniques for STIs/STDs

Click on the following link to learn how to prevent STIs:

[How You Can Prevent STDs](#)

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14.4: What is the Incidence, Prevalence, and Cost of STIs?

2021 The Center for Disease Control (CDC) analyses^{1,2} provide the clearest picture to date of how common and costly sexually transmitted infections (STIs) are in the United States. CDC's latest estimates indicate that 20% of the U.S. population – approximately one in five people – had an STI on any given day in 2018, and STIs acquired that year cost the American healthcare system nearly \$16 billion in direct medical costs alone.

CDC's analyses included eight common STIs, four of which are easily treated and cured if diagnosed early: chlamydia, gonorrhea, syphilis, and trichomoniasis. Also included in the analyses are four sexually transmitted viruses: human papillomavirus (HPV), herpes simplex virus type 2 (HSV-2), human immunodeficiency virus (HIV), and hepatitis B virus (HBV). Many of these infections go undetected because they often have no symptoms and can have [serious health consequences](#).

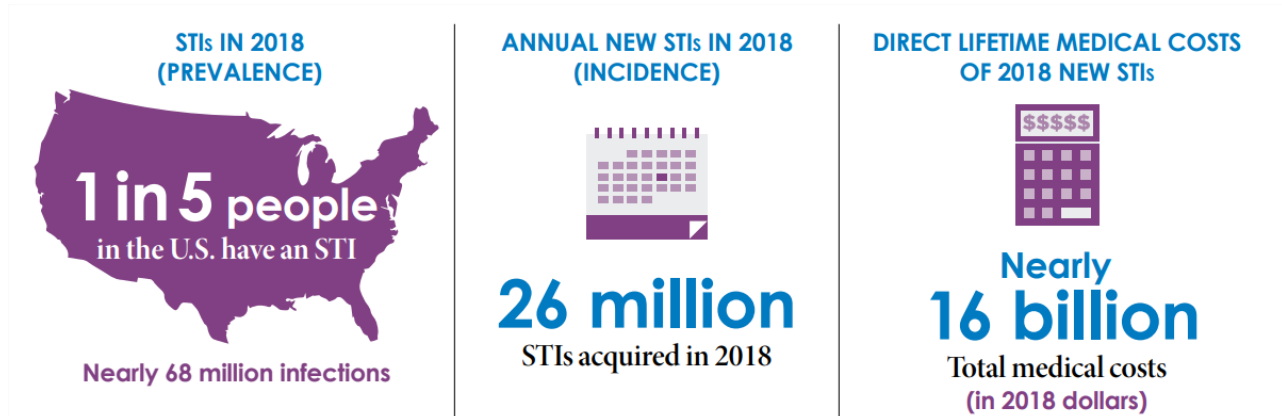


Figure 1: STIs remain common and costly to the nation's health. (Public Domain; CDC)

Fighting STIs: prevention, diagnosis, and prompt treatment

Because STIs are preventable, significant reductions in new infections are not only possible, they are urgently needed. Prevention can minimize the negative, long-term consequences of STIs and reduce healthcare costs. To do this, prevention efforts should:

- Focus on hard-hit populations. Young people and women face some of the biggest impacts and most significant consequences of STIs.
- Consider the social, cultural & economic conditions that make it more difficult for some sexually active people to stay healthy (e.g., poverty, unstable housing, drug use, lack of medical insurance or medical home, high burden of STIs in some communities).

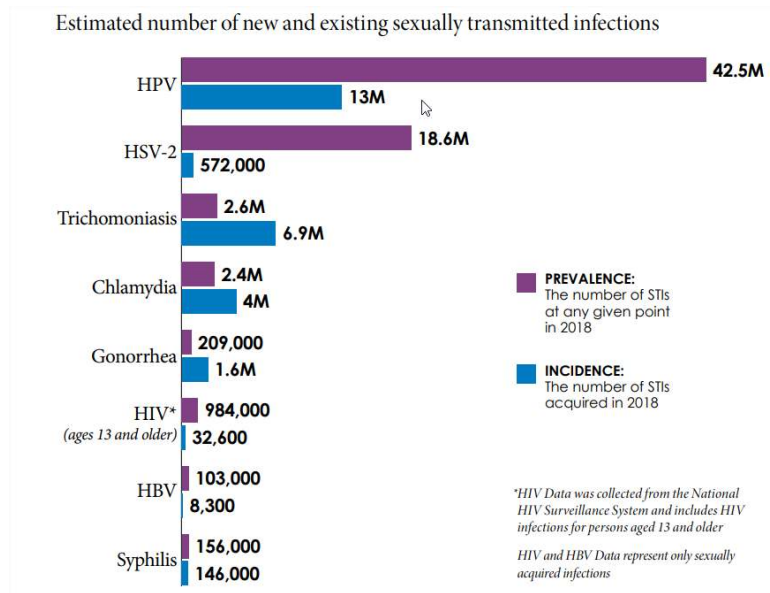


Figure 2: Estimated number of new and existing sexually transmitted infections. (Public Domain; CDC)

[More information on STD prevention is available here.](#)

For all individuals who are sexually active – particularly young people and women – STI screening and prompt treatment (if infected) are critical to protect a person’s health and prevent transmission to others. If you are sexually active, be sure to talk to your healthcare provider about STI testing and which tests may be right for you.

While medical costs alone are significant, the overall cost of STIs is higher when factoring in costs associated with lost productivity, other non-medical costs and STI prevention.

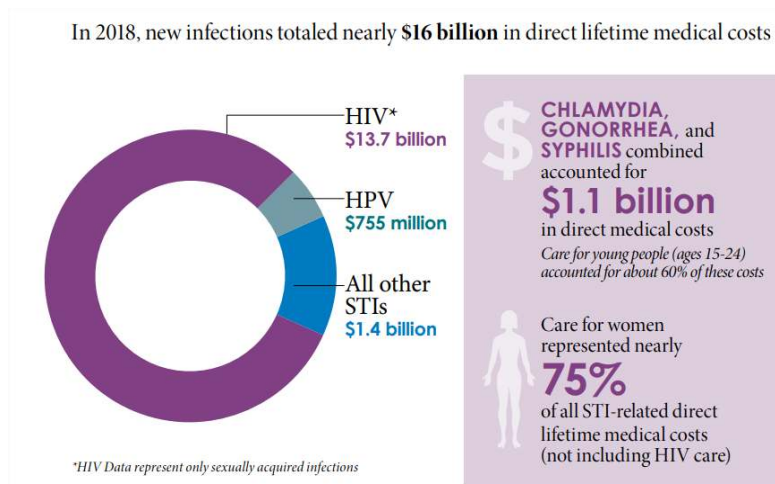


Figure 3: STIs cost the U.S. Healthcare system Billions each year. (Public Domain; CDC)

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Contributors

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14.5: STI Treatment Options-

The following information about the most common STIs is published by the US Department of Health and Human Services and found on the NIH's website on the page "[What are the treatments for sexually transmitted diseases and sexually transmitted infections \(STDs/STIs\)?](#)":

STDs/STIs caused by bacteria, yeast, or parasites can be treated with antibiotics. These antibiotics are most often given by mouth (orally). However, sometimes they are injected or applied directly to the affected area. Whatever the infection, and regardless of how quickly the symptoms resolve after beginning treatment, the infected person must take all of the medicine prescribed by the health care provider to ensure that the STD/STI is completely treated.

Although treatments, complications, and outcomes vary among viral STDs/STIs depending on the particular virus (HIV, genital herpes, human papillomavirus, hepatitis, or cytomegalovirus), health care providers can provide treatments to reduce the symptoms and the progression of most of these illnesses. For example, medications are available to limit the frequency and severity of genital herpes outbreaks while reducing the risk that the virus will be passed on to other people.

Individuals with HIV need to take special antiretroviral drugs that control the amount of virus they carry. These drugs, called *highly active antiretroviral therapy*, or HAART,¹ can help people live longer, healthier lives. If a woman with HIV becomes pregnant, these medicines also can reduce the chance that her fetus or infant will get the infection.

Being tested and treated for STDs/STIs is especially important for pregnant women because some STDs/STIs may be passed on to their infants during pregnancy or delivery. Testing women for these STDs/STIs early in their pregnancy is important, so that steps can be taken to help ensure delivery of a healthy infant. The necessary treatment will depend on the type of STD/STI involved.

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14.6: Developing a Personal Plan for STI Prevention

Complete the following lab to develop a personal plan for STI prevention. Submit the Lab per your Instructor's directions.

[Plan for Change: Preventing STIs](#)

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14.7: Helpful Resources

If you are a student contact the Student Support Services at your institution, for example, the author's of this book at Georgia Highlands College suggest that their students contact [GHC's Student Support Services](#)

[How to Get Tested](#)

Departments of Public Health in your state or city offer important help for example the [Georgia Department of Public Health](#)

[Lesbian and Bisexual Health](#)

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CHAPTER OVERVIEW

15: Environmental Health

Environmental health is the branch of public health that is concerned with all aspects of the natural and built environment that may affect human health. Health is the science, practice, and study of a human's well-being and their health and preventing illnesses and human injuries. Other terms referring to or concerning environmental health are environmental public health, and public health protection/environmental health protection.

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Thumbnail: Runoff of soil and fertilizer during a rain storm. (Public Domain; [Natural Resources Conservation Service](#), part of the [United States Department of Agriculture](#)).

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15.1: Intro to Environmental Health

Environmental health is the branch of public health that is concerned with all aspects of the natural and built environment that may affect human health. Health is the science, practice, and study of a human's well-being and their health and preventing illnesses and human injuries. Other terms referring to or concerning environmental health are environmental public health, and public health protection/environmental health protection. Environmental health and environmental protection are very much related. Environmental health is focused on the natural and built environments for the benefit of human health, whereas environmental protection is concerned with protecting the natural environment for the benefit of human health and the ecosystem. Research in the environmental health field tries to limit the harmful exposures through natural things such as soil, water, air food, etc.

The natural environment encompasses all living and non-living things occurring naturally, meaning in this case not artificial. The term is most often applied to the Earth or some parts of Earth. This environment encompasses the interaction of all living species, climate, weather, and natural resources that affect human survival and economic activity. The concept of the natural environment can be distinguished as components:

- Complete ecological units that function as natural systems without massive civilized human intervention, including all vegetation, microorganisms, soil, rocks, atmosphere, and natural phenomena that occur within their boundaries and their nature
- Universal natural resources and physical phenomena that lack clear-cut boundaries, such as air, water, and climate, as well as energy, radiation, electric charge, and magnetism, not originating from civilized human activity

In contrast to the natural environment is the built environment. In such areas where man has fundamentally transformed landscapes such as urban settings and agricultural land conversion, the natural environment is greatly modified into a simplified human environment. Even acts which seem less extreme, such as building a mud hut or a photovoltaic system in the desert, modify the natural environment into an artificial one. Though many animals build things to provide a better environment for themselves, they are not human, hence beaver dams and the works of Mound-building termites are thought of as natural.

People seldom find absolutely natural environments on Earth, and naturalness usually varies in a continuum, from 100% natural in one extreme to 0% natural in the other. More precisely, we can consider the different aspects or components of an environment, and see that their degree of naturalness is not uniform. If, for instance, in an agricultural field, the mineralogic composition and the structure of its soil are similar to those of an undisturbed forest soil, but the structure is quite different.

The carrying capacity of a biological species in an environment is the maximum population size of the species that the environment can sustain indefinitely, given the food, habitat, water, and other necessities available in the environment. In population biology, carrying capacity is defined as the environment's maximal load, which is different from the concept of population equilibrium. Its effect on population dynamics may be approximated in a logistic model, although this simplification ignores the possibility of overshoot which real systems may exhibit.

Carrying capacity was originally used to determine the number of animals that could graze on a segment of land without destroying it. Later, the idea was expanded to more complex populations, like humans. For the human population, more complex variables such as sanitation and medical care are sometimes considered as part of the necessary establishment. As population density increases, birth rate often decreases and death rate typically increases. The difference between the birth rate and the death rate is the "natural increase". The carrying capacity could support a positive natural increase or could require a negative natural increase. Thus, the carrying capacity is the number of individuals an environment can support without significant negative impacts to the given organism and its environment. Below carrying capacity, populations typically increase, while above, they typically decrease. A factor that keeps population size at equilibrium is known as a regulating factor. Population size decreases above carrying capacity due to a range of factors depending on the species concerned, but can include insufficient space, food supply, or sunlight. The carrying capacity of an environment may vary for different species and may change over time due to a variety of factors including: food availability, water supply, environmental conditions and living space. The origins of the term "carrying capacity" are uncertain, with researchers variously stating that it was used "in the context of international shipping" or that it was first used during 19th-century laboratory experiments with micro-organisms. A recent review finds the first use of the term in an 1845 report by the US Secretary of State to the US Senate.

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15.2: Overpopulation

Human overpopulation occurs when the *ecological footprint* of a human population in a specific geographical location exceeds the *carrying capacity* of the place occupied by that group. Overpopulation can further be viewed, in a long term perspective, as existing when a population cannot be maintained given the rapid depletion of *non-renewable resources* or given the degradation of the capacity of the environment to give support to the population.

The term *human overpopulation* refers to the relationship between the entire human population and its environment: the Earth, or to smaller geographical areas such as countries. Overpopulation can result from an increase in births, a decline in mortality rates, an increase in immigration, or an unsustainable biome and depletion of resources. It is possible for very sparsely populated areas to be overpopulated if the area has a nonexistent capability to sustain life (e.g. a desert). Advocates of population moderation cite issues like quality of life, carrying capacity and risk of starvation as a basis to argue against continuing high human population growth and for population decline. Scientists suggest that the human impact on the environment as a result of overpopulation, profligate consumption and proliferation of technology has pushed the planet into a new geological epoch known as the Anthropocene.

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15.3: Air Pollution

Air pollution occurs when harmful substances including particulates and biological molecules are introduced into Earth's atmosphere. It may cause diseases, allergies or death of humans; it may also cause harm to other living organisms such as animals and food crops, and may damage the natural or built environment. Human activity and natural processes can both generate air pollution.

Indoor air pollution and poor urban air quality are listed as two of the world's worst toxic pollution problems in the 2008 Blacksmith Institute World's Worst Polluted Places report. According to the 2014 World Health Organization report, air pollution in 2012 caused the deaths of around 7 million people worldwide, an estimate roughly matched by the International Energy Agency.

An air quality index (AQI) is a number used by government agencies to communicate to the public how polluted the air currently is or how polluted it is forecast to become. As the AQI increases, an increasingly large percentage of the population is likely to experience increasingly severe adverse health effects. Different countries have their own air quality indices, corresponding to different national air quality standards. Some of these are the Air Quality Health Index (Canada), the Air Pollution Index (Malaysia), and the Pollutant Standards Index (Singapore).

Indoor air quality (IAQ) is a term that refers to the air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants. IAQ can be affected by gases (including carbon monoxide, radon, volatile organic compounds), particulates, microbial contaminants (mold, bacteria), or any mass or energy stressor that can induce adverse health conditions. Source control, filtration and the use of ventilation to dilute contaminants are the primary methods for improving indoor air quality in most buildings. Residential units can further improve indoor air quality by routine cleaning of carpets and area rugs.

Determination of IAQ involves the collection of air samples, monitoring human exposure to pollutants, collection of samples on building surfaces, and computer modelling of air flow inside buildings.

IAQ is part of indoor environmental quality (IEQ), which includes IAQ as well as other physical and psychological aspects of life indoors (e.g., lighting, visual quality, acoustics, and thermal comfort). Indoor air pollution in developing nations is a major health hazard. A major source of indoor air pollution in developing countries is the burning of biomass (e.g. wood, charcoal, dung, or crop residue) for heating and cooking. The resulting exposure to high levels of particulate matter resulted in between 1.5 million and 2 million deaths in 2000.

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15.4: Climate Change

Climate change is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time (i.e., decades to millions of years). Climate change may refer to a change in average weather conditions, or in the time variation of weather within the context of longer-term average conditions. Climate change is caused by factors such as biotic processes, variations in solar radiation received by Earth, plate tectonics, and volcanic eruptions. Certain human activities have been identified as primary causes of ongoing climate change, often referred to as **global warming**.

Global warming is the observed century-scale rise in the average temperature of the Earth's climate system and its related effects. Multiple lines of scientific evidence show that the climate system is warming. Many of the observed changes since the 1950s are unprecedented in the instrumental temperature record which extends back to the mid-19th century, and in paleoclimate proxy records covering thousands of years.

In 2013, the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report concluded that "It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century." The largest human influence has been the emission of greenhouse gases such as carbon dioxide, methane and nitrous oxide. Climate model projections summarized in the report indicated that during the 21st century, the global surface temperature is likely to rise a further 0.3 to 1.7 °C (0.5 to 3.1 °F) in the lowest emissions scenario, and 2.6 to 4.8 °C (4.7 to 8.6 °F) in the highest emissions scenario. These findings have been recognized by the national science academies of the major industrialized nations and are not disputed by any scientific body of national or international standing.

Future climate change and associated impacts will differ from region to region around the globe. Anticipated effects include increasing global temperatures, rising sea levels, changing precipitation, and expansion of deserts in the subtropics. Warming is expected to be greater over land than over the oceans and greatest in the Arctic, with the continuing retreat of glaciers, permafrost and sea ice. Other likely changes include more frequent extreme weather events such as heat waves, droughts, heavy rainfall with floods and heavy snowfall; ocean acidification; and species extinction due to shifting temperature regimes. Effects significant to humans include the threat to food security from decreasing crop yields and the abandonment of populated areas due to rising sea levels. Because the climate system has a large "inertia" and greenhouse gases will remain in the atmosphere for a long time, many of these effects will persist for not only decades or centuries, but for tens of thousands of years to come.

Possible societal responses to global warming include mitigation by emissions reduction, adaptation to its effects, building systems resilient to its effects, and possible future climate engineering. Most countries are parties to the United Nations Framework Convention on Climate Change (UNFCCC), whose ultimate objective is to prevent dangerous anthropogenic climate change. Parties to the UNFCCC have agreed that deep cuts in emissions are required and that global warming should be limited to well below 2.0 °C (3.6 °F) compared to pre-industrial levels, with efforts made to limit warming to 1.5 °C (2.7 °F).

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15.5: Water

Drought is a natural phenomenon during which regions or communities experience shifts in the balance between *precipitation* and *evapotranspiration* (the processes of evaporation and transpiration)—a balance that is inherent to the earth's water cycle (see the Understanding Natural Cycles in Water Distribution section). Several factors affect the impact of drought on humans and other life forms, including the timing of precipitation events, effectiveness of the rain that is falling (i.e., rainfall intensity and the number of rain events), characteristics of the built environment in the affected area, and local demand for water. Individual areas or communities can be affected differently by drought depending on several additional variables, including:

- the structure and capacity of existing water systems,
- economic development,
- the at-risk populations living within the affected area,
- local governance of water use, and
- other societal factors, such as the presence of local social networks.

Because the conditions that signify drought can vary substantially by U.S. region and locality, drought should ultimately be defined based on the context and location in which the water shortage is occurring.

Although drought most commonly is defined climatologically, drought can also be exacerbated by human activities. For example, even when precipitation is occurring at average rates within a specific area, urban expansion and development without regard to existing water supply and water system capacity can trigger a human-induced drought. Drought can occur anywhere in the world, and it is considered a transient environmental hazard except in arid geographical regions that historically receive very limited amounts of rainfall. In addition, because of the substantial amount of time that elapses between the warning signs of drought and any measurable negative consequences to human and environmental health, drought should be considered a chronic or “low rise” natural event rather than an acute emergency for public health preparedness and response purposes. Drought is unlike other natural emergencies such as hurricanes, floods, or earthquakes; drought-related conditions can take years to escalate to the point at which water supply becomes severely limited, and the length of time that drought conditions may persist and impact communities is unknown.

Water Recycling and Reuse

Because freshwater is only a minimal percentage of the total global water supply and water treatment and distribution are costly, water should be considered a scarce and valuable resource. Many groups are advocating new approaches to water use and distribution. For example, the U.S. Green Building Council has proposed that traditional water distribution systems could be modified to limit the distribution of potable water and that parallel systems be developed to enable the collection and redistribution of gray water. Some municipalities have installed distribution systems that encourage households and commercial operations to use recycled water in lieu of treated freshwater for specific applications (e.g., irrigation), thus conserving the freshwater that is available within their watersheds. However, this is an expensive option because it requires the establishment of separate piping systems for the recycled water. Alternative methods for using rainwater also are being developed. For example, buildings are increasingly being engineered with the capability to collect and use rainwater for non-potable applications (such as for flushing toilets and landscape irrigation).

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15.6: Waste Management

Waste management or waste disposal are all the activities and actions required to manage waste from its inception to its final disposal. This includes amongst other things collection, transport, treatment and disposal of waste together with monitoring and regulation. It also encompasses the legal and regulatory framework that relates to waste management encompassing guidance on recycling.

The term normally relates to all kinds of waste, whether generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, or other human activities, including municipal (residential, institutional, commercial), agricultural, and social (health care, household hazardous waste, sewage sludge). Waste management is intended to reduce adverse effects of waste on health, the environment or aesthetics.

Waste management practices are not uniform among countries (developed and developing nations); regions (urban and rural area), and sectors (residential and industrial).

Waste Hierarchy

The waste hierarchy refers to the "3 Rs" reduce, reuse and recycle, which classify waste management strategies according to their desirability in terms of waste minimization. The waste hierarchy remains the cornerstone of most waste minimization strategies. The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of waste; see: resource recovery. The waste hierarchy is represented as a pyramid because the basic premise is for policy to take action first and prevent the generation of waste. The next step or preferred action is to reduce the generation of waste i.e. by re-use. The next is recycling which would include composting. Following this step is material recovery and waste-to-energy. Energy can be recovered from processes i.e. landfill and combustion, at this level of the hierarchy. The final action is disposal, in landfills or through incineration without energy recovery. This last step is the final resort for waste which has not been prevented, diverted or recovered. The waste hierarchy represents the progression of a product or material through the sequential stages of the pyramid of waste management. The hierarchy represents the latter parts of the life-cycle for each product.

Noise Pollution

Noise pollution is the disturbing noise with harmful impact on the activity of human or animal life. The source of outdoor noise worldwide is mainly caused by machines and transportation systems, motor vehicles engines and trains. Outdoor noise is summarized by the word environmental noise. Poor urban planning may give rise to noise pollution, side-by-side industrial and residential buildings can result in noise pollution in the residential areas. Documented problems associated with urban environment noise go back as far as Ancient Rome. Noise from roadways and other urban factors can be mitigated by urban planning and better design of roads.

Outdoor noise can be caused by machines, construction activities, and music performances, especially in some workplaces. Noise-induced hearing loss can be caused by outside (e.g. trains) or inside (e.g. music) noise. High noise levels can contribute to cardiovascular effects in humans and an increased incidence of coronary artery disease. In animals, noise can increase the risk of death by altering predator or prey detection and avoidance, interfere with reproduction and navigation, and contribute to permanent hearing loss.

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