KINESIOLOGY 104: FITNESS AND WELLNESS

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Kinesiology 104

Fitness and Wellness

Remixed by Jennifer O'Connor

Cerritos College

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1: AN INTRODUCTION TO HEALTH AND WELLNESS

Do you exercise? Are you trying to get back into a workout routine or start one for the first time? What is exercise and how is that different from physical activity and wellness? How do we determine if someone is healthy or not? What does the word healthy mean? Have you attempted to set a New Year's resolution before regarding your health or set a goal? How did it go? Were you successful in your goal(s)? Welcome to Fitness and Wellness! As you read through this book, you will be taken on a learning journey that will continually ask you to reflect on your own life, your health, your wellness, your choices, and your behaviors. Fitness and wellness is a topic that impacts all of us, thus this learning journey is personal to you and your life experiences.

In this chapter, we are going to look at health and wellness.

1.1: What Does Health and Wellness Mean?

How have you used the words health and wellness? Do you use them interchangeably? Do you think there is a difference? How would you define these terms?

The World Health Organization (WHO) defines health as, “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (illness)” and defines wellness as, “the optimal state of health of individuals and groups,” which may be expressed as “a positive approach to living.” The National Wellness Institute explains wellness as, “an active process through which people become aware of, and make choices toward, a more successful existence.”

The National Wellness Institute states that there is general agreement that: 1. Wellness is considered a conscious, self-directed, and evolving process of achieving full potential.

2. Wellness is multidimensional and holistic, encompassing lifestyle, mental and spiritual well-being, and the environment.

3. Wellness is positive and affirming.

The primary difference between health and wellness is that health is your state of being or a goal to achieve and wellness is the active process of achieving it through growth and change. Through wellness we hope to reach our fullest potential of health and well-being.

The Nine Dimensions of Wellness

Both health and wellness are very broad terms. To help identify ways we can grow and change to reach our optimal health, it is helpful to view wellness in terms of the Nine Dimensions of Wellness. The Nine Dimensions of Wellness can help to identify ways you can make wellness a part of your everyday life.

The Nine Dimensions of Wellness include: Physical, Emotional, Social, Environmental, Financial, Intellectual, Occupational, Spiritual, and Cultural. These dimensions of wellness are not isolated, but rather are interconnected. Problems or challenges in one dimension can impact the other, while the opposite can also be true, that by improving your health and wellness in one area can help to improve other dimensions. For example, your emotional wellness can be positively impacted through exercise (physical wellness) but negatively impacted by financial struggles that often lead to high stress.

Physical Wellness

People who are focused on improving their physical health recognize the need for regular physical activity, they choose to eat healthy foods, to go to the doctor, and to get adequate sleep. People who are physically well actively make healthy decisions on a daily basis. This may include making a habit of exercising three to five times per week or recording their dietary intake to ensure they are receiving proper nutrition for optimal health.

How would you rate your physical wellness and what behaviors could you change, or actions could you take, to positively improve your physical wellness?

Emotional Wellness

Coping effectively with life and expressing emotions in an appropriate manner are keys to 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.

How would you rate your emotional wellness and what behaviors could you change, or actions could you take, to positively improve your emotional wellness?

Social Wellness

People who are focused on their social wellness are striving for positive relationships, developing a sense of connection, belonging, and sustained support system. 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.

How would you rate your social wellness and what behaviors could you change, or actions could you take, to positively improve your social wellness?

Environmental Wellness

Environmental wellness includes a desire to positively impact our planet Earth and also our local community by striving to occupy pleasant, healthy, and safe environments that support well-being and positively impact the quality of our surroundings (including protecting and preserving nature). 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.

How would you rate your environmental wellness and what behaviors could you change, or actions could you take, to positively improve your environmental wellness?

Financial Wellness

Financial wellness refers to achieving satisfaction with current and future financial situations by handling finances wisely. 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 financial goals.

How would you rate your financial wellness and what behaviors could you change, or actions could you take, to positively improve your financial wellness?

Intellectual Wellness

Intellectual wellness includes being open-minded, recognizing creative abilities, and/or finding ways to expand knowledge and skills. 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.

How would you rate your intellectual wellness and what behaviors could you change, or actions could you take, to positively improve your intellectual wellness?

Occupational Wellness

Occupational wellness refers to personal fulfillment and enrichment from one's work and/or responsibilities. 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.

How would you rate your occupational wellness and what behaviors could you change, or actions could you take, to positively improve your occupational wellness?

Spiritual Wellness

Spiritual wellness refers to having a sense of purpose and meaning in life, this may come from establishing peace, harmony, and balance in our lives. 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.

How would you rate your spiritual wellness and what behaviors could you change, or actions could you take, to positively improve your spiritual wellness?

Cultural Wellness

Cultural wellness refers to the way you interact with others who are different from you. This includes understanding and celebrating our differences. 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

How would you rate your cultural wellness and what behaviors could you change, or actions could you take, to positively improve your cultural wellness?

1.2: ASSESSING HEALTH AND WELLNESS PRACTICES

How long would you like to live? What would you like to be able to do throughout life, especially into your later years? Striving for health by implementing wellness practices will impact both your quantity and quality of life.

Life Expectancy and Leading Causes of Death in the United States

Life Expectancy

Life expectancy is often used as a measurement of overall health of a population. Life expectancy at birth represents the average number of years that a group of infants would live if the group were to experience age-specific death rates present in the year of birth. Differences in life expectancy among various demographic subpopulations, including racial and ethnic groups, may reflect differences in a range of factors such as socioeconomic status, access to medical care, and the prevalence of specific risk factors in a particular subpopulation.

Life expectancy is increasing. Did you know that those born in 1900 had a life expectancy of 47.3 years? In 2000, average Americans lived to 76.8 years old. Life expectancy almost doubled in just one century.

During 1975-2015, life expectancy at birth in the United States (U.S.) increased from 68.8 to 76.3 years for males and from 76.6 to 81.2 years for females. During this

period, life expectancy at birth for males and females was longer for white persons than for black persons. Racial disparities in life expectancy at birth persisted for both males and females in 2015, but continued to narrow.

Leading Cause of Death

What health goals were achieved that lead to almost doubling the life expectancy in one century? What actions took place?

In order to answer these questions, we need to take a deeper look at what the leading cause of death was in the 1900s and in 2000. The leading cause of death in the early 1900s was infectious diseases and currently the leading cause of death is Cardiovascular Disease and Cancer. So what changed in over a century of time? In the 1900s, worldwide, there were several actions that were implemented to reduce death from infectious diseases. These actions included increased access to clean drinking water, development of medications, development and implementation of vaccines, and increased workplace safety. People began to wear hard hats at the workplace and the use of a seatbelt when in a vehicle.

Across the entire U.S. population from 1975 to the present, Cardiovascular Disease and Cancer are the top two causes of death; however, variation exists for age and ethnicities. For example, until age 44 the leading cause of death is unintentional injuries, then between 45-64 the leading cause of death is Cancer followed by Cardiovascular Disease, and beginning at age 65 Cardiovascular Disease takes the number one rank.

Later in this chapter we will learn how there are various factors that lead to the increase of Cardiovascular Disease and Cancer in our population today.

1.2.1: Healthy People

We want people to be healthy. A healthy population is a nation's greatest resource. It means a productive population, a prosperous population, and a healthy economy. Your individual commitment to striving for personal wellness may contribute to our national goals for a healthy population!

The U.S. Department of Health and Human Services has published healthy goals for our U.S population called the Healthy People initiative every decade since 1980. The Healthy People initiative is designed to guide national health promotion and disease prevention efforts to improve the health of the nation.

Determinants of Health

What makes some people healthy and others unhealthy? How can we create a society in which everyone has a chance to live a long, healthy life? To answer these questions, we need to dive deeper into the determinants of health.

Determinants of health are factors that contribute to a person's current state of health. These factors may be biological, socioeconomic, psychosocial, behavioral, or social in nature. Scientists generally recognize five determinants of health of a population.

Healthy People 2020 is exploring these questions by:

- Developing objectives that address the relationship between health status and biology, individual behavior, health services, social factors, and policies. ● Emphasizing an ecological approach to disease prevention and health promotion. An ecological approach focuses on both individual-level and population-level determinants of health and interventions.
- Genes and biology: for example, sex and age
- Health behaviors: for example, alcohol use, injection drug use (needles), unprotected sex, and smoking
- Social environment or social characteristics: for example, discrimination, income, and gender
- Physical environment or total ecology: for example, where a person lives and crowding conditions
- Health services or medical care: for example, access to quality health care and having or not having insurance
- Other factors that could be included are culture, social status, and healthy child development

The Broad Categories of Determinants of Health

The determinants of health can be divided into the following five broad categories: policymaking, social factors, health services, individual behavior, and biology and genetics.

Policymaking

Policies at the local, state, and federal level affect individual and population health. Increasing taxes on tobacco sales, for example, can improve population health by reducing the number of people using tobacco products.

Some policies affect entire populations over extended periods of time while simultaneously helping to change individual behavior. For example, the 1966 Highway Safety Act and the National Traffic and Motor Vehicle Safety Act authorized the Federal Government to set and regulate standards for motor vehicles and highways. This led to an increase in safety standards for cars, including seat belts, which in turn reduced rates of injuries and deaths from motor vehicle accidents. We also saw that as a factor in increasing life expectancy that we learned about in the section above.

Social Factors

Social determinants of health reflect the social factors and physical conditions of the environment in which people are born, live, learn, play, work, and age. Also known as social and physical determinants of health, they impact a wide range of health, functioning, and quality-of-life outcomes.

Examples of social determinants include:

- Availability of resources to meet daily needs, such as educational and job opportunities, living wages, or healthful foods
- Social norms and attitudes, such as discrimination
- Exposure to crime, violence, and social disorder, such as the presence of trash
- Social support and social interactions
- Exposure to mass media and emerging technologies, such as the Internet or cell phones
- Socioeconomic conditions, such as concentrated poverty
- Quality schools
- Transportation options
- Public safety
- Residential segregation

Examples of physical determinants include:

- Natural environment, such as plants, weather, or climate change
- Built environment, such as buildings or transportation
- Worksites, schools, and recreational settings
- Housing, homes, and neighborhoods
- Exposure to toxic substances and other physical hazards
- Physical barriers, especially for people with disabilities
- Aesthetic elements, such as good lighting, trees, or benches

Poor health outcomes are often made worse by the interaction between individuals and their social and physical environment. For example, millions of people in the U.S. live in places that have unhealthy levels of ozone or other air pollutants. In counties where ozone pollution is high, there is often a higher prevalence of asthma in both adults and children compared with state and national averages. Poor air quality can worsen asthma symptoms, especially in children.

Health Services

Both access to health services and the quality of health services can impact health. Healthy People 2020 directly addresses access to health services as a topic area and incorporates quality of health services throughout a number of topic areas.

Lack of access, or limited access, to health services greatly impacts an individual's health status. For example, when individuals do not have health insurance, they are less likely to participate in preventive care and are more likely to delay medical treatment.

Barriers to accessing health services include:

- Lack of availability
- High cost
- Lack of insurance coverage
- Limited language access

These barriers to accessing health services lead to:

- Unmet health needs
- Delays in receiving appropriate care
- Inability to get preventive services
- Hospitalizations that could have been prevented

Individual Behavior

Individual behavior also plays a role in health outcomes. For example, if an individual quits smoking, his or her risk of developing heart disease is greatly reduced. Many public health and health care interventions focus on changing individual behaviors such as substance abuse, diet, and physical activity. Positive changes in individual behavior can reduce the rates of chronic disease in this country.

Examples of individual behavior determinants of health include:

- Diet
- Physical activity
- Alcohol, cigarette, and other drug use
- Hand washing

Biology and Genetics

Some biological and genetic factors affect specific populations more than others. For example, older adults are biologically prone to being in poorer health than adolescents due to the physical and cognitive effects of aging.

Sickle cell disease is a common example of a genetic determinant of health. Sickle cell is a condition that people inherit when both parents carry the gene for sickle cell. The gene is most common in people with ancestors from West African countries, Mediterranean countries, South or Central American countries, Caribbean islands, India, and Saudi Arabia.

Examples of biological and genetic social determinants of health include:

- Age
- Sex
- HIV status
- Inherited conditions, such as sickle-cell anemia, hemophilia, and cystic fibrosis
- Carrying the BRCA1 (Breast Cancer Gene 1) or BRCA2 (Breast Cancer Gene 2) gene, which increases risk for breast and ovarian cancer
- Family history of heart disease

Health Disparities

Although the term disparities is often interpreted to mean racial or ethnic disparities, many dimensions of disparity exist in the U.S., particularly in health. If a health outcome is seen to a greater or lesser extent between populations, there is disparity. Race or

ethnicity, sex, sexual identity, age, disability, socioeconomic status, and geographic location all contribute to an individual's ability to achieve good health. It is important to recognize the impact that social determinants have on health outcomes of specific populations. Healthy People strives to improve the health of all groups.

To better understand the context of disparities, it is important to understand more about the U.S. population. In 2008, the U.S. population was estimated at 304 million people.

- In 2008, approximately 33%, or more than 100 million people, identified themselves as belonging to a racial or ethnic minority population.
- In 2008, 51%, or 154 million people, were women.
- In 2008, approximately 12%, or 36 million people not living in nursing homes or other residential care facilities, had a disability.
- In 2008, an estimated 70.5 million people lived in rural areas (23% of the population), while roughly 233.5 million people lived in urban areas (77%).
- In 2002, an estimated 4% of the U.S. population ages 18 to 44 identified themselves as lesbian, gay, bisexual, or transgender.

During the past 2 decades, one of Healthy People's overarching goals has focused on disparities and there has been great progress in these goals. In Healthy People 2000, it was to reduce health disparities among Americans. In Healthy People 2010, it was to eliminate, not just reduce, health disparities. In Healthy People 2020, that goal expanded even further: to achieve health equity, eliminate disparities, and improve the health of all groups.

Healthy People 2020 defines health equity as the, "attainment of the highest level of health for all people. Achieving health equity requires valuing everyone equally with focused and ongoing societal efforts to address avoidable inequalities, historical and contemporary injustices, and the elimination of health and health care disparities."

Healthy People 2020 defines a health disparity as "a particular type of health difference that is closely linked with social, economic, and/or environmental disadvantage. Health

disparities adversely affect groups of people who have systematically experienced greater obstacles to health based on their racial or ethnic group; religion; socioeconomic status; gender; age; mental health; cognitive, sensory, or physical disability; sexual orientation or gender identity; geographic location; or other characteristics historically linked to discrimination or exclusion."

Over the years, efforts to eliminate disparities and achieve health equity have focused primarily on diseases or illnesses and on health care services; however, the absence of disease does not automatically equate to good health. Powerful, complex relationships exist between health and biology, genetics, and individual behavior, and between health and health services, socioeconomic status, the physical environment, discrimination, racism, literacy levels, and legislative policies. These factors, which influence an individual or population's health, are known as determinants of health.

For all Americans, other influences on health include the availability of and access to:

- High-quality education
- Nutritious food
- Decent and safe housing
- Affordable, reliable public transportation
- Culturally sensitive health care providers
- Health insurance
- Clean water and non-polluted air

Throughout the next decade, Health People 2020 will assess health disparities in the U.S. population by tracking rates of illness, death, chronic conditions, behaviors, and other types of outcomes in relation to demographic factors including:

- Race and ethnicity
- Gender
- Sexual identity and orientation
- Disability status or special health care needs
- Geographic location (rural and urban)

Figure 1.2.1.1: Healthy People 2030

The 5th iteration of the Healthy People initiative is called Healthy People 2030.

Watch this 3 minute and 2 second video to learn "Five Things to Know about Healthy People 2030's Framework."

As we learned in the video, the 2030 broad goals for this decade include the following:

- Attain healthy, thriving lives and well-being, free of preventable disease, disability, injury and premature death.
- Eliminate health disparities, achieve health equity, and attain health literacy to improve the health and well-being of all.
- Create social, physical, and economic environments that promote attaining full potential for health and well-being for all.
- Promote healthy development, healthy behaviors and well-being across all life stages.
- Engage leadership, key constituents, and the public across multiple sectors to take action and design policies that improve the health and well-being of all.

The five broad goals are further divided into over 400 objectives: 355 core objectives, 115 developmental objectives and 40 newly added research objectives. The science-based objectives include targets to monitor progress and motivate action. These objectives were carefully chosen based on national data. The goal is to work together as a nation to achieve the objectives and goals to hopefully improve health and well-being nationwide.

1.2.2: Your Choices, Your Risk- What is Your Risk Factor?

Part of learning how to take charge of one's health requires understanding risk factors for different diseases. Risk factors are things in life that increase your chances of getting a certain disease. Some risk factors are beyond your control. A person may be born with them or have exposure with no fault assigned.

Many of the risk factors for Cardiovascular Disease and Cancer are related to your lifestyle choices you make may impact your chances of being diagnosed with Cardiovascular Disease and Cancer. Part of learning how to take charge of your health requires understanding your risk factors for different diseases. Risk factors are aspects in your life that increase your chances of getting a certain disease. Some risk factors are beyond your control. For example, you may be born with genetic factors or exposed to risk factors that you do not have control over.

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

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

There are also risk factors that we can control. Some examples of those include:

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

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

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

You can have one risk factor for a disease or you can have many. The more risk factors you have, the more likely you are to get the disease. For example, if you eat healthy, exercise on a regular basis, and control your blood pressure, you have a lower chance of getting Cardiovascular Disease than someone who is diabetic, a smoker, and inactive. To lower your risks, take small steps towards engaging in a healthy lifestyle, and you will see big rewards.

People with a family health history of chronic disease may have the most to gain from making lifestyle changes. You cannot change your genes; however, you can make the decision to stop smoking or to choose to go on daily walks no matter how busy your schedule is. Another change you can make is to have screening tests, such as mammograms and colorectal cancer screening. These screening tests help detect disease early. People who have a family health history of a chronic disease may benefit the most from screening tests that look for risk factors or early signs of disease. You can talk to your primary care doctor to find out what health screenings would be best for you. Finding disease early, before symptoms appear, can mean better health in the long run.

1.2.3: A Wealth of Information

We live in a time and age where there is so much information available to us with the click of a button. With so much information available to us, it is imperative that we understand how to critically evaluate information we see or hear. The need to be critical consumers of information is reflected in the Healthy People's broad goal to, “eliminate

health disparities, achieve health equity, and attain health literacy to improve the health and well-being of all.” We need to increase our health literacy.

The Center of Disease and Control defines personal health literacy as the degree to which individuals have the ability to find, understand, and use information and services to inform health-related decisions and actions for themselves and others. We must be critical consumers of information which starts with evaluating the source of the information.

Evaluating and Finding Health Information

As you read information critically, ask yourself the following questions:

Currency: The timeliness of the information.

- When was the information published or posted?
- Has the information been revised or updated?
- Does your topic of interest require current information, or will older sources work as well?
- Are the links functional?

Relevance: The importance of the information for your needs.

- Does the information relate to your topic or answer your question?
- Who is the intended audience?
- Is the information at an appropriate level (i.e. not too elementary or advanced for your needs)?
- Have you looked at a variety of sources before determining this is one you will use?
- Would you be comfortable citing this source in a research paper?

Authority: The source of the information.

- Who is the author/publisher/source/sponsor?
- What are the author’s credentials or organizational affiliations?
- Is the author qualified to write on the topic?
- Is there contact information, such as a publisher or email address?
- Does the URL reveal anything about the author or source? examples: .com .edu .gov .org .net?

Accuracy: The reliability, truthfulness, and correctness of the content.

- Where does the information come from?
- Is the information supported by evidence?
- Has the information been reviewed or refereed?
- Can you verify any of the information in another source or from personal knowledge?
- Does the language or tone seem unbiased and free of emotion?
- Are there spelling, grammar or typographical errors?

Purpose: The reason the information exists.

- What is the purpose of the information? Is it to inform, teach, sell, entertain or persuade?
- Do the authors/sponsors make their intentions or purpose clear?
- Is the information fact, opinion or propaganda?
- Does the point of view appear objective and impartial?
- Are there political, ideological, cultural, religious, institutional or personal biases?

The following are examples of websites that will most likely pass the CRAAP test for health information. Descriptions are added to the websites that perhaps are not as familiar:

- The Center for Disease Control and Prevention
- World Health Organization
- PubMed Central - this is a free full-text archive of biomedical and life sciences journal literature in the U.S. National Institutes of Health's National Library of Medicine.
- MyHealthFinder - is a prevention and wellness resource that includes evidence-based health information in English and Spanish that is actionable and easy to use.
- U.S. Department of Health and Human Services

2: HOW TO MAKE HEALTHY CHOICES REGARDING YOUR HEALTH

2.1: Introduction

We learned in Chapter 1 that the choices you make every day can impact your quality and quantity of life. We also understand that physical activity can positively impact your quality and quantity of life; however, we will explore deeper in this chapter that there are numerous barriers to physical activity. Healthy behavior change and adaptation of a habitual physical activity regimen into an individual's lifestyle may seem like a daunting task. College students may feel particularly challenged in implementing a regular physical activity plan into their schedule, given the need to balance school, work, and social lives. We will first look at what these barriers are, why we have barriers, and then look at the steps of change in how to overcome them. Whether you work out every day or just beginning your fitness journey, we all have barriers that need to overcome or have overcome to maintain our current workout routine.

Barriers to Physical Activity

Figure 2.1.1: Overcoming Impossible

The physiological, cognitive, and psychological benefits that may be gained from regular participation in physical activity are vast; however, many individuals experience barriers to habitual exercise.

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.

Personal, Environmental, and Behavioral Barriers

The degree to which an individual feels barred from participating in physical activity may be influenced by personal factors, environmental aspects, and behavioral characteristics are too numerous to be reviewed in this chapter alone. The perceived barriers to physical activity reviewed below relate to college students, as well as the general population.

Personal

There are several reasons individuals give for avoiding participation in regular physical activity that are personal in nature. Personal factors include, but are not limited to: insufficient time, inconvenience, lack of enjoyment or increased boredom with physical activity, fear of injury, and feelings of self-consciousness or shame when being physically active.

Environmental

Environmental aspects which may influence an individual's physical activity participation are both physical and psychosocial in nature. Physical barriers in the environment include: lack of access to gyms and workout facilities, inadequate sidewalk coverage, few parks/green spaces or deficiency in walking/biking trails that are safe and in a convenient location. Psychosocial barriers in

the environment include: lack of encouragement, social support or companionship with family and friends when trying to initiate a physical activity program. These factors may particularly impact those within academic environments, as college students report a lack of social support networks or campus environmental/facility-related obstacles as major barriers to physical activity.

Behavioral

Behavioral characteristics play an important role in shaping perceptions of physical activity participation. Individuals who struggle with self-management skills may not set effective personal health goals or engage in proper goal monitoring and progression. Further, low confidence and low self-efficacy (i.e., one's situation self-confidence for a behavior) in their ability to be physically active may prove to be a significant deterrent to exercise. Moreover, lack of motivation appears to exert a major negative effect on physical activity participation in both the general population and college student population. College students indicate that low motivation and increased fatigue play a role in prevention of exercise.

Common Barriers to Physical Activity for College Students

Perceived barriers to physical activity may significantly impact an individual's behavior choices, and prevent the individual from engaging in exercise. College students face unique challenges to being physically active, as they strive to balance academic, professional, and social opportunities and duties. A sample of full-time college students between the ages of 18-24 identified student-specific factors which may either be considered beneficial or detrimental to physical activity participation. The common perceptual factors identified by these students are listed below. They are categorized as either a barrier to or benefit of physical activity participation.

Barriers to Physical Activity	Benefits of Physical Activity
Low motivation	Psychological improvement
Lack of peer interest	Social benefits
Inconvenience (challenging to find a gym/facility location or no equipment availability)	Physical appearance

Time constraints (exercise interrupts work/school/social duties)	Feeling productivity
Lack of confidence in using equipment	Identity improvement (enhanced self-concept and attitude)

In addition, 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.

As we looked at, there are many barriers and benefits to physical activity. An individual must weigh their current “readiness” to make a behavior change in order to effectively plan and implement desired behavioral changes into their daily routine. Are you ready to change your behaviors?

You may be able to quickly identify behaviors you could change to increase your wellness, but you might not be able to quickly begin implementing the change. Are you ready to take the steps necessary to begin change in the areas you identified? Change happens over various stages.

Self-Reflection Questions

What do you believe is the most significant barrier to participation in physical activity in your own daily routine? Is your most significant barrier found on the list of factors above? How might you overcome perceived barriers to physical activity? Remember that your perceived benefits must outweigh any perceived barriers.

2.2: The Stages of Change

The Stages of Change, also known as the Transtheoretical Model of Behavior Change (TTM), was developed by Prochaska and DiClemente to help understand the stages a person goes through when trying to make changes in their life. TTM proposes the concept of healthy behavioral change as a series of stages an individual must progress through to active success in altering his or her behavior patterns. It assesses an individual's readiness to implement a healthier behavior and provides insight into the decision-making process that leads to action. The five stages include: Precontemplation, Contemplation, Preparation, Action, and Maintenance. You might not go through the stages linearly, rather you might find yourself moving between them, and regressing. For example, you might first believe you are in the Preparation Stage and then realize you are actually in the Contemplation Stage. Or you might jump into the Action Stage beginning the change and then discontinue with your plan stepping back into the Preparation or Contemplation Stage.

As you review the five stages of the Stages of Change along with characteristics and strategies, think about a behavior you would like to change. Next, identify which stage you are currently in and what you could do to move to the next stage.

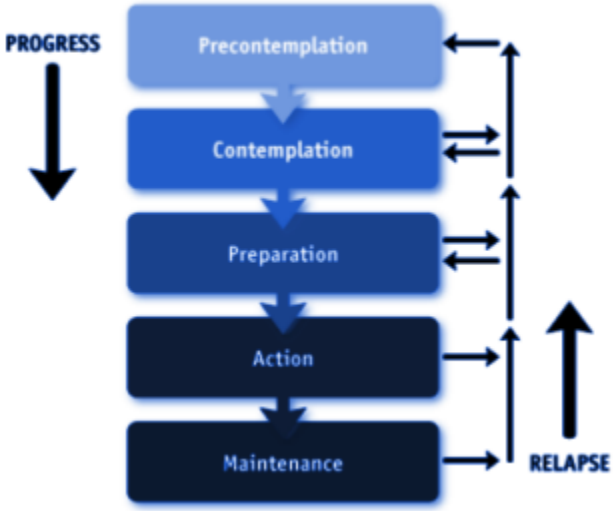


Figure 2.2.1: Stages of Change

There are numerous studies that support using this model for healthy eating and physical activity behavior change endeavors.

Let's take a look at each of the stages.

Precontemplation Stage (Not Ready to Change)

People in the Precontemplation Stage are not intending to take action in the foreseeable future, are not interested in getting help, and can be unaware or do not believe that their behavior is problematic. This stage correlates to the statement, "I won't/I can't."

The characteristics of the Precontemplation Stage include ignoring the problem, being ignorant to the problem, or denying the problem exists.

To move to the next stage, some strategies would include identifying the risks to their life if they do not change and taking the time to analyze or rethink their behaviors and actions.

Contemplation Stage (Getting Ready to Change)

People in the Contemplation Stage are beginning to recognize that their behavior is problematic, are more aware of the consequences of their behavior, and start to look at the pros and cons of either continuing or changing their behavior. They start

to become more accepting or receptive to the information about their unhealthy behavior and more open to learning about ways that they can change. This stage correlates with the statement, “I may.”

The characteristics of the Contemplation Stage include being doubtful or ambivalence of the change or having conflicted emotions about the change.

To move to the next stage, some strategies would include making a list of the pros and cons of changing their behavior, identifying barriers to changing and strategies you could use to overcome the barriers, and lastly looking for resources that could help a person make the change.

Preparation Stage (Ready to Change)

People in the Preparation Stage are intending to take action in the immediate future, are committed to making changes, and may begin to take small steps toward behavior

change by research to find resources or strategies to help them with their change. This stage likely includes the development of a behavior change plan. It correlates with the statement, “I will.”

The characteristics of the Preparation Stage include experimenting with small changes and collecting information about the change.

To move to the next stage, people would need to write down their goals, prepare for a plan of action, and make a list of motivating statements.

Action Stage (Actively Changing)

People in the Action Stage believe they can change and are actively changing their behaviors. They are open to help, seek support, and work to overcome barriers to stay committed. This stage correlates to the statement, “I am.”

The characteristic of the Action Stage is to make a direct action toward the goal.

To move to the next stage, a person would need to reward their successes and seek out social support.

Maintenance Stage (Maintain Change)

People in the Maintenance Stage have been able to sustain action for at least six months and are working to prevent relapse into previous unhealthy behaviors. This stage correlates with the statement, “I still am.”

The characteristics of the Maintenance Stage includes maintenance of the new behavior and avoiding temptations.

A person would also need to have strategies in place to prevent relapses. Some of these strategies would include developing positive coping strategies for overcoming temptations and remembering to continue to reward themselves.

An Example of Using the TTM

It’s time to apply what we just learned about the Stages of Change. For this example, let’s consider that there is a college student beginning a new exercise regimen to help us visualize the stages of the TTM.

- Precontemplation: The student believes that s/he is not capable of jogging a mile continuously; therefore s/he does not engage in any physical activity.
- Contemplation: The student begins to contemplate the target behavior (completing a 1-mile jog), and s/he is now open to the possibility of future success. However, the student has not yet definitely set a date to begin training.
- Preparation: The student has now firmly committed to start training for the target behavior, and has joined a local jogging group in order to stay accountable. At this stage, the student may be participating in short jogging bouts, but has not yet attempted to run continuously for 1 mile.
- Action: The student is now participating in regular training, and has completed several 1-mile jogs. The student feels as if s/

he has achieved their behavioral goal.
- Maintenance: The student has continued to train by engaging in multiple distance runs. Perhaps the student has progressed to a fitness level where s/he may target an advanced goal (for example: completing a 5K race), and therefore s/he may cycle through the TTM stages again with this new goal in mind.

2.3: Creating Healthy Physical Activity Habits - Increasing Self-Efficacy and Goal Setting

In order for an individual to overcome physical activity barriers, thus facilitating successful progression through the TTM stages of change, the individual must include increasing self-efficacy for physical activity and engaging in effective goal setting.

Physical Activity and Self-Efficacy

Self-efficacy is defined as the belief that one has the ability to initiate or sustain a desired behavior. Self-efficacy refers to an individual's beliefs that they will be successful in performing a specific behavior. Self-efficacy differs from self-confidence,

which refers to a more global sense of personal worth. Studies indicate that increased self-efficacy may positively impact an individual's motivation to participate in a particular behavior, the performance achievements gained from participation in said behavior, and overall well-being. Notably, self-efficacy can be developed for a variety of human behaviors. For the purpose of this chapter, the focus of this discussion will be on physical activity self-efficacy. It is important to note that improvements in physical activity self-efficacy may reduce an individual's negative perception of exercise, which is a commonly cited barrier to physical activity as we learned earlier in this chapter.

Factors That May Enhance an Individual's Self-Efficacy for Physical Activity

There are a few factors that may enhance an individual's self-efficacy for physical activity. These factors include:

- Experiencing positive physiological states (i.e., mood)
- Receiving verbal encouragement for physically active behavior
- Observing others successfully performing physically active tasks (i.e., role model)
- Mastering physical activity skills on an individual level

An individual can strengthen their physical activity self-efficacy in three areas which correlate with personal, environmental, and behavioral factors.

1. Personal (Mood)

   Noticing and acknowledging positive physiological states (i.e., feelings of calmness and enjoyment) during physical activity may increase self-efficacy for future physical activity participation.

2. Environmental (Surrounding oneself by a healthy environment) Speaking positively about physical activity participation (verbal encouragement) and observing and being mindful of the physical activity behaviors of those individuals in one's social group (watching role-models in exercise and sport) may positively impact an individual's self-efficacy for future physical activity participation.

3. Behavioral (Engaging in exercise - "Doing!")

   Engaging in consistent, successful efforts related to physical activity (mastery experiences) may increase physical activity-related self-efficacy.

Making the Change with SMART Goal Setting

Have you ever tried to change your behaviors? Maybe you set a New Year's Resolution? How did it go?

If you have been successful at changing your behaviors, it is highly likely that you followed a very specific plan. If you have not been successful, you likely followed a path similar to what many people do around January first each year which is to make broad

statements such as, “I am going to lose weight this year” or, “this is the year I am going to work out” or, “I am going to get healthy.” Each of these statements have good intent; however, are lacking an actual goal or target to achieve. It is like saying you are taking a vacation, but you haven’t made any plans, decided where to go, or how you will get there.

The first step in creating and maintaining a plan for lifelong participation in physical activity is to identify what your desired outcomes are. Perhaps the desired outcome is to embrace a healthy lifestyle, enhance mental wellbeing, and improve self-esteem. Research clearly indicates that exercise may produce numerous positive outcomes; however, the challenge lies in overcoming perceptual and environmental barriers in order to consistently follow an exercise plan. Often, an individual will revert to old habits of inactivity (despite their desired outcomes) if clear goals are not set regarding physical activity participation.

Participation in habitual physical activity requires a clear vision for oneself, effective goal-setting, and self-monitoring of progress. A review of how to best create a vision, set appropriate goals, plan for adversity, and self-monitor is the final step in this chapter’s overview of the benefits of physical activity, perceived barriers, and healthy behavior change. Research indicates that the following methods may be effective in planning, monitoring, and adhering to a personal health and fitness.

Create a Compelling Vision

Before beginning your behavior change journey, take a moment to create a vision of a “healthier you.” What is driving you to engage in behavior change? Why do you wish to create new health habits? How will this improve your life? How will this positive change benefit those close to you? What behaviors do you wish to consistently engage in to become your “best self?”

Create SMART Goals

Creating SMART goals can help you to have a better chance at being successful with behavior change by giving you direction and a target to achieve. SMART is an acronym that stands for Specific, Measurable, Attainable/Achievable, Realistic, and Time Based. This type of goal setting requires the goal setter to think about the five factors involved in achieving their goal and to help define a pathway to reaching their goal. The more well-defined that pathway becomes, the easier it is to follow.

Figure 2.3.1: SMART Goals

Create a goal that has a focused and clear path for what you actually need to do. The goal needs to be concrete, detailed, and well defined so that you know where you are going and what to expect when you arrive. Some questions to ask yourself to determine if your goals are specific can include: What do you want to accomplish? Why have you set this goal?

Create a goal that provides means of measurement and comparison by using numbers and quantities. This enables you to track your progress. Including a measurement lets you know whether or not you have met your goal. Some questions to ask yourself to determine if your goals are measurable can include: How will you measure your progress? How will you know when you have successfully achieved your goal?

Attainable/Achievable

Make sure that your goal is within your capabilities and not too far out of reach. For example, if you have not been physically active for a number of years, it would be highly unlikely that you would be able to achieve a goal of running a marathon within the next month. Your goal must be feasible and easy to put into action. A question to ask yourself to see if your goal is attainable/

achievable is, do you have the skills, abilities, or time needed to achieve your goal?

Relevant/Realistic

When deciding on your goal, you need to consider constraints such as resources, personnel, and cost. Try to ensure that your goal is something you will be able to continue doing and incorporate as part of your regular routine/lifestyle. For example, let's say that you made a goal to kayak two times a week. When you start to work on this goal you realize that you do not have the financial resources to purchase or rent the equipment, no way to transport the kayak, and/or are not close enough to a body of water in which to partake in kayaking twice a week, then this is not going to be a feasible goal for you. Some questions to ask yourself to determine if your goal is realistic/relevant are: Why do you want to achieve the goal? Is your goal in line with our lifestyle?

Time Based

A time frame helps to set boundaries around the objective. Give yourself a target date or deadline in which the goal needs to be met. This will keep you on track and motivated to reach the goal and also help you evaluate your progress. When setting your time based goal, you should ask yourself what your timeline to change is.

Moving from Broad to SMART Goals

When writing goals for ourselves, we have a tendency to make our goals vague and broad. As we learned above, this makes our goals: hard to achieve because they are not specifically defined, not easy to measure because we haven't defined what we are trying to accomplish specifically, not necessarily attainable/achievable because they are so broad, it is hard to determine if they are realistic because it is not clearly defined, and usually not time based because a timeline is not placed or the timeline is broadly defined. The chart below provides examples of how to make a vague goal into a SMART goal.

Vague Goal	SMART Goal
"I will workout"	"I will engage in 30 minutes of aerobic physical activity 5 days a week for the next 4 weeks"
"I will lose weight"	"I will lose weight by tracking my calories every day for the next 2 months and reducing my calorie intake by 10% each week beginning with week 1 with 2,000 calories per day intake, week 2 calorie intake 1,800 calories per day intake, week 3 calorie intake 1,620 calories per day intake, and will continue to assess for the future weeks and make adjustments"
"I will be happier"	"I will increase my happiness by incorporating positive affirmations into my daily life. For the next 2 months, I will begin week 1 with choosing one positive affirmation that I will repeat to myself 5 times a day. Each subsequent week, I will add another affirmation so that by week 8 I am repeating 8 positive affirmations 5 times a day"

“I will go to the gym”	“I will increase my physical activity by doing cardio and weight training at the gym 4 times a week for the next 10 weeks. I will track my progress by keeping a workout log. I will increase cardio time and weight training sets/reps each week by 5-10%”

Plan for Setbacks

Setbacks are going to happen. It is important to mentally acknowledge that setbacks are part of the journey of change and that is ok. To help plan for setbacks, discern how you will best overcome these setbacks and write down a “game plan” for challenging situations. How will you react and respond to adversity?

Track and Measure Progress

Keep a journal of your progress. Self-monitor any adjustments you need to make in order to be successful in maintaining your plan. Once you have achieved several of your short-term goals, you may wish to reassess your long-term goals. Perhaps your goals will change slightly, or you will discover that you have exciting and new goals. Therefore, it is important to complete a “goal check” with yourself on a regular basis and track your achievements, as well as, your areas for improvement.

Increase Your Opportunity for Successful Change

Behavior change is hard for many reasons. Here are some strategies to help increase your chances of successfully achieving your health and wellness goals.

Set Approach Goals Instead of Avoidance Goals

Approach goals are goals where you are taking actions to meet a desired outcome, whereas avoidance goals are focused on not taking actions. Research has shown that we are more successful when we set approach goals rather than avoidance goals. For example, rather than setting an avoidance goal such as, “I will not drink soda” the focus could be, “I will drink water instead of soda.”

Set Mastery (Learning) Goals Instead of Performance Goals

A performance goal might be to lose 20 pounds, whereas a mastery (learning) goal would focus on the actions you are taking to lose weight. Some examples of actions to focus on would be on your nutrition or exercise. A mastery skill involves increasing existing abilities or learning new skills. Performance goals may be less effective than mastery goals. It is ok to set a performance goal, but it should always be accompanied by a mastery goal.

Find Your Why

Take a moment to think about why you want to change. How will this change make your life better? How will this change help you feel better, have better relationships with yourself and others, or help your family or friends? You might like to refer to this as finding or discovering your why.

Your Daily Action Plan

If you think about your SMART goal as your destination, how will you get there and what are the directions or what route will you take? Developing an action plan is a helpful strategy to increase your motivation. An action plan specifies what (always a behavior),

how much, how often, and usually when (which days and times). In other words, your action plan is the steps by which the SMART goal will be achieved. Your action plan provides you with your goal for each day, which allows you to focus on your day-to-day

actions rather than just on your long term goal. This allows you to be successful each day that you complete your stated actions in your action plan.

Boost Your Self-Efficacy

Implementing a carefully and thoughtfully crafted action plan and meeting the goals of your action plan can help you to improve health and build your self-efficacy. This in turn builds your motivation to change.

A Positive Mindset

Having a positive mindset can also help to increase your self-efficacy. This might include focusing on positive self-talk by purposefully telling yourself that you can complete your goals. A positive mindset may also take the form of finding enjoyment in your changes. When the thought of your change brings you enjoyment, you are more likely to engage in the behavior change and stick to it.

2.4: Conclusion/Summary

This semester we will work together to create SMART Goals and increase our self-efficacy. We will monitor our progress and gradually increase the intensity of our workouts in the lab so that we can progressively work towards our goal.

3: PHYSICAL ACTIVITY, EXERCISE, AND PHYSICAL FITNESS

What is the difference between physical activity, exercise, and physical fitness?

Although often used interchangeably, the terms physical activity, exercise, and physical fitness have different meanings. In short, physical activity refers to any body movement, exercise is physical activity that is planned and structured to achieve physical fitness, and physical fitness refers to how well your heart, lungs, muscles, and joints respond to daily tasks.

We will look at each term individually and explore how they are different and how they are related.

Physical Activity

Physical activity is any form of bodily movement performed by skeletal muscles that result in an increase in energy expenditure.

Examples of physical activity include the following:

- Shopping
- Cleaning your house
- Gardening
- Washing your car

Exercise

Exercise is a form of physical activity that is planned, structured, repetitive, and performed with the goal of improving health or fitness. Exercise is purposeful to improve or maintain one or more components of physical fitness. All exercise is physical activity, but not all physical activity is exercise.

Examples of exercise include the following:

- Jog for 30 minutes
- Swim 1 mile
- Attend an aerobic class
- Lift weights

Physical Fitness

Physical fitness is a person's ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy to enjoy leisure-time pursuits and respond to emergencies. A person's physical fitness is developed by incorporating an exercise routine that specifically develops the components of physical fitness.

The components of physical fitness are categorized into two categories:

1. Health-related components of physical fitness: Cardiorespiratory endurance, muscular strength, muscular endurance, flexibility, and body composition.
2. Skill-related components of physical fitness: Balance, agility, speed, power, coordination, and reaction time.

Reflection: Your Physical Activity, Exercise, and Physical Fitness

Take a moment to reflect on your physical fitness, physical activity, and exercise.

- How would you rate your level of physical fitness? Are you able to carry out daily tasks with vigor and without fatigue? Do you have a lot of energy?
- How does your level of physical activity impact your physical fitness level? Are you active throughout the day?
- What exercise do you purposefully perform that impacts your level of physical fitness? Do you follow an exercise program?

Do you include regular exercise that helps your heart and lungs, and helps you become stronger?

3.1: Health Benefits of Physical Activity and Exercise

Why is it important to be physically active and build your fitness? What are the health benefits of physical activity and exercise?

Living an active lifestyle is one of the most important things people can do to improve their health. Physical activity is beneficial for everyone, regardless of age, sex, race, ethnicity, or current fitness level, and benefits can start accumulating with small amounts of, and immediately after doing, physical activity. Being active improves your health in numerous ways 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; and
- 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.

Health Benefits Associated with Regular Physical Activity

The following two charts are a summary of the strength-of-evidence rating with health benefits associated with regular physical activity in children and adolescents and in adults and older adults respectively.

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

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

As you can see in the charts above, there are many health benefits with regular and physical activity. We learned in Chapter 1 that the leading cause of death is cardiovascular disease and cancer and that physical activity is a risk factor that we can control. From the charts above, we can see that there is strong evidence in the research that increasing your physical activity can lower your risk of: early death, coronary heart disease, stroke, high blood pressure, colon cancer, and breast cancer. We also see strong evidence in the research that physical activity can prevent weight gain, improve cardiorespiratory and muscular fitness, and lower our risk of type 2 diabetes. In addition, physical activity can reduce fall risk in older adults, improve cognitive function, and reduce depression.

You can also categorize the benefits into three major categories: physical benefits, cognitive benefits, and psychological benefits.

1. Physical Benefits: reduced risk of a variety of diseases and conditions (i.e., cardiovascular disease, diabetes, hypertension, some types of cancer, etc.), improvements in mobility and fitness, and overall enhancement of quality of life.
2. Cognitive Benefits: heightened academic performance, improved brain function, and reduced risk of age-related cognitive impairment and disease.
3. Psychological benefits: enhanced mood, reductions in stress, anxiety, and depression, and increased self-esteem and body image.

Furthermore, participation in physical activity regimens which increase individual's cardiorespiratory or muscular fitness may result in lifestyle enhancements, such as:

- Ability to complete activities of daily living (i.e., climbing the stairs or catching the bus) without becoming winded
- Ability to engage in recreational activities (i.e., playing with a young child or performing a sport) for extended periods of time
- Ability to easily move or lift a heavy load (i.e., carry grocery bags or move furniture)

These are all great benefits! This would lead to the question of what type of physical activity is best and how much physical activity is needed for various health benefits. That led to the development of The Physical 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 details on the Physical Activity Guidelines for Americans, please see the table below.

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)

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 are not 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.

3.2: Increase Both Physical Activity and Physical Fitness

Increase Physical Activity: Move More, Sit Less

How much of your typical day do you spend sitting, reclining, or lying down? Are you considered a sedentary person? One way you could determine that is to keep track of your daily movement patterns through a journal. You could record your movement throughout the day. You could sample a few of your working days, as well as, a few weekend days so that you can take an average. In your journal, record the time you spend sitting, laying down, doing low intensity activities of daily living, and purposeful exercise. Writing down your activities in a journal can help you to clearly see your active and inactive patterns in your life to help you identify opportunities for increasing physical activity.

Inactive, Insufficiently Active, Active, or Highly Active

Are you inactive, insufficiently active, active, or highly active? Below is guidance specifically for your current level of fitness.

Inactive means not getting any moderate- or vigorous intensity physical activity beyond basic movement from daily activities. For people who are inactive, that is, people who do not do any moderate- or vigorous-intensity physical activity beyond basic movement from daily life activities. A person who is described as inactive, also known as sedentary, means that they are sitting, reclining, or lying down. Most desk-based office work, driving a car, and watching television are examples of sedentary behaviors. It is important to limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits. It reduces the risk of all-cause mortality, cardiovascular disease incidence and mortality, and the incidence of Type 2 Diabetes and some cancers. If you are a sedentary person, a good first step is to replace sedentary behavior with light-intensity physical activity. Previously, evidence supported that light intensity physical activity could provide health benefits; however, was not sufficient to support a recommendation. No matter how much time they spend in sedentary behavior or light-intensity activity, inactive people can reduce their health risks by gradually increasing their moderate-intensity physical activity.

Insufficiently active means doing some moderate- or vigorous-intensity physical activity but less than 150 minutes of moderate-intensity physical activity a week or 75 minutes of vigorous-intensity physical activity or the equivalent combination. This level is less than the target range for meeting the key guidelines for adults. For people who are insufficiently active, that is, people who do some moderate- or vigorous-intensity physical activity, but who do not yet meet the key guidelines target range (150 to 300 minutes a week of moderate-intensity physical activity for adults). The target range can sound daunting possibly; however, even small increases to moderate-intensity physical activity provide health benefits. There is no threshold that must be exceeded before benefits begin to occur. Greater benefits can be achieved by reducing sedentary behavior, increasing moderate-intensity physical activity, or a combination of both. For any given increase in moderate-to-vigorous physical activity, the relative

gain in benefits is greater for insufficiently active people than for people who are already meeting the key guidelines.

Active means doing the equivalent of 150 minutes to 300 minutes to moderate-intensity physical activity a week. This level meets the key guideline target range for adults. Although those within target range already have substantial benefits from their current volume of physical activity, more benefits can be gained by doing additional moderate-to-vigorous physical activity or reducing sedentary behavior.

Highly active means doing the equivalent of more than 300 minutes of moderate-intensity physical activity a week. This level exceeds the key guideline target range for adults. People who are highly active, that is, people who do more than the equivalent of 300 minutes a week of moderate-intensity physical activity, should maintain or increase their activity level by doing a variety of activities.

Increasing Your Level of Physical Activity

As you read the descriptions of the level of activity, you could be thinking that you are pleased with your level of physical activity. You could also on the other hand be thinking through how you are not at the level of physical activity that you want to be at and may be wondering where to start.

The first thing you should do is identify opportunities throughout your day to move and sit less.

You might be thinking about how you spend your day whether studying for school assignments, working, and taking care of your activities of daily living. You could be thinking you move around all the time and that is great; however, some of you might be feeling discouraged in how little you are able to move throughout the day. Remember that some physical activity is better than none and that every step counts!

Here are some strategies to increase your activity throughout your day:

- Walk instead of drive, whenever you can
- Walk your children to school
- Take the stairs instead of the escalator or elevator
- Take a family walk after dinner
- Replace a Sunday drive with a Sunday walk
- Go for a half-hour walk instead of watching television
- Get off the bus a stop early and walk to your destination
- Park farther from the store and walk
- Make a Saturday morning walk a family habit
- Walk briskly in the mall
- Take the dog on longer walks
- Go up hills instead of around them

- Garden or make home repairs
- Do yard work. Get your children to help rake, weed, or plant
- Work around the house. Ask your children to help with active chores
- Wash the car by hand
- Use a snow shovel instead of a snow blower
- Avoid labor-saving devices such as a remote control or electric mixers
- Do sit-ups in front of the television. Have a sit-up competition with your kids

There are some possible ways that fitness and health outcomes may relate to physical activity. One example is that physical activity leads to improvements in physical fitness and physical fitness causes improvements in health outcomes. In addition, physical fitness may modify the amount of the effect that physical activity has on health outcomes. Physical activity can lead to improved physical fitness as a health outcome.

3.3: The Components of Physical Fitness

The components of physical fitness are often categorized into health-related components and skill-related (performance-related) components. Although skill-related components are valuable, most tend to be more specific toward athletes.

The health-related components of physical fitness are: flexibility, muscular strength, muscular endurance, cardiorespiratory endurance (also called aerobic endurance), and body composition.

The skill-related components of physical fitness are: balance, agility, speed, power, coordination, and reaction time.

The focus of this class will be on the health-related components of physical fitness and we will define those terms.

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. 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.

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 no 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 stretch two to four times, accumulating 60 seconds per stretch.

Muscular Strength and Endurance

Muscular strength is defined as the ability of muscles to exert maximal effort. This differs from **muscular endurance**, which is the ability of muscles to exert sub-maximal effort repetitively (contract over and over gain or hold a contraction for a long time).

Activities for Muscular Strength and Endurance

These kinds 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 using elastic bands or body weight for resistance (climbing a tree or doing push-ups, for example).

Activities for Muscular Strength and Endurance also have three components:

- Frequency, or how often a person does muscle strengthening activity;
- Intensity, or how much weight or forces is used relative to how much a person is able to lift; 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 weight loss program.

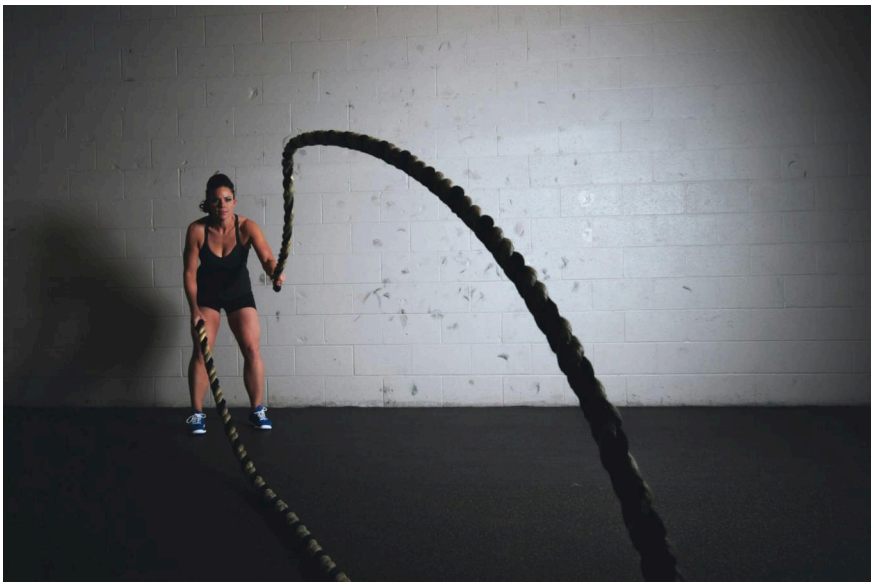
Muscle-strengthening activities make muscles do more work than they are accustomed to doing. That is they overload the muscles. Resistance training, including weight training, is a familiar example of muscle-strengthening activity. Other examples include working with resistance bands, doing calisthenics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

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.

Cardiorespiratory Endurance



Cardiorespiratory endurance (aerobic endurance) is defined as 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

Cardiorespiratory endurance exercises involve large muscle groups in prolonged, dynamic movement (ex. Running, swimming, etc).

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	• Race walking, 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 (Time)

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 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.

Body Composition

Body composition is 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 will be discussed later in our text.

3.4: Develop an Exercise Program to Build Your Physical Fitness

At least a minimal level of physical fitness is required in order to carry out daily activities without being physically overwhelmed. To build or sustain your physical fitness, it is important to develop an exercise program that targets the important components of fitness. Development of these various components will improve your quality of life, reduce your risk of chronic disease, and optimize your health and well-being.

It is also important to ensure that you are exercising all major muscle groups. When one set of muscles are stronger, weaker, or tighter than the opposing group of muscles it can cause injuries or pain, or impact your body's alignment or posture. Muscle imbalance might occur in athletes who have one dominant side or might occur through exercising when a person only focuses on specific areas. For example, if a person only performs strength training exercises to grow their biceps, chest, and quadriceps, they are forgetting to also train the opposing muscle groups which are the triceps, back, and hamstrings. Be sure to train the major muscles of the legs, hips, back, abdomen, chest, shoulders, and arms.

We will continue to discuss how to build an individual exercise program that is specific for you and dig deeper into how to create a balanced workout applying fitness principles.

Exercise Safely

All individuals are unique in their exercise programming needs. Personal, environmental, and behavioral factors should be considered and assessed when planning to engage in a physical fitness training regimen.

Key Exercise Safety Guidelines

Before beginning an exercise program, it is important to make sure that you have safety protocols in place.

Here are a few key guidelines:

- Be confident that physical activity can be safe for almost everyone, yet recognize that activities may have risks.
- Choose physical activities that are appropriate for your current fitness level.
- Increase physical activity gradually over time. Inactive people should “start low and go slow” by starting with lower intensity activities and gradually increasing how often and how long activities are done.
- Take precautions when exercising to minimize risk. This might include using appropriate gear and sports equipment,

choosing safe environments, following rules and policies, and making sensible choices about when, where, and how to be active.
- If you have chronic conditions or symptoms, be sure to consult with a healthcare professional or physical activity specialist to discuss the types and amounts of activity appropriate for you.

Access Your Physical Activity Readiness

To help ensure you are of good physical health to start an exercise program. You are recommended to complete The Physical Activity Readiness Questionnaire for Everyone, more commonly known as the PAR-Q. The PAR-Q was established by the British Columbia Ministry of Health and the Multidisciplinary Board on Exercise. This questionnaire is intended to determine if there are any underlying health issues that should be discussed with a doctor before starting an exercise program. The PAR-Q consists of the following 7 questions that participants should answer yes or no to:

1. Has your doctor ever said that you have a heart condition that you should only perform physical activity recommended by a doctor?
2. Do you feel pain in your chest when you perform physical activity? 3. In the past month, have you had chest pain when you were not performing any physical activity?
3. Do you lose your balance because of dizziness, or do you ever lose consciousness?
4. Do you have a bone or joint problem that could be made worse by a change in your physical activity?
5. Is your doctor currently prescribing any medication for your blood pressure or a heart condition?
6. Do you know any other reason why you should not engage in physical activity?

If you answered yes to one or more of the 7 questions above, then you should consider consulting your doctor or other qualified medical professional before becoming more physically active.

Warm Up and Cool Down

Although the health benefits of including a warm-up and cool down are not yet proven, research studies of effective exercise programs typically include warm-up and cool-down activities. Warming up before and cooling down after exercise are commonly recommended to prevent injuries and adverse cardiac events. A warmup before moderate- or vigorous-intensity aerobic activity allows a gradual increase in heart and breathing at the start of the episode of activity. A cool-down after activity allows a gradual heart rate decrease at the end of the session.

4: CARDIORESPIRATORY ENDURANCE

Cardiorespiratory Endurance

As we learned in Chapter 3, **Cardiorespiratory endurance** (also known as cardiovascular endurance and aerobic endurance) is defined as 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

To begin this chapter, we will start by learning more about the cardiovascular system and how it works.

4.1: The Cardiovascular System

If your heart beats 75 times per minute, it would contract approximately 108,000 times in one day, more than 39 million times in one year, and nearly 3 billion times during a 75-year lifespan. Your heart is an amazing organ that works all day, everyday, to ensure all of the cells, tissues, and organs in your body get the oxygen and nutrients needed to survive, while also removing carbon dioxide and waste by pumping about 2,000 gallons of blood around your body. This is a lot of work for an organ about the size of your first that weighs less than a pound.

How the Heart Works - An Overview

The heart is power, or the pumping force, behind the circulation of blood through the body. Every time your heart beats it is contracting in order to push blood, much like you would squeeze a plastic ketchup bottle and push out ketchup. The heart is just one part of the cardiovascular system, the other part are the vessels through which blood travels through the body. The heart and blood vessels are a closed-loop system, where blood moves in one direction to and from your heart.

The heart has two halves, each with atria and ventricles known as the right atrium, right ventricle, left atrium, and left ventricle. As a closed-loop system, blood moves through the following heart in a precise pattern:

- Deoxygenated blood enters the heart through the largest vein of the body called the superior vena cava.
- The deoxygenated blood first enters the heart through the right atrium.
- The blood is then pushed down into the right ventricle.
- The deoxygenated blood now leaves the heart to go to the lungs and pick up oxygen.
- Oxygenated blood then returns to the heart through the left atrium.
- The blood is pushed into the left ventricle.
- Lastly the oxygenated blood leaves the heart to go to the body through the largest artery of the body called the aorta.

Each side of the heart plays an important role in the circulation of blood. The right side of the heart is responsible for circulating the deoxygenated blood to the lungs to pick up oxygen, called pulmonary circulation, and the left side of the heart is responsible for circulating the blood to the rest of the body, called systemic circulation.

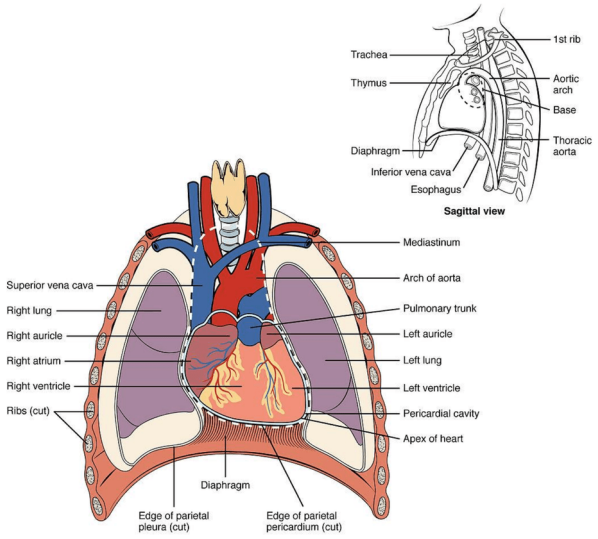


Figure 4.1.1: Position of the Heart in the Body

The three main types of blood vessels that transport blood throughout the body are the arteries, veins, and capillaries. In short, arteries are large blood vessels that carry blood away from the heart, veins are large blood vessels that carry blood to the heart, and capillaries are the small blood vessels that deliver oxygenated blood to organs and tissues and pick up deoxygenated blood from organs and tissues for the veins to take back to the heart. You might think of arteries and veins as big freeways or highways

and the capillaries as the neighborhood streets, both working to provide a pathway to deliver food and take away waste.

In pictures of the circulatory system, arteries are typically represented by red blood vessels and veins are typically represented as blue blood vessels. Red is used for arteries because most arteries carry oxygenated blood, or red blood. Veins typically carry deoxygenated blood, or blue blood. The faster the heart beats, the more oxygen and nutrients are transported throughout the body.

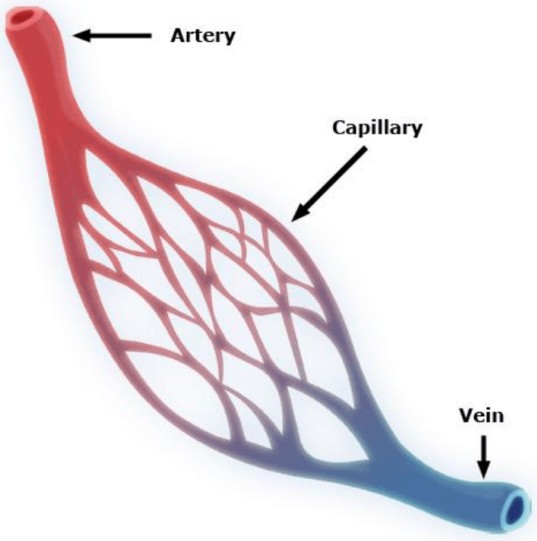


Figure 4.1.2: Arteries, Capillaries, and Veins

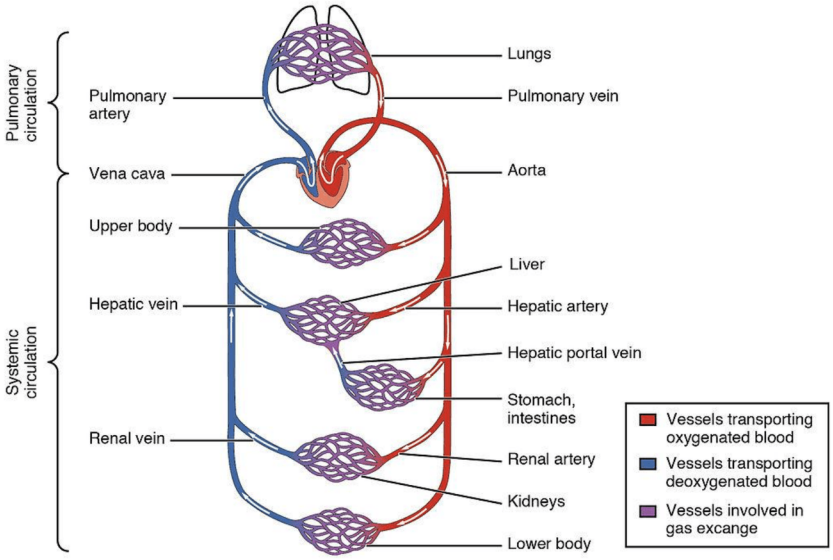


Figure 4.1.3: Blood Flow Through the Body

Each beat of the heart helps to keep the blood moving within the closed system; however, the heart has an additional feature that helps to keep the blood moving in one direction and these are called heart valves. Heart valves ensure unidirectional blood flow through the heart. Valves operate link french doors that open when the heart contracts and close when the heart is at rest. The four valves in the heart are the tricuspid valve, pulmonary valve, bicuspid valve, and aortic valve.

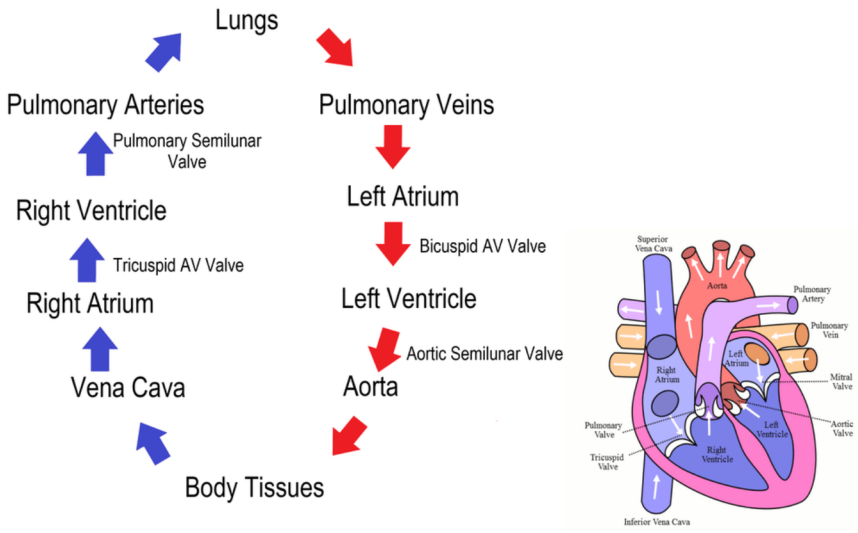


Figure 4.1.4: Circulation of Blood Through the Heart

You do not tell your heart to beat, rather your heart beats automatically. For example, when your body needs more oxygen, such as when exercising, your body's autonomic nervous system tells your heart to speed up and pump more blood throughout your body. The Autonomic Nervous System specifically sends messages to a specialized group of cells located high in the right atrium, called the **Sinoatrial Node**, or SA node. The SA Node is commonly referred to as the pacemaker of the heart and is responsible for normal cardiac rhythm by sending an electrical signal that makes the heart contract.

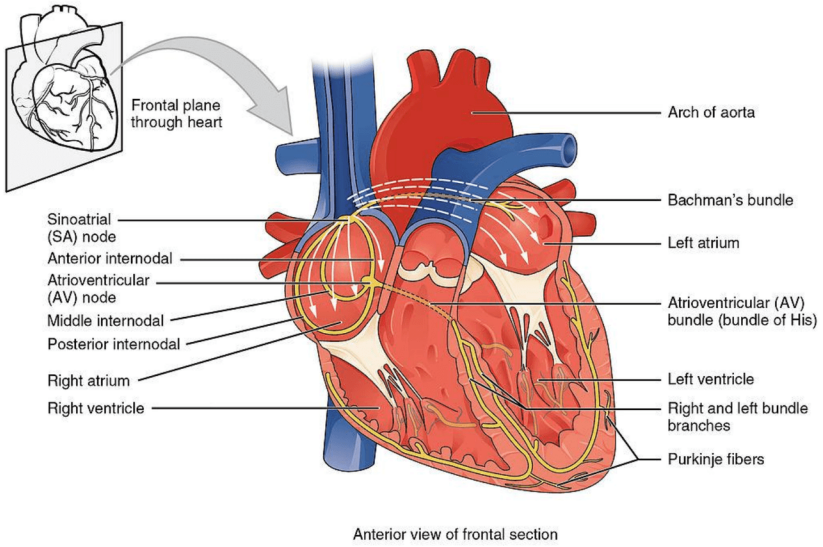


Figure 4.1.5: Conduction System of the Heart

The contraction of the heart is called **systole** and the relaxation of the heart is called **diastole**. Imagine clenching and relaxing your first, when it is clenched that is representing systole and when it is relaxed that is diastole. When the heart contracts (systole) and pushes blood from the heart into the blood vessel (artery) it puts pressure on the blood vessel walls. When the heart relaxes (diastole) the pressure on the blood vessel walls lowers. By measuring the pressure in the blood vessel we can better understand the health of the heart and blood vessels. Measuring the pressure created in the blood vessel is known as your **blood pressure**. When you get your blood pressure tested they give you two numbers, the top number is the pressure created during systole and the bottom number is the pressure created during diastole. Thus, blood pressure readings are read as systolic over diastolic pressure. Average blood pressure is considered to be 120/80 (systolic/diastolic). If the pressure increases to 140/90, you are considered to have high blood pressure.

Manually Pumping Blood: Cardiopulmonary Resuscitation (CPR)

If the heart stops beating, the blood can be manually pumped by using an emergency technique known as cardiopulmonary resuscitation (CPR). When performing CPR, repeated pressure is placed on the heart to push the blood through both the pulmonary and systemic circuits. This is particularly critical for the brain, as irreversible damage and death of neurons occur within minutes of loss of blood flow.

4.2: The Principles of Training

When designing your exercise routine, remember that it is important to overload your body to allow it to respond by building more strength or increasing the capacity of your cardiorespiratory system. Since your body will adapt to the overload, you cannot continue with the same exercise routine, you need to continue to increase the demand by progressively increasing your workouts. Lastly, be sure you are including a variety of exercises intended to build each specific body system.

Let's look at each of these principles individually and in more detail.

The Overload Principle

The **Overload Principle** is the physical stress placed on the body when physical activity is greater in the 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.

As a person's level of fitness continues to improve, adjustments in the exercise program will need to continue to take place in order to see further improvements. This is because the previous level of exertion to meet the demands of the overload may no longer be sufficient to continue to overload the body.

The Progression Principle

The **Progression Principle** is closely tied to the Overload Principle. Once a person reaches a certain fitness level, then the person is able to progress to higher levels of physical activity by continued overload adaptation. Small, progressive changes in

overload help the body adapt to the additional stresses while minimizing the risk of injury.

The Specificity Principle

The **Specificity Principle** means that the benefits of physical activity are specific to the body systems that are doing the work. For example, the physiological benefits of walking are largely specific to the lower body and the cardiovascular system. Push-ups primarily benefit the muscles of the chest, shoulders, and upper arms.

The Reversibility Principle

The **Reversibility Principle** refers to how people may lose the beneficial effects of training when that person stops participating in an exercise program. In order to maintain the fitness benefits of exercising, you must continue to workout consistently. If you do not maintain a consistent workout routine, the fitness gains are reversed. This is commonly referred to as "use it or lose it."

The F.I.T.T. Principle

When designing your exercise routine, it is important to remember to target the health-related components of physical fitness and ensure you are meeting the recommended Frequency, Intensity, Time, and Type for each component, which is commonly referred to as the F.I.T.T Principle.

The F.I.T.T. Principle is defined as the following:

- **Frequency**- refers to how often you will exercise
- **Intensity**- refers to how hard you will work during your exercise session
- **Time**- refers to how long your exercise session will be

- **Type**- refers to the type of exercise you will do to build your fitness

The four elements of the F.I.T.T. Principle help you create an exercise plan that will build or sustain your level of physical fitness.

Applying the F.I.T.T. Principle for Cardiorespiratory Endurance (Aerobic Activity)

Here is an example of how you can apply the F.I.T.T. Principle to creating a workout plan for cardiorespiratory endurance.

Frequency: At least 3 days a week.

Intensity: Moderate or vigorous intensity.

Time: 150 minutes to 300 minutes a week of moderate-intensity, or 75 to 150 minutes (2 hours and 30 minutes) a week of vigorous-intensity. 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 is roughly the same as 15 minutes of vigorous-intensity activity. The 1996 Surgeon General's Report on Physical Activity and Health and the 2008 Physical Activity Guidelines for Americans included the guidance that aerobic activity needed to last at least 10 minutes count in your total minutes of aerobic exercise each week. However, continued research into aerobic exercise bouts has shown that moderate-vigorous aerobic exercise of any length is beneficial for your health. So remember throughout your day that moderate-to-vigorous physical activity of any duration counts toward meeting the key guidelines.

Type: Any exercise where the body's large muscles move in a rhythmic manner for a sustained period of time. Brisk walking, running, bicycling, jumping rope, and swimming are all examples. Aerobic activity causes a person's heart to beat faster, and they will breathe harder than normal.

4.3: Measuring Cardiorespiratory Endurance Intensity

The intensity of your cardiorespiratory endurance, also known as cardiovascular endurance and aerobic exercise, is measured by how the activity affects your heart rate and breathing. **Intensity** refers to work or effort exerted to perform activity or exercise. Relative intensity may be determined by focusing on heart rate and breathing patterns while engaging in cardiorespiratory endurance.

Heart Rate

A common method of monitoring physical activity intensity is by calculating heart rate and determining if the Target Heart Rate zone has been reached. The equations below may be utilized to determine Resting Heart Rate, Maximum Heart Rate, and Target Heart Rates for moderate-intensity and vigorous-intensity physical activity.

Resting Heart Rate

The Resting Heart Rate is the number of beats per minute (bpm) when the body is not engaged in physical activity. An individual may take their Resting Heart Rate at the

neck, wrist, or chest. The recommended location is to place the index and middle finger lightly on the radial pulse on the wrist. Count the number of heartbeats within sixty seconds, or count the number of heartbeats in thirty seconds and multiply this answer by two. For the most valid measurement of Resting Heart Rate, it is advised that individuals take this measure in the morning prior to getting out of bed. This is called the True Resting Heart Rate.

Maximum Heart Rate

The Maximum Heart Rate is the age-related number of beats per minute of the heart when working at its maximum; usually estimated at 220 minus the individual's age.

Heart Rate Reserve

The Karvonen Method of Heart Rate Reserve (HHR) is utilized to determine an individual's Target Heart Rate by incorporating the Resting Heart Rate into the formula; thus, reducing risk of under training or overtraining. HHR is calculated by subtracting Resting Heart Rate from the Maximum Heart Rate.

An Example on How To Calculate Heart Rate Reserved

For this example, the individual is 30 years old with a resting heart rate of 60 bpm. Formula for Maximum Heart Rate (Max HR) = 220 - Age

Max HR calculation:

220-30 = 190 bpm as a max HR

Formula for HHR = Maximum Heart Rate (Max HR) - Resting Heart Rate (resting HR)

HHR calculation:

190-60 = 130 bpm

Summary: For our individual who is 30 years old with a resting HR of 60 bpm, their HHR is 130 bpm.

Target Heart Rate

The rate that your heart is beating is a good indicator of your aerobic intensity. To figure out whether you are exercising within the Target Heart Rate zone, you must briefly stop exercising to take your pulse or wear a heart rate monitor while exercising. For moderate-intensity, your Target Heart Rate should be between 64-76%. For vigorous-intensity physical activity, your Target Heart Rate should be between 77-93%.

The HHR 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 HHR can be seen above. The American College of Sports Medicine (ACSM) recommends to improve aerobic fitness, exercise intensity should be set at either 40-85 percent of HHR or 55-90 percent of Maximum Heart Rate. These ranges are deliberately broad to reflect the different levels of fitness; that is, someone with relatively low levels of fitness who has just started an exercise program 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 and overload in an exercise program.

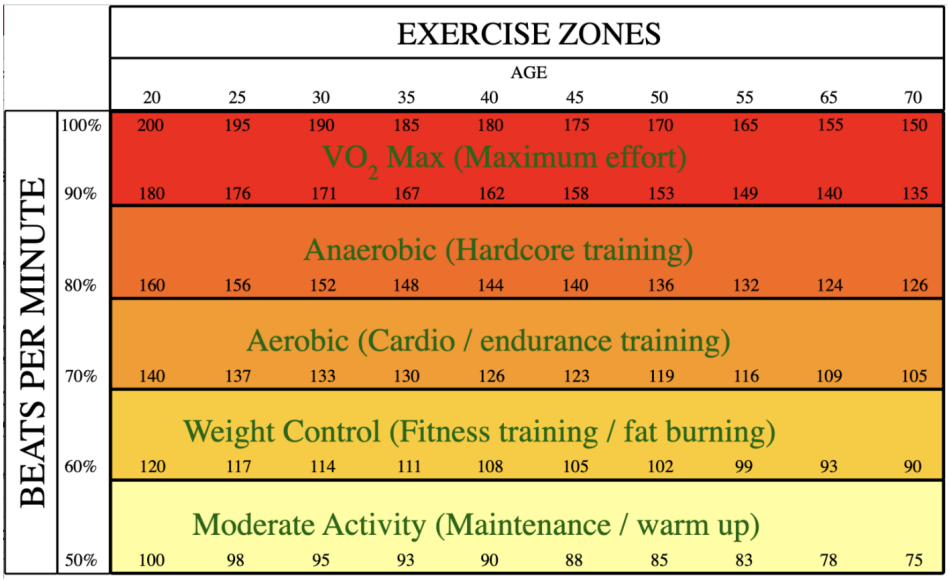


Figure 4.3.1: Target Heart Rate Zones

An Example on How to Calculate Your Target Heart Rate using HHR For the purpose of this class, we will set our Target Heart Rate between 60-85% to cover all fitness levels that are in this class. The following example will provide the formulas and step by step guidance on how to calculate an individual's Target Heart Rate who is 25 years old and has a Resting Heart Rate of 65 bpm.

Step 1: Calculate the Maximum Heart Rate

To estimate your maximum age-related heart rate, subtract your age from 220 Formula: 220 - Age = Maximum Heart Rate

Ex: 220-25 = 195

Maximum Heart Rate = 195 bpm

Step 2: Calculate the HHR

Formula: Maximum Heart Rate - Resting Heart Rate

Ex: 195-65 = 130

Step 3: Multiply HHR by Target Heart Rate Range

Multiply the answer from Step 2 by .60 and by 0.85

Formula:

Answer from Step 2 x 0.6

Answer from Step 2 x 0.85

Ex:

130 x 0.6 = 78 (Answer 1)

130 x 0.85 = 110.5 (Answer 2)

Step 4: Add the Resting Heart Rate back to each answer for Step 3 Formula:

Answer 1 from Step 3 + Resting Heart Rate

Answer 2 from Step 3 + Resting Heart Rate

Example:

78 + 65 = 143

110.5 + 65 = 175.5 round to nearest beat 176

Target Heart Range for our example is 143-176 bpm.

The Rate of Perceived Exertion Scale

The Borg Rating of Perceived Exertion (RPE) Scale is a way that provides a person to assess their level of effort when doing cardiorespiratory endurance exercises. This scale relies upon the individual's personal perception of how much effort is being exerted during activity. The original scale introduced by Gunnar Borg rated exertion on a scale of 6-20. This 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 bpm. Although this measure is somewhat subjective, the RPE Scale appears to be a reasonably accurate estimate of heart rate.

The scale ranges from 6-20, with 6 representing "no exertion" and 20 representing "maximal exertion." On the scale 9 corresponds to "very light" exercise. This would be equivalent to walking slowly at their own pace for a period of time. A range of 12-13 on the Borg Scale generally represents "moderate-intensity" physical activity. A 13 would correspond to "somewhat hard" exercise. Though the exercise is considered "somewhat hard," the person would still feel like they are ok to continue with that exercise. A score of 17 would correspond to "very hard" and would be during very strenuous exercise. A person who is healthy would be able to still continue with the strenuous exercise; however, would have to push themselves. They would feel very heavy and would feel very tired. Lastly, a score of 19 would correspond to "extremely strenuous" level of exercise. This would be considered the most strenuous exercise a person has ever experienced before.

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 monitoring is not appropriate for people on this type of medication. In medicine, this is used to document the patient's exertion during a test, and the sports coaches use the scale to assess the intensity of training and competition.

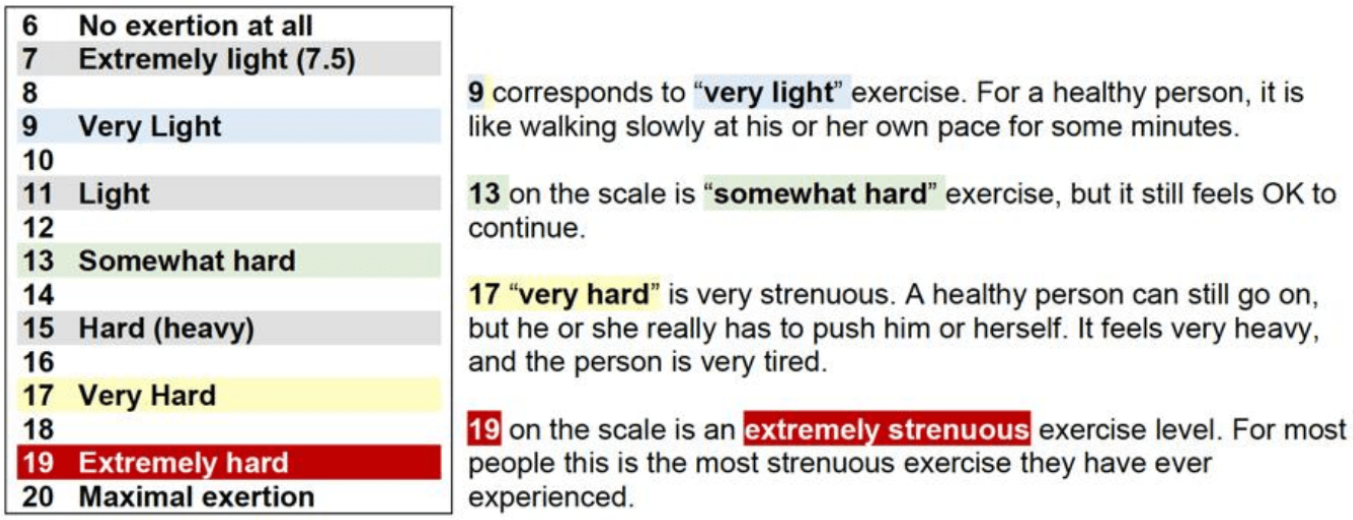


Figure 4.3.2: The Rate of Perceived Exertion

The Talk Test

The Talk Test is a way of measuring aerobic intensity. As a rule of thumb, a person doing moderate-intensity aerobic activity can talk, but not sing, during the activity. A person doing vigorous-intensity activity cannot say more than a few words without pausing for a breath.

Energy Cost

Energy expenditure (calories "burned) may be estimated through calculations by taking into account the individual's body weight, activity type, and physical activity intensity level.

Step-Count Data

Physical activity may be measured by wearable devices which record step-count data, such as pedometers and smart watches. Wearable devices which provide immediate feedback regarding step-count data have been associated with increases in physical activity. A common minimum recommendation for health is to aim for at least 10,000 steps-per-day; however, upcoming physical activity guidelines may increase the recommendation for daily step count to 15,000 steps-per-day.

Pedometers are devices which measure steps or count data, and specific count cutoffs may be utilized to approximate intensity levels; however, pedometers cannot directly measure physical activity intensity.

Research-Based Activity Assessment Methods of Levels of Intensity

Metabolic Equivalents

Metabolic Equivalents, also known as METS, are commonly utilized in physical activity research to measure intensity levels. METS measure these exercise intensity levels based upon oxygen consumption of the body. MET intensity level cut-points are categorized as follows:

- 1 MET = Resting Metabolic Rate
- 1.0-1.5 MET = Sedentary Behavior
- 1.6-2.9 MET = Light Intensity

- 3.0-5.9 MET = Moderate Intensity
- ≥ 6.0 MET = Vigorous Intensity

A movement monitor which has capabilities to record step-count data, as well as physical activity intensity levels. Accelerometers measure an individual's acceleration forces on one, two, or three planes (axis) of motion. Accelerometers are often utilized in physical activity research studies.

Aerobic versus Anaerobic Exercise

Aerobic exercise is when oxygen is utilized in the energy-generating process for muscle contraction. Aerobic exercise improves cardiorespiratory endurance. These types of workouts primarily use large muscle groups of the body and are typically performed continuously. Some examples of aerobic exercise include jogging, rowing, and biking. These exercises can be maintained for longer duration than anaerobic exercises.

Anaerobic Exercise is when oxygen is not utilized in the energy-generating process for muscle contraction. These exercises use muscles at high-intensity for shorter bursts of time. Some examples of anaerobic exercises include short springs and heavy weight lifting.

4.4: Endurance Exercise

We will go more into detail about muscle anatomy in Chapter 5, but for now, skeletal muscles are composed of fast- and slow-twitch muscle fibers. Slow fibers are

predominantly used in endurance exercises that require little force but involve numerous repetitions. The aerobic metabolism used by slow-twitch fibers allows them to maintain contractions over long periods. Endurance training modifies these slow fibers to make them even more efficient by producing more mitochondria, the powerhouse of the cells, to enable more aerobic metabolism and more ATP production, ATP stands for adenosine triphosphate and is the cell's energy source. Endurance exercise can increase the amount of myoglobin in a cell, as increased aerobic respiration increases the need for oxygen. Myoglobin acts as an oxygen storage supply for the mitochondria.

The training can trigger the formation of more extensive capillary networks around the fiber, a process called **angiogenesis**, to supply oxygen and remove metabolic waste. To allow these capillary networks to supply the deep portions of the muscle, muscle mass does not greatly increase in order to maintain a smaller area for the diffusion of nutrients and gasses. All of these cellular changes result in the ability to sustain low levels of muscle contractions for greater periods without fatiguing.

The proportion of the slow-twitch muscle fibers in the muscle determines the suitability of that muscle for endurance, and may benefit those participating in endurance activities. Postural muscles have a large number of slow-twitch fibers and relatively few fast-twitch fibers, to keep the back straight (Figure 4.8). Endurance athletes, like marathon-runners, also would benefit from a larger portion of slow-twitch fibers, but it is unclear if the most-successful marathoners are those with naturally high slow-twitch fibers, or whether the most successful marathon runners develop high numbers of slow-twitch fibers with repetitive training. Endurance training can result in overuse injuries such as stress fractures and joint and tendon inflammation.

Figure 4.4.1: Marathon and other long-distance runners have a large number of slow-twitch muscle fibers and fewer fast-twitch fibers

Interval Training

One of the most popular interval training right now is High-Intensity Interval Training. Take a few minutes to read the brochure provided by the ACSM on High-Intensity Interval Training. You can also view the Alternate Text Version of the ACSM High-Intensity Interval Training brochure.

4.5: Physiological, Cognitive, and Psychological Benefits to Cardiorespiratory Endurance Exercise

Physiological Benefits

The physiological benefits associated with regular physical activity participation range from risk reductions for several diseases and health maladies, to improvements in mobility, fitness, and overall quality of life. The following summary of health benefits associated with participation in physical activity is a broad overview drawn from scientific studies conducted in adult populations, and does not take into account individual differences. Please refer to a healthcare professional for further information, especially regarding your individual needs and medical background before beginning an exercise regimen.

Reduced Risk of Premature Death

Inflammation in the body is strongly related to future risk for chronic diseases and conditions which may jeopardize health. Physical activity results in a reduction of systemic inflammation in the body and has been linked to a reduction in all-cause risk of premature death. Further, research indicated that the protective benefits of physical activity may improve with additional time spent in exercise. In one recent study, individuals with the highest levels of physical activity participation and fitness had the lowest risk of premature death. However, individuals should be aware that overtraining (i.e., participating in physical activity to the point where risks outweigh benefits) may occur. Therefore, adhering to physical activity guidelines is a wise strategy for students beginning a physical activity regimen.

Reduced Risk for Cardiovascular Disease

Cardiovascular disease (CVD), such as heart attack and stroke, is the leading health-related cause of death in the United States adult men and women. Improvements in cardiorespiratory fitness have been associated with risk reductions of CVD. Specifically, participating in the recommended duration of physical activity as outlined in the Physical Activity Guidelines for Americans has been found to provide the greatest health benefits, which include but are not limited to: improved coronary blood flow, decreased blood coagulation, and enhanced cardiac function.

Reduced Risk for Diabetes

Physical activity and exercise also play a role in metabolic functions such as the body's insulin sensitivity (how responsive the body is to insulin) and subsequent ability to balance blood glucose levels. Decreased insulin sensitivity and elevated insulin and blood glucose levels have been linked to diabetes. Regular physical activity participation increases insulin sensitivity and glucose metabolism, with both aerobic and resistance exercise associated with risk reduction for type 2 diabetes.

Improved Blood Pressure Control

Hypertension, or an abnormal elevation in blood pressure, is a risk factor for heart attack, stroke, and congestive heart failure. A variety of physical activity types have been associated with decreased blood pressure, such as habitual aerobic exercise and dynamic resistance training. Notably, recent studies have even examined and cited the numerous health benefits of regular yoga practice among hypertensive individuals.

Improved Cholesterol Levels

Elevated levels of low-density lipoprotein cholesterol (LDL; the "bad" cholesterol) and depressed levels of high-density lipoprotein cholesterol (HDL; the "good" cholesterol) have been linked to a variety of health risks, such as heart disease. Regular aerobic exercise has the ability to alter lipid protein levels and reduce triglyceride levels in the body, resulting in increased HDL and decreased LDL.

Reduced Risk for Stroke

Participation in aerobic and anaerobic exercise is recommended to reduce the risk of stroke. Studies indicate that individuals who participated in a moderate amount of physical activity reduced their risk of stroke up to 20%, compared with those who participated in a greater amount of activity increasing this risk reduction to 27%.

Reduced Risk of Some Types of Cancer

Numerous studies have shown associations between reduced risk for colon and breast cancer and physical activity participation. In detail, physically active men and women exhibited a 30-40% risk reduction for colon cancer, and physically active women presented with a 20-30% risk prediction for breast cancer compared with their inactive counterparts. Systematic reviews spanning decades of research indicate that moderate-intensity physical activities produce a greater protective effect than low-intensity activities.

Improved Bone Health and Musculoskeletal Fitness

The combination of muscular strength, weight-bearing resistance, and aerobic physical activity may stimate bones to increase in strength. Research has also shown that the combination of cardiovascular fitness and progressive overload of resistance exercise can increase flexibility and joint stability. We will discuss this in more detail in Chapter 5.

Improved Ability to Maintain Healthy Body Composition and Weight Status

Studies indicate that regular physical activity participation may result in reduced body fat and improved weight control. This will be discussed further in Chapter 8.

Cognitive Benefits

In addition to the physiological benefits of regular physical activity participation, there are numerous benefits related to cognitive functioning. Such benefits include, but are not limited to: heightened academic performance, improved brain function, and reduced risk of age-related cognitive impairment and disease.

Improved Academic Performance

Research has shown a consistent relationship between physical activity participation and enhanced academic performance (i.e., learning and cognitive outcomes) in children with aerobic exercise producing the greatest benefits. Several cognitive outcomes positively impacted by physical activity throughout childhood and young adulthood include: perceptual skills, intelligence quotients, and verbal and mathematical tests. However, further research is needed to examine the potential academic benefits in college-age and older populations.

Enhanced Brain Function

Oxidative stress, caused in part by the buildup of harmful free radicals within the body, may result in damage to brain functions. Current research indicates that regular physical activity participation increases the body's ability to resist oxidative stress. Optimal protection is provided via increased antioxidant activity when exercise is performed at specific intensity levels. Notably, habitual engagement in moderate-intensity aerobic physical activity appears to provide the greatest benefit for brain function.

Decreased Incidence and Risk for Age-Related Cognitive Impairment and Disease

Several studies have found a reduced risk for Alzheimer's disease and dementia in individuals who engage in greater amounts of physical activity versus those who are more sedentary. Frequency of exercise engagement appears important, as older adults who engage in three or more sessions of physical activity per week are significantly less likely to be diagnosed with dementia than their counterparts who engage in fewer sessions per week. When examining only adults who have not been diagnosed with Alzheimer's or dementia, a reduction in risk for cognitive decline is apparent when physical fitness levels are improved.

Psychological Benefits

The psychological benefits of exercise complete the aforementioned cognitive and physiological benefits. Several psychological benefits include, but are not limited to: enhanced mood, reduced stress, anxiety, and depression, and improved self-esteem and body image.

Enhanced Mood

Mood, one's state of mind or feeling, may be positively impacted by a variety of physical activity types. Resistance training programs have been associated with improved mood states in healthy adult populations. Other research utilizing aerobic training programs also show promising results. Notably, even participation in light aerobic activities, such as leisurely walking, may result in an overall increased positive mood. Indeed, enhanced mood state following physical activity has been well-documented throughout decades of literature and is collectively known as the "feel-good" effect.

Stress Relief

Participation in physical activity may decrease perceptions of stress. In a study examining leisure-time activity choice, participants who increased their physical activity engagement reported a reduction in stress levels. Further, participation in many types of physical activity may prove especially effective in reducing stress in college students and decreasing the number of day-to-day happenings that students perceive to be inconveniences or difficulties.

Reduced Anxiety

Physical activity participation may play an important role in decreasing an individual's fears and sensations associated with anxiety. Research indicates that anxiety-related symptoms may be reduced following physical activity interventions as short as two weeks in length. Multiple studies also suggest that increased adherence to physical activity programs results in reduced anxiety, especially when exercise is combined with other treatment options such as therapy and medication. Of note, both aerobic and anaerobic exercise regimens reduce symptoms of anxiety.

Reduced Risk for Depression

Depression is a significant health issue, with major depressive disorder ranking as the most prevalent clinically-diagnosed mental disorder. National guidelines recommend physical activity as an important component of a depression treatment program. A recent in-depth analysis examining the effects of various physical activity interventions on depression indicated that exercise is effective in reducing depressive symptoms, with the positive effects observed when physical activity is delivered both as a stand-alone treatment or in addition to medication. Notably, when combined with prescribed medication, regular physical activity participation over time may be superior in preceding depression relapse when compared to medication alone.

Improved Self-Esteem

Physical activity participation positively impacts self-esteem. Individuals who identify as "exercisers" report more positive body image than individuals who do not identify as "exercises" (i.e., do not participate in regular physical activity). Further, research has also indicated that body image can be enhanced in both inactive and active individuals following a physical activity intervention. These are noteworthy findings as self-esteem may be an important factor for college-aged students in particular. Students who engage in educational programs which promote physical activity report increased physical self-esteem and subsequently increased quality of life indices.

5: INTRODUCTION TO MUSCULAR STRENGTH AND ENDURANCE

5.1: Introduction to Muscular Strength and Muscular Endurance

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.

As we learned in Chapter 3, **Muscular strength** is defined as the ability of muscles to exert maximal effort. We also learned that this differs from **muscular endurance**, which is the ability of muscles to exert submaximal effort repetitively (contract over and over gain or hold a contraction for a long time). Resistance training is the method of developing muscular strength and muscular endurance, which in turn improves wellness.

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. These muscles 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.

Overview of Muscle Tissue

Muscle is one of the four primary tissue types of the body, and the body contains three types of muscle tissue: skeletal muscle, cardiac muscle, and smooth muscle (Figure 1). All three muscle tissues have some properties in common; they all exhibit a quality called excitability as their plasma membranes can change their electrical states (from polarized to depolarized) and send an electrical wave called an action potential along the entire length of the membrane. Skeletal muscle completely depends on signaling from the nervous system to work properly. On the other hand, both cardiac muscle and smooth muscle can respond to other stimuli, such as hormones and local stimuli.

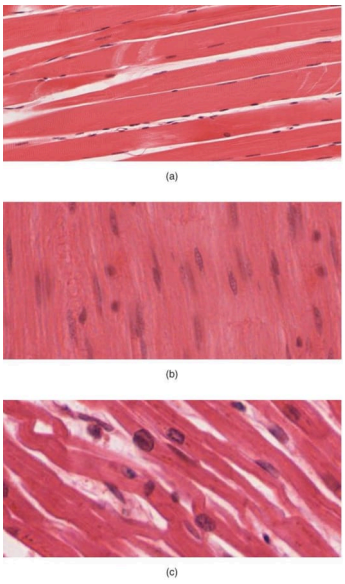


Figure 5.1.1: The Three Types of Muscle Tissue. The body contains three types of muscle tissues: (a) skeletal muscle, (b) smooth muscles, and (c) cardiac muscle.

The muscles all begin the actual process of contracting (shortening) when a protein called actin is pulled by a protein called myosin. This occurs in striated muscle (skeletal and cardiac) after specific binding sites on the actin have been exposed in response to the interaction between calcium ions and proteins (troponin and tropomyosin) that “shield” the actin-binding sites. Calcium ions also are required for the contraction of smooth muscle, although its role is different: here calcium ions activate enzymes, which in turn activate myosin heads. All muscles require adenosine triphosphate (ATP) to continue the process of

contracting, and they all relax when the calcium ions are removed and the actin-binding sites are re-shielded.

A muscle can return to its original length when relaxed due to a quality of muscle tissue called **elasticity**. It can recoil back to its original length due to elastic fibers. Muscle tissue also has the quality of **extensibility**; it can stretch or extend. **Contractility** allows muscle tissue to pull on its attachment points and shorten with force.

Skeletal muscles are made up of contractile proteins called actin and myosin. The actin and myosin proteins are arranged very regularly in the cytoplasm of individual muscle cells (referred to as fibers), which creates a pattern, or stripes, called striations. The striations are visible with a light microscope under high magnification (see Figure 1). Skeletal muscle fibers are multinucleated structures that compose the skeletal muscle.

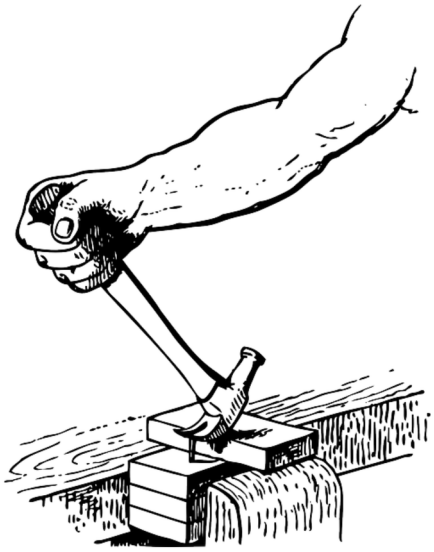
5.2: Skeletal Muscle

The best-known feature of skeletal muscle is its ability to contract and cause movement. Skeletal muscles act not only to produce movement but also to stop movement, such as resisting gravity to maintain posture. Small, constant adjustments of the skeletal muscles are needed to hold a body upright or balanced in any position. Muscles also prevent excess movement of the bones and joints, maintaining skeletal stability and preventing skeletal structure damage or deformation. Joints can become misaligned or dislocated entirely by pulling on the associated bones. Skeletal muscles work to keep joints stable. Skeletal muscles are located throughout the body at the openings of internal tracts to control the movement of various substances. These muscles allow functions, such as swallowing, urination, and defecation, to be under voluntary control. Skeletal muscles also protect internal organs (particularly abdominal and pelvic organs) by acting as an external barrier or shield to external trauma and by supporting the weight of the organs.

Skeletal muscles also contribute to the maintenance of homeostasis in the body by generating heat. Muscle contraction requires energy, and when ATP is broken down, heat is produced. This heat is very noticeable during exercise, when sustained muscle movement causes body temperature to rise, and in cases of extreme cold, when shivering produces random skeletal muscle contractions to generate heat. Every skeletal muscle is also richly supplied by blood vessels for nourishment, oxygen delivery, and waste removal. In addition, every muscle fiber in a skeletal muscle is supplied by the axon branch of a somatic motor neuron, which signals the fiber to contract. Unlike cardiac and smooth muscle, the only way to functionally contract a skeletal muscle is through signaling from the nervous system.

The Lever System of Muscle and Bone Interactions

Skeletal muscles do not work by themselves. Muscles are arranged in pairs based on their functions. For muscles attached to the bones of the skeleton, the connection determines the force, speed, and range of movement. These characteristics depend on each other and can explain the general organization of the muscular and skeletal systems.



The skeleton and muscles act together to move the body. Have you ever used the back of a hammer to remove a nail from wood? The handle acts as a lever and the head of the hammer acts as a fulcrum, the fixed point that the force is applied to when you pull back or push down on the handle. The effort applied to this system is the pulling or pushing on the handle to remove the nail, which is the load, or “resistance” to themovement of the handle in the system. Our musculoskeletal system works in a similar manner, with bones being stiff levers and the articular endings of the bones-encased in synovial joints- acting as fulcrums. The load would be an object being lifted or any resistance to a movement (your head is a load when you are lifting it), and the effort, or applied force, comes from contracting skeletal muscle.

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 insertion. The point where the muscle is attached to a bone that remains in a fixed position is called the origin.

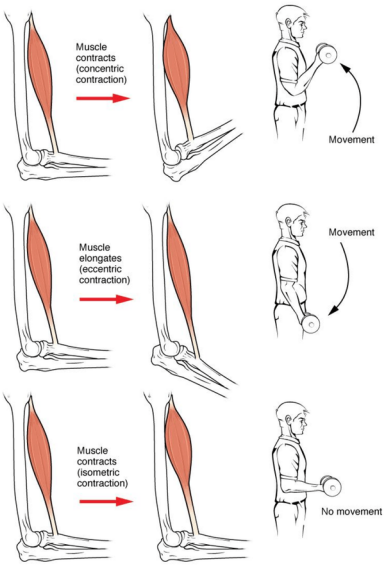
When one muscle contracts, another opposing muscle will relax. In this way, muscles are arranged in pairs. An example is when you bend your arm at the elbow: you contract your bicep muscle and relax your tricep muscle. This is the same for every movement in the body. There will always be one contracting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

Agonist (Prime Mover)	**Antagonist**
Bicep (Front of Arm)	Tricep (Back of Arm)
Quadriceps (Front of Thigh)	Hamstrings (Back of Thigh)
Gastrocnemius and Soleus (Calf)	Tibialis Anterior (Front of Lower Leg)
Rectus Abdominis (Stomach)	Erector Spinae (Part of the Back)

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 push-up. The front of the deltoid provides additional force during the push-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 afixed 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.

5.3: Types of Muscular Contractions



Isometric

An **isometric** contraction is a static contraction where the length of the muscle, or the joint angle, does not change. An example of an isometric contraction would be pushingagainst a stationary object such as a wall. This type of contraction is known to lead to rapid rises in blood pressure.

Isotonic

An **isotonic** contraction is a moving contraction, also known as a dynamic contraction. During this contraction the muscle fattens and there is movement at the joint.

Types of Isotonic Contraction

There are two types of isotonic contractions: concentric and eccentric. A **concentric** contraction is when the muscle contracts and shortens against a resistance. This maybe referred to as the lifting or positive phase. An example of this type of contraction would be the lifting phase of the bicep curl. An **eccentric** contraction occurs when the muscle is still contracting and lengthening at the same time. This may be referred to as the lowering or negative phase.

5.4: Muscle Fiber Types

As we briefly covered in Chapter 4, we learned that skeletal muscles are composed of two main types of fibers, fast- and slow-twitch muscle fibers. Fast- and slow-twitch muscle fibers are also known as Type I and Type II. Type I is often called slow-twitch or highly-oxidative muscle fibers. Type II is often called fast-twitch or low-oxidative muscle fibers. Let's look at each type in more detail.

Type I (Slow-Twitch or Highly-Oxidative 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 fibers. 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 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 II (Fast-Twitch or 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.

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 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.

Number 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.

5.5: Exercise and Muscle Performance

Physical training alters the appearance of skeletal muscles and can produce changes in muscle performance. Conversely, a lack of use can result in decreased performance and muscle appearance. Although muscle cells can change in size, new cells are notformed when muscles grow. Instead, structural proteins are added to muscle fibers in a process called **hypertrophy**, so cell diameter increases. The reverse, when structural proteins are lost and muscle mass decreases, is called **atrophy**. Age-related muscle atrophy is called **sarcopenia**. Cellular components of muscles can also undergo changes in responses to changes in muscle use.

Resistance Exercise

Resistance exercise, as opposed to endurance exercise, requires a large amount of fast twitch fibers to produce short, powerful movements that are not repeated over long periods. Muscles used for power have a higher ratio of fast-twitch to slow-twitch fibers, and trained athletes possess even higher levels of fast-twitch fibers in their muscles. Resistance exercise affects muscles by increasing the formation of myofibrils, thereby increasing the thickness of muscle fibers. This added structure causes hypertrophy, or the enlargement of muscles as we learned above, exemplified by the large skeletal muscles seen in bodybuilders and athletes (Figure 2). Because this muscular enlargement is achieved by the addition of structural proteins, athletes trying to build muscle mass often ingest large amounts of protein.

Figure 5.5.1: Hypertrophy. Bodybuilders have a large number of fast-twitch fibers and relatively few slow-twitch fibers

Except for the hypertrophy that follows an increase in the number of sarcomeres and myofibrils in a skeletal muscle, the cellular changes observed during endurance training do not usually occur with resistance training. There is usually no significant increase in mitochondria or capillary density. However, resistance training does increase the development of connective tissue, which adds to the overall mass of the muscle and helps to contain muscles as they produce increasingly powerful contractions. Tendons also become stronger to prevent tendon damage, as the force produced by muscles is transferred to tendons that attach the muscle to bone. For effective strength training, the intensity of the exercise must continually be increased. There must be a progressive overload for the specific muscle group that is being trained. For instance, continued weight lifting without increasing the weight of the load does not increase muscle size. To produce ever greater results, the weights lifted must become increasingly heavier, making it more difficult for the muscles to move the load. The muscle then adapts to this heavier load, and an even heavier load must be used if even greater muscle mass is desired.

5.6: 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 machines, 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.

1. 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. For example, when you work on a shoulder press machine 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.

2. 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. These types of equipment are low-cost, easily accessible, and can be used anywhere. Though commonly used 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.

3. 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. Some specialized machines use the DVT principle most effectively by allowing 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.

4. 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 IKT, 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 bicep curl while maintaining the same speed. IKT often involves opposing body parts. Trainers can use a variety of apparatuses with their clients to achieve isokinetic stasis between muscle groups.

5. Isometric Training

Familiar to most people, isometric training (IMT) is an excellent way to build strength with little adverse effects 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 lenthens 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 used when performing planks or wall sits. Another common IMT exercise is pressing the hands together to strengthen the pectorals 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.

6. 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 flexed 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. The true essence of isotonic training is keeping resistance constant in both the positive and negative portion of each repetition.

5.7: Exercise Principles Applied to Muscular Strength and Endurance

As we learned in Chapter 4, when designing your exercise routine, it is important to remember to overload your body to allow it to respond by building more strength. Since your body will adapt to the overload, you cannot continue with the same exercise routine, you will need to continue to increase the demand by progressively increasing the weight in your workouts. Lastly, be sure you are including a variety of exercises intended to build each muscle group.Let's look at each of these principles individually and in more detail as we apply them to increasing muscular strength and endurance.

The Overload Principle

As we learned in Chapter 4, the **Overload Principle** is the physical stress placed on the body when physical activity is greater in the amount or intensity than usual. We learned that the body's structure and functions respond and adapt to these stresses. Muscles must be overloaded meaning that during muscle-strengthening activities, muscles have to be under a greater amount of weight than they are accustomed to lifting to see improvements in muscular strength or muscular endurance. Muscle-strengthening and bone-strengthening activities overload muscles and bones, making them stronger.

As a person's level of muscular strength and endurance continues to improve, adjustments in the exercise program will need to take place in order to see further improvements. In the case of muscular strength and muscular endurance, the improvements to the exercise program would need to include increasing the amount of weight being lifted. This is because the previous level of exertion to meet the demands of overload may no longer be sufficient to continue to overload the body.

The Progression Principle

As we also learned in Chapter 4, the **Progression Principle** is closely tied to the Overload Principle. Once a person reaches a certain fitness level, then the person is able to progress to higher levels of physical activity by continued overload adaptation. Increases in the amount of weight, progressively, or the days a week of exercising will result in stronger muscles. Small, progressive changes in overload help the body adapt to the additional stresses while minimizing the risk of injury.

Specificity Principle

As a review from Chapter 4, the **Specificity Principle** means the benefits of physical activity are specific to the body systems that are doing the work. This means that the effects of muscle-strengthening activity are limited to the muscles doing the work. For example, push-ups primarily benefit the muscles of the chest, shoulders, and upper arms. It is important to work all the major muscle groups of the body: the legs, hips, back, abdomen, chest, shoulders, and arms.

Reversibility

The Specificity Principle, as we learned in Chapter 4, means that the benefits of physical activity are specific to the body systems that are doing the work. In order to maintain the fitness benefits of doing muscular strength and muscular endurance exercises, you must continue to workout consistently. If you do not "use it, you will lose it." This is the Reversibility Principle and can be applied to muscular strength and muscular endurance. If you do not continue to participate in muscle strengthening exercises, then you may lose the beneficial effects of training. If you want to maintain your muscular strength or endurance, you must continue to workout consistently. Otherwise, the fitness gains that you worked for are reversed.

Applying the F.I.T.T. Principle for Muscular Strength and Endurance

The F.I.T.T. Principle can be applied to muscular strength and to muscular endurance exercises. As we have learned, **Muscular strength** is defined as the ability of muscles to exert maximal effort. This is measured in how much a person can lift one time, also known as a one repetition maximum. This differs from **muscular endurance**, which is the ability of muscles to exert submaximal effort repetitively. Muscular endurance would be being able to lift a percentage of a one repetition maximum over a period of

time (contract over and over gain or hold a contraction for a long time). It is important to determine whether a person is focused on muscular strength or muscular endurance before attempting to use the F.I.T.T. Principle.

Remember that the **specificity principle** states that a person must work each muscle group to have strength gains in that particular part of the body.

Frequency - how often a person plans to do muscular strength and/or endurance exercises.

- Beginner
  - 2-3 times per week
  - Full body workout of all 6 body areas
  - 48-72 hours of rest in between workouts
- Intermediate to Advanced
  - 4-5 days per week, often performing split workouts
    - Example: Monday/Thursday work chest, shoulders, triceps and abdominals. Tuesday/Friday work back, legs, and biceps
  - 48-72 hours of rest in between workouts

Intensity - how much weight or force is used relative to how much a person is able to lift.

- Beginner
  - Set the weight for 60-70% of maximum strength
- Intermediate to Advanced
  - Set the weight to 70-90% of maximum strength

Time - is how long you need to spend to see physiological effects. No specific amount of time is recommended for muscle strengthening. Development of muscle strength and endurance is progressive over time based on the Progressive and Overload Principles. Increases in the amount of weight or the days a week of exercising will result in stronger muscles. This will also include repetitions, or how many times a person lifts a weight. 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. 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.

- Beginner
  - 1-3 sets of 8-12 repetitions with 30 seconds to 1 minute in between sets
- Intermediate to Advanced
  - 3-5 sets of 2-6 repetitions with 2 to 5 minutes in between sets
- Endurance
  - 2-3 sets of 12-20+ repetitions with 30 seconds to 1 minute in between sets

Type- the type of muscular strength and/or endurance training the person plans to do. This includes: weight machines, free weights, resistance tubing, medicine ball, and body weight exercises.

The effects of muscle-strengthening actively are limited to the muscles doing the work. As we have learned in this chapter, it is important to work all the major muscle groups of the body: the legs, hips, back, abdomen, chest, shoulders, and arms. The amount of repetitions play a key role in determining if an activity is improving muscular strength or muscular endurance. Low repetitions with more weight will focus more on muscular strength, while high repetitions with less weight will focus more on muscular endurance.

5.8: Recommendations for Resistance Training Programming and Exercises

When creating an exercise program, it is recommended to 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. It is also recommended to choose more compound, or multi-joint exercises, which involve more muscles with fewer exercises. An example of a compound exercise would be completing a lunge with a bicep curl. Exercises should be completed 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.

When completing each resistance training exercise, it is important to be using proper form and in a controlled manner. Each exercise should be completed 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. When performing resistance training exercises, maintain a normal breathing pattern or breathe out during the power phase of the exercise. Whenever possible, train with a partner. Workout partners can provide feedback, assistance, and motivation.

Exercise Order for Resistance Training

When planning a resistance workout, a person should also consider a sequence strategy. When 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. There would be no additional fatigue induced to the muscles for bench press because different muscle groups are being stressed.

Position Stand on Progression Models in Resistance Training for Healthy Adults

When training, utilize both concentric and eccentric muscle actions. When creating your exercise sequence:

- large muscle groups before small muscle groups.

- multiple-joint exercises before single-joint exercises.
- higher intensity before lower intensity exercises

When taking in consideration when to add additional weight to a set, if you are able to lift one to two repetitions over the desired number of repetitions for that set. When increasing weight, consider a 2-10% weight increase.

As a trainee is progressing from beginner to intermediate resistance training, gradually increase the days of resistance training from 2 to 3 days per week. When progressing to advanced resistance training, increase weight training to 4 to 5 days per week.

ACSM Position Stand and Recommendations

The American College of Sports Medicine Position Stand: The American College of Sports Medicine (ACSM) provides recommendations which are consistent with the Physical Activity Guidelines Advisory Committee Report, 2008 regarding aerobic physical activity and resistance training guidelines; however, the ACSM position stand provides additional recommendations for flexibility and neuromotor exercise.

ACSM on Resistance Training for Health and Fitness

Resistance training is for everyone! Take a few minutes to review ACSM on Resistance Training for Health and Fitness. This document looks at the various types of resistance training including looking at the differences between muscular strength, muscular power, muscular hypertrophy, and muscular endurance. It discusses the load amount, the volume in sets and repetitions for each, and the rest periods when focused on the various types of training. This section will introduce sarcopenia and overtraining. We will discuss both in more detail later in the chapter. Lastly, it reviews how to build a complete physical activity program including a review of exercise safety.

Overtraining Continued

If done improperly, resistance training can lead to overuse injuries of the muscle, tendon, or bone. These injuries can occur if the load is too heavy or if the muscles are not given sufficient time between workouts to recover or if joints are not aligned properly during the exercises. Cellular damage to muscle fibers that occurs after intense exercise includes damage to the sarcolemma and myofibrils. This muscle damage contributes to the feeling of soreness after strenuous exercise, but muscles gain mass as this damage is repaired, and additional structural proteins are added to replace the damaged ones. Overworking skeletal muscles can also lead to tendon damage and even skeletal damage if the load is too great for the muscles to bear.

Aging and Muscle Tissue

Although atrophy due to disuse can often be reversed with exercise, muscle atrophy with age, referred to as **sarcopenia** as we learned above, is irreversible. This is a primary reason why even highly trained athletes succumb to declining performance with age. This decline is noticeable in athletes whose sports require strength and powerful movements, such as sprinting, whereas the effects of age are less noticeable in endurance athletes such as marathon runners or long-distance cyclists. As muscles age, muscle fibers die, and they are replaced by connective tissue and adipose tissue (Figure 5.3). Because those tissues cannot contract and generate force as muscle can, muscles lose the ability to produce powerful contractions. The decline in muscle mass causes a loss of strength, including the strength required for posture and mobility. This may be caused by a reduction in the fast-twitch fibers that hydrolyze ATP quickly to produce short, powerful contractions. Muscles in older people sometimes possess greater numbers of slow-twitch fibers, which are responsible for longer contractions and do not produce powerful movements. There may also be a reduction in the size of motor units, resulting in fewer fibers being stimulated and less muscle tension being produced.

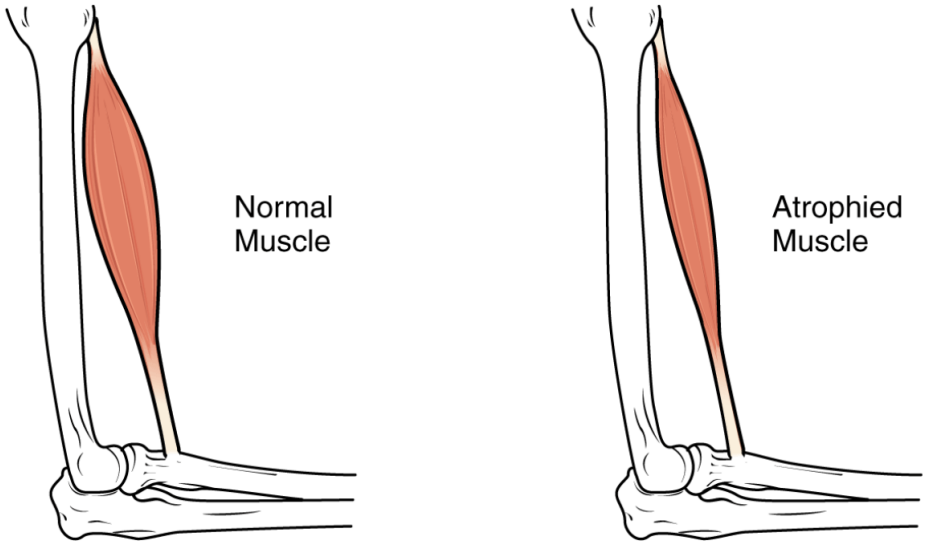


Figure 5.8.1: Normal bicep muscle compared to an atrophied bicep muscle

Sarcopenia can be delayed to some extent by exercise, as training adds structural proteins and causes cellular changes that can offset the effects of atrophy. Increased exercise can produce greater numbers of cellular mitochondria, increase capillary density and increase the mass and strength of connective tissue. The effects of age-related atrophy are especially pronounced in people who are sedentary, as the loss of muscle cells is displayed as functional impairments such as trouble with locomotion, balance, and posture. This can lead to a decrease in quality of life and medical problems, such as joint problems because the muscles that stabilize bones and joints are weakened. Problems with locomotion and balance can also cause various injuries due to falls.

Delayed Onset Muscle Soreness (DOMS)

Have you ever worked out before and been sore a day or two later? Do you know why you are sore? Is it related to lactic acid? This video will discuss what happens to our body physiologically when we feel sore a day or more from working out and how to treat it. DOMS can occur when doing a variety of different types of exercises.

Watch this 16 min 25 second video Causes and Treatments of DOMS - Delayed Onset Muscle Soreness

As you are watching the video and applying it to your personal experience, think through the following questions:

1. Is being sore a bad thing?
2. How do I know if I am sore from working out versus sore because of an injury?
3. How long can I expect to be sore?

5.9: Physiological Benefits to Resistance Exercises

As we have learned, there are many physiological benefits associated with physical activity. We will look at some of the physiological benefits associated with muscular strength and endurance.

Reduce Risk of Type 2 Diabetes and High Blood Pressure

In Chapter 4, we learned that a combination of cardiorespiratory endurance and resistance exercise can reduce the risk for Type 2 diabetes. We also learned habitual aerobic exercise and dynamic resistance training has been shown to decrease blood pressure.

Improved Bone Health and Musculoskeletal Fitness

Just as resistance training improves muscle strength, weight-bearing resistance training and aerobic physical activity may stimulate bones to increase in strength. Research indicates that participation in muscle strengthening activity across the lifespan may positively impact factors related to bone health, such as bone mineral density, mass, or strength. Bone mass accruement predominantly occurs within childhood and early adulthood. However, individuals may improve bone health in later years by participating in specific types of physical activity. Resistance exercise (i.e., weight-lifting programs) appear to have the greatest effects on bone mineral density, with this type of activity recommended at least twice weekly. Risk for osteoporosis, an age-related bone disease characterized by loss of bone density and increased risk for bone fractures, may therefore be decreased through habitual weight-bearing physical activity participation-particularly among postmenopausal women.

Musculoskeletal health is also impacted by age-related factors and can be mediated by engagement in resistance training and other weight-bearing activities. Sarcopenia is the age-related loss of muscle mass and strength; rates of sarcopenia are relatively consistent at approximately 1-2% per year starting at age 50. Of note, greater levels of musculoskeletal fitness are positively associated with feelings of independence and autonomy related to one's mobility, balanced blood glucose, improved bone health, decreased risk of fall and injury, and enhanced overall quality of life. Nonetheless, it is clear that physical activity facilitates similar beneficial effects on bone density and musculoskeletal health no matter an individual's age, but it is critical to commit to lifelong physical activity regimens in order to experience the greatest benefits.

Improved Joint Health

Arthritis is a serious health condition characterized by pain, stiffness, and possible loss of joint function. Regular physical activity participation may be effective in treating symptoms of arthritis. However, one must first concentrate on gradually increasing cardiovascular fitness, with progressive overload of resistance exercises following thereafter. It is also critical to slowly increase flexibility and enhance joint stability through activities requiring increased range of motion and balance.

Improved Body Composition

We will talk more about nutrition and caloric intake in later chapters. Caloric expenditure is most often associated with exercise; however, most of our daily caloric expenditure is to maintain bodily functions, like breathing, circulating our blood, and digesting food. Metabolism is the chemical process in the body that converts calories into energy. Your body needs a minimum number of calories to sustain these functions. Basal Metabolic Rate (BMR) and Resting Metabolic Rate (RMR) are measurements used to estimate how many calories your body burns when you are not exercising. These two measurements are often used interchangeably; however, they do have a slight difference. A BMR measurement is slightly more accurate because it is measured when you are doing nothing, just upon waking up, while laying down in a dark room after sleeping for at least eight hours and fasting for 12 hours. RMR is taken without the strict conditions of BMR; BMR is usually slightly lower than your RMR. Both BMR and RMR measure the amount of energy (calories) that your body needs to stay alive and function properly. It is helpful to understand your BMR/RMR since it accounts for about 60-80% of total energy expenditure each day. Your BMR/RMR is affected by your weight, height, age, gender, and genetics. A key component of your weight that impacts BMR/RMR is the amount of muscle you have. Muscle mass increases your BMR/RMR.

Psychological Benefits of Resistance Exercises

We have learned that there are several psychological benefits to physical activity that are not limited to, but including: enhanced mood, reduced stress, anxiety, and depression, and improved self-esteem.

Enhanced Mood

In Chapter 4, we learned a mood is one's state of mind or feeling. Resistance training programs have been associated with improved mood states in healthy adult populations.

Safety with Muscular Resistance Exercises

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.

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 will get hurt. For these people, there is even more good news: They can take steps that are proven to reduce their risk of injury and adverse events.

The guidelines in this chapter provide advice to help people do physical activity safely. Most advice applies to people of all ages. Specific guidance for particular age groups and people with certain conditions is also provided.

Performance-Enhancing Substances

Some athletes attempt to boost their performance by using various agents that may enhance muscle performance. Anabolic steroids are one of the more widely known agents used to boost muscle mass and increase power output. Anabolic steroids are a form of testosterone, a male sex hormone that stimulates muscle formation, leading to increased muscle mass.

Endurance athletes may also try to boost the availability of oxygen to muscles to increase aerobic respiration by using substances such as erythropoietin (EPO), a hormone normally produced in the kidneys, which triggers the production of red blood cells. The extra oxygen carried by these blood cells can then be used by muscles for aerobic respiration. Human growth hormone (hGH) is another supplement, and although it can facilitate building muscle mass, its main role is to promote the healing of muscle and other tissues after strenuous exercise. Increased hGH may allow for faster recovery after muscle damage, reducing the rest required after exercise, and allowing for more sustained high-level performance.

Although performance-enhancing substances often do improve performance, most are banned by governing bodies in sports and illegal for nonmedical purposes. Their use to enhance performance raises ethical issues of cheating because they give users an unfair advantage over nonusers. A greater concern, however, is that their use carries serious health risks. The side effects of these substances are often significant, nonreversible, and in some cases fatal. The physiological strain caused by these substances is often greater than what the body can handle, leading to effects that are unpredictable and dangerous. Anabolic steroid use has been linked to infertility, aggressive behavior, cardiovascular disease, and brain cancer.

Similarly, some athletes have used creatine to increase power output. Creatine phosphate provides quick bursts of ATP to muscles in the initial stages of contraction. Increasing the amount of creatine available to cells is thought to produce more ATP and therefore increase explosive power output, although its effectiveness as a supplement has been questioned.

6: FLEXIBILITY

6.1: Flexibility

In Chapter 3, we learned that **flexibility** is the ability of moving a joint through the range of motion. Developing a complete fitness program requires taking time to emphasize this component by stretching. Unfortunately, as the American Council on Exercise points out, “Most people neglect flexibility training, limiting freedom of movement, physical and mental relaxation, release of muscle tension and soreness, and injury prevention.”

Perhaps the reason it is so easy for people to overlook flexibility is because its benefits, while significant, are felt more than seen. However, failing to address this component of fitness can have serious consequences, especially as a person ages. Without flexibility, everyday tasks, such as sweeping the floor or even getting out of bed, become difficult. Reduced mobility of joints increases the risk of injury during an exercise routine, as well as the risk of occasional and chronic back pain. This chapter will provide a greater understanding of this vitally important component of a complete fitness program and demonstrate why flexibility shouldn’t be overlooked.

Types of Flexibility

Flexibility is classified into two types: static and dynamic.

Static Flexibility

This type of flexibility is a measure of the limits of a joint’s overall range of motion. It is measured by stretching and holding a joint in the position of its maximum range while using a measuring instrument to quantify that range. To achieve the maximum range, passive forces, the force generated from an external source, are required.

Dynamic Flexibility

This type of flexibility is a measure of overall joint stiffness during movement. Unlike static flexibility, dynamic flexibility requires active force production, or your own muscles contracting. Because quantifying “stiffness,” is difficult, dynamic flexibility is measured more subjectively. Assessment is based on how easy or difficult it is to perform certain tasks, such as swinging a tennis racket, climbing steps, or getting in and out of a car.

The aim of any good stretching program is to improve both static and dynamic flexibility so that normal range of motion can be achieved. The definition of *normal* in this context is one developed from population studies that measured various areas of the body and established an average degree of movement for a particular joint.

6.2: Improving Range of Motion

Joint range of motion results from a combination of factors, which are classified as either internal or external. Internal structures relate to the physical structures of body materials and tissue. External factors are non-structural and include gender, age, excess fat mass, muscle mass, environmental temperature, and restrictions in clothing or equipment.

Internal factors include joint structure/joint mechanics and the connective and soft tissue surrounding the joint. Because muscular actions, such as muscular contractions and stretching, are controlled by the nervous system, another internal factor can be attributed to the neuromuscular system and how the stretching and tension is managed.

Joint Structure

A joint is defined as a location on the skeletal system where two or more bones intersect and interact. For example, the humerus (upper arm) intersects with the radius and ulna (lower arm) at the point of the elbow. The bony formation of each joint structurally limits its range of motion. For example, the shoulder joint, which is structurally a ball-in-socket joint, can rotate in multiple directions, giving it a wide range of motion. However, the knee joint is a modified hinge joint, which is limited to essentially a forward-backward direction of movement.

Additionally, range of motion may be limited to excessive fat mass or even large muscle mass surrounding a particular joint. Although the amount of mass and fat mass surrounding a joint can be altered by diet and activity level, joint structure is permanent. As a result, little can be done to improve flexibility in this area.

Not only is range of motion related to the joint structure, but flexibility exercises are joint-specific. Stretching the hamstring will not improve the flexibility in the shoulders. Likewise, flexibility in the shoulders may be excellent while fingers or ankles remain“stiff.” As such, a complete and effective stretching program includes multiple stretches for various joints.

Connective and Muscle Tissue

Joints are surrounded and connected by muscles, tendons, ligaments, and skin. The head of the humerus fits into a small cavity to create the shoulder joint. However, those bones cannot remain in that position without the muscles, tendons, and ligaments that keep the joint tight and hold it in place. In addition, muscle tissue is surrounded with connective tissue, primarily collagen and elastin. As a joint moves through its normal range of motion, all of this soft tissue must stretch to accommodate the movement. Therefore, static and dynamic flexibility is probably most limited by the flexibility of the surrounding soft tissue, specifically the connective tissue.

While the exact biomechanics of how flexibility is changed is not well understood, they do appear to be related to the elastic and plastic properties of the connective tissue. **Elasticity** is defined as the ability to return to resting length after passive stretching (i.e., elastic recoil). Like a spring, soft tissues stretch and then recoil to their resting position. **Plasticity** is the tendency to assume a greater length after passive stretching (i.e., plastic deformation). Stretching that spring composed of soft tissues will change its resting position to a new longer length. The goal of a flexibility program is to repeatedly overload the elastic properties of the muscle to elicit plastic deformation over time. Experts suggest that a slow, sustained stretch for 30-90 seconds is necessary to produce chronic plastic deformation.

Neuromuscular System

Modern cars come equipped with a central computer and sensors to troubleshoot problems with the vehicle. Sensors in the engine monitor temperature. Sensors on the wheels gauge tire pressure while sensors in the gas tank alert the driver when fuel is low. Much like a car, our bodies are equipped with sensors, called **proprioceptors**, that help us manage movement and prevent injury.

Muscles have two specific types of proprioceptors that determine the length and tension of the muscle. These proprioceptors are called muscle spindles and Golgi tendon organs (GTOs).

Muscle spindles lie parallel to the regular muscle and help determine the length of muscles when they are being stretched. When

a muscle is stretched, it sends signals to the central nervous system causing the stretched muscle to contract. This resistance to the stretch, called **myotatic or stretch reflex**, is generated by the nervous system's reflexive stimulus sent to the stretching muscle. That same signal also causes the antagonist, or opposing muscle to relax, called **reciprocal inhibition**. As such, when the upper thigh muscles (quadriceps are stretched, the hamstrings (antagonist to the quadriceps) relax.

The GTOs are located near the musculotendon junction, the end points of the muscle, and relay messages to the central nervous system regarding muscle lengthening and tension of the muscle. When activated, these signals will override the stretch reflex causing a sudden relaxation of the stretching muscle. This is called **autogenic inhibition** or the inverse myotatic reflex. This inhibitory reflex can only occur after the muscle has been stretched for 5 seconds or longer. This is why, to effectively stretch, movements must be sustained for long, slow increments of time. Otherwise, the resistance encountered from the stretch reflex will not be overridden and lengthening cannot occur. Whether signaling the muscles to contract or relax, the neuromuscular system manipulates the stretched muscle, presumably as a protective mechanism to prevent injury.

6.3: Improving Flexibility

Research has identified multiple stretching techniques that aid in improving range of motion. Regardless of the specific technique or specific mode used, each technique can be performed using either active or passive mode. **Active stretching**, also called unassisted stretching, is done individually without an external stimulus. **Passive stretching**, or assisted stretching, is when a partner or trainer is used as the stimulus in the stretching exercise. Both modes are effective and can be applied to each of the techniques described below.

Static Stretching

The technique most commonly prescribed and used to improve flexibility is the static stretch. A static stretch involves slow, gradual, and controlled movements. The muscle group is stretched toward the end of the joint's range of motion until the point of mild discomfort is reached. Once that point is reached, the stretch is held in a "static" position for 30 to 90 seconds. After the prescribed time, the stretch can be repeated. Common ways in which static stretching is applied would be performing Yoga routines or stretching after a workout or an athletic event. Some of the major advantages of static stretching are as follows:

- It is generally considered safe
- It is simple to perform.
- It is effective at increasing range of motion.

The only major disadvantage comes from doing it too much, which can reduce strength and may make joints unstable. Of course, this potential risk applies to all of the techniques.

Ballistic Stretching

Ballistic stretching involves forceful bouncing or ball-like movements that quickly exaggerate the joint's range of motion without holding the position for any particular duration. This type of stretching involves dynamic movements like those done by athletes during sports events. In that regard, ballistic stretching is seen as being very specific to and beneficial for athletes. However, one criticism of ballistic stretching is that because of the short duration of the stretch and the forceful nature of ballistic movements, the muscular contractions from the stretch reflex may cause muscle soreness or even injury. For that reason, many coaches regard ballistic stretching as unsafe. Also, many researchers contend that it is less effective at improving range of motion. Nonetheless, the American College of Sports Medicine (ACSM) still recommends ballistic stretching as one method to effectively increase flexibility.

Dynamic Stretching

Ballistic stretching is a form of dynamic stretching. However, when referring to dynamic stretching routines, most fitness professionals are referring to dynamic movements that do not involve forceful bouncing motions. Instead, dynamic stretching, in this context, suggests performing exaggerated sports movements in a slower, more controlled manner. For example, a sprinter may use several exaggerated stride lengths before a race to improve a hip range of motion.

An advantage of dynamic stretching is its ability to target and improve dynamic flexibility, which in turn may improve performance. A disadvantage comes from the movements involved, which often require good balance and coordination. Since mastering the correct form requires time and a certain level of athleticism, dynamic stretching may not be suitable for certain populations.

Proprioceptive Neuromuscular Facilitation (PNF) Stretching

This type of exercise usually involves a partner. The partner will passively stretch the person's muscle. This movement is immediately followed by an isometric muscle contraction against resistance. This contraction is then followed by another passive stretch. This type of stretch is also named contract-relax stretch because of thesequence of movements involved. Other types of PNF stretching involve contract-relax-antagonist contraction, also describing the sequence of movements involved but adding an additional step.

As the name of the technique implies, PNF stretching emphasizes the natural interaction of the proprioceptors with the muscles to increase the range of motion during the stretch. Remember that during the stretch, the muscle spindles cause two responses: the stretch reflex and the reciprocal inhibition (the relaxing of antagonist muscle). After 5 seconds, the GTOs then override the muscle spindle's signals causing autogenic inhibition. Because the muscle is relaxed, it can be stretched more easily. To reiterate, the stretch either uses the activity of the antagonist muscle to get the target muscle to relax or the target muscle itself relaxes as a result of the contraction of the antagonist muscle.

While many experts assert that PNF stretching is the most effective technique, studies that compare static and PNF stretching are inconclusive. Regardless, it does appear to be very effective at increasing static flexibility. Some disadvantages to PNF are that it generally requires a knowledgeable partner, it is somewhat complicated, and it can cause soreness as a result of the contraction.

6.4: Benefits of Flexibility and Stretching

Regular stretching provides many benefits, the most important of which is simple: flexibility provides freedom of movement and the ability to complete activities with greater ease.

Healthy Joints and Pain Management

As many as 26 percent of all adults report pain and stiffness in joints. That number increases dramatically with age, and women are more likely to develop joint symptoms. For adults, arthritis is one of the most common conditions, with 54 percent of people 75 years and older having been diagnosed with arthritis. Regular exercise, including regular stretching, is essential for people with arthritis to maintain function and manage joint pain. Even for those not affected by joint conditions, stretching increases joint mobility and function, and decreases joint stiffness and pain.

Imbalances in the muscles can cause discomfort and pain. For example, if the front of a person's thighs and hips gets too tight from a lack of flexibility, the tension will pull on the hips, where the muscles are attached. The result is the pelvis may be pulled forward and cause greater sway in your lower back. This affects posture and can eventually lead to pain and stiffness in the neck, shoulders, and lower back. Stretching all major muscle groups and joint areas regularly promotes good alignment and balance.

Muscle Relaxation and Stress Relief

Staying in one position for long periods of time, repetitive movements, and other everyday stressors can result in stiff muscles and knots, also called trigger points. Regular stretching decreases anxiety, blood pressure, and breathing rate, which help to relax muscles and aches and pains related to neuromuscular tension (stress). Flexibility has also been prescribed successfully to treat dysmenorrhea, which is painful menstruation. It also relieves muscle cramps that can occur during exercise or participation in sports.

We have learned that participation in physical activity may decrease perceptions of stress. Numerous studies indicate the association between regular yoga practice and decreased stress levels. Further, participation in many types of physical activity may prove especially effective in reducing stress in college students and decreasing the number of day-to-day happenings that students perceive to be inconveniences or difficulties (i.e., “life hassles”)

Additional Benefits

In addition to the benefits listed above, research has documented additional benefits that provide good reasons for maintaining a routine of stretching.

There is increased blood flow. Blood carries vital nutrients and oxygen to muscles and tissues. Stretching increases blood flow to the muscles being stretched, which helps them recover from exercise faster.

An additional benefit is reduced risk of developing future lower back pain. Although research is still inconclusive, most experts agree that muscle fitness and stretching exercises reduce the risk of developing lower back pain by counteracting the natural loss in muscle and connective tissue elasticity that occurs with aging.

6.5: Flexibility and Aging

For many college students, maintaining long-term flexibility is not a concern. For young adults, bending over to tie their shoes is painless. Walking around campus with a backpack requires minimal effort. However, a person's range of motion declines with age. Simple activities like rotating the head and neck to glance over the shoulders,getting in and out of a vehicle, or carrying groceries can become painful. Therefore, flexibility is critical in maintaining a high quality of life throughout the aging process.

The Inactivity-Mobility Cycle

Anyone who has suffered an injury and had to wear a splint, cast, or brace to immobilize a joint knows how important mobility is to overall health. Unfortunately, when the joints' range of motion becomes restricted by arthritis or other injuries, activity declines. As activity declines, the range of motion continues to diminish as a result of inactivity, and a vicious cycle ensues. A simple stretching program can help alleviate this problem and break the cycle.

Creating an Effective Stretching Program

In order to create an effective stretching program, you first need to evaluate your current flexibility status by assessing various joints' range of motion. A popular flexibility assessment is the sit-and-reach test. The sit-and-reach test assesses your hamstring and lower back flexibility. Another method of assessing flexibility is using a goniometer. A goniometer can be used to assess the range of motion in your ankles, knees, hips, neck, and shoulders. There are many ways to assess flexibility. These are just a few examples.

Setting Flexibility Goals

Once you determine which of your joints are the most and least flexible, you can set some realistic goals to improve or maintain your range of motion. Be specific when you set goals. Instead of just saying, "I want to increase my flexibility," identify the specific area of the body you intended to improve. You will also want to make sure your goal can be measured. A better way to state your goal is, "I will improve my sit-and-reach score by 4 cm by the end of the semester." Notice this goal, as stated, includes a specific area, is measurable, and includes a deadline. By stating your goal properly, you will increase the likelihood of achieving it.

Applying the F.I.T.T. Principle for Flexibility

When designing a flexibility program, use the F.I.T.T. Principle (Frequency, Intensity, Time, and Type). Your flexibility program should include multiple stretching exercises that target all major joints, including the neck, shoulders, elbows, wrists, trunk, hips, knees, and ankles.After selecting your exercise, follow the recommendations below when performing your routine:

Frequency: At least 2-3 times per week, ideally 5-7 days per week. Daily stretching is most effective.

Intensity: Stretch to the point of tightness or mild discomfort.

Time (duration of each stretch): Stretch for a minimum of 10 seconds for very tight muscles with an emphasis on progressing 30-90 seconds. Complete two to four repetitions of each stretch.

Type (mode): Select the technique that best suits your circumstances: static, dynamic, ballistic, or PNF.

When to Stretch

Although stretching can be done any time, the ACSM traditionally recommends that flexibility training be incorporated into the warm up or cool down phase of an exercise session. Recent studies suggest that stretching before an exercise session will compromise the force-producing capabilities of muscles and should be avoided. Therefore, it is recommended that stretching be restricted to after the warm-up or workout, when the temperature of the body and muscles has increased. Additional evidence pertaining to this concept shows that applying heat packs for 20 minutes to increase muscle temperature can increase hamstring

flexibility more so than 30 seconds of static stretching. These findings confirm that temperature also plays a significant role in muscle range of motion.

Stretching Safely

In addition to warming up your muscles before performing stretching exercises, additional precautions can be taken to ensure the safety of your routine. When muscles are stretched quickly and forcefully, the stretch reflex can be activated. This creates significant tension because the muscle fibers will not only be stretching but also attempting to contract. As mentioned previously, this is one of the reasons ballistic stretching may not be suitable for everyone. To avoid this, stretch slowly and in a controlled fashion while holding the stretch for 10 seconds or more.

Most joints you use during exercise are synovial joints, which have synovial fluid in the joint space between two bones. Exercise and stretching may also have a beneficial effect on synovial joints. Synovial fluid is a thin, but viscous film with the consistency ofegg whites. When you first get up and start moving, your joints feel stiff for a number of reasons. After proper stretching and warm-up, the synovial fluid may become less viscous, allowing for better joint function.

Research indicates that some stretches are **contraindicated**, which means they are not recommended because they provide little to no benefit and may cause injury. To avoid injury, it is important to consider personal limitations before performing a stretch exercise.

Flexibility Testing

The first step in creating a successful flexibility program is to assess your own flexibility. Follow the links below for instructions on how you can perform these assessments.

Flexibility and Mobility Testing

7: NUTRITION

7.1: Introduction to Nutrition for Health and Physical Activity

An individual's wellness may be influenced by food and dietary choices. Indeed, a nutritious and balanced diet may positively impact health throughout the lifetime, prevent a variety of chronic diseases, and improve performance during exercise and physical activity participation. This chapter will explore basic principles regarding balanced nutrition, and will emphasize the importance of healthy eating patterns for optimal wellness and physical activity performance. Additionally, common barriers to healthy eating will be identified, and nutritional education and meal planning resources will be provided for the busy college student.

Introduction to Nutrition

Nutrients are components found in food and dietary supplements. Nutrients provide an individual with energy needed for growth and movement (i.e., physical activity), and play a critical role in the maintenance of bodily functions. There are six nutrients which are considered necessary, or essential, in the human diet. These essential nutrients are: carbohydrates, fats, proteins, vitamins, minerals, and water.

Essential nutrients are nutrients that cannot be synthesized in the body in adequate amounts. Therefore, essential nutrients must be consumed in a person's diet. This differs from nonessential nutrients. Nonessential nutrients are nutrients that can be synthesized in the body and also can be found in food. An example of a nonessential nutrient is creatine.

Nutrients can also be divided into macronutrients and micronutrients. Macronutrients are nutrients which the body requires in relatively large amounts. The daily requirements of macronutrients is generally measured in grams. Macronutrients include: carbohydrates, fats, proteins, and water. Micronutrients are nutrients which the body requires in minute amounts. The daily requirements for micronutrients are generally measured in milligrams or micrograms. Micronutrients include minerals and vitamins.

Nutrients

We are going to look at what your food is made up of, which means we are going to look at the nutrients provided to your body when you consume food. As mentioned in our introduction, nutrients are commonly divided into two categories, macronutrients and micronutrients.

Macronutrients include carbohydrates, fats, and proteins. Micronutrients are vitamins and minerals.

We also learned in our introduction that some nutrients are essential and some are considered nonessential. Essential nutrients are nutrients that must be consumed through the foods we eat, the body cannot synthesize the nutrients. Nonessential nutrients are nutrients that the body can synthesize, so they do not need to be consumed from food.

Three essential nutrients provide energy. The energy is called Calories. The three essential nutrients that provide energy, also known as Calories, are carbohydrates, fats, and proteins. Alcohol also provides energy (Calories), but is not considered an essential nutrient. The other nutrients do not directly provide Calories, but they do aid in the production and utilization of energy by the body.

7.2: MACRONUTRIENTS

Carbohydrates (Starch, Fiber, and Sugar)

A carbohydrate is a molecule containing carbon, hydrogen, and oxygen. Carbohydrates are commonly referred to as carbs. They are one of the main types of nutrients and they are the most important source of energy for your body.

For each gram of carbohydrate we consume, we are provided with 4 calories. This is less than half of the Calories provided by one gram of fat! Carbohydrates are the primary energy source for the body's cells, tissues, and organs (such as the brain and muscles).

When we eat carbohydrates, our body breaks them down into glucose. Glucose then enters our blood stream and is readily available to provide energy to the body both to fuel the brain and nervous system and provide quick energy for exercising. If glucose in the blood, often called blood sugar, is not immediately used, it is stored in the liver and muscles for later use.

On your food label you will see the total carbohydrate intake, which is further broken down into fiber and sugar intake. Carbohydrates are made up of three components: fiber, starch, and sugars. Carbohydrates are present in food in the form of sugar, starch, or fiber. Carbohydrates can be simple (i.e., monosaccharide meaning a single sugar molecule) or complex (i.e., polysaccharide meaning a chain of sugar molecules). Fiber and starch are considered complex carbohydrates and sugar is a simple carbohydrate. Complex carbohydrates have more nutrients than simple carbohydrates and are better for your health. Complex carbohydrates are higher in fiber, so they digest more slowly, and keep us feeling fuller for a longer period of time.

Here are some examples of the types of carbohydrates in foods:

- Simple Carbohydrates: Candy, carbonated beverages, corn syrup, fruit juice, honey, table sugar
- Complex Carbohydrates: Apples, broccoli, lentils, spinach, unrefined whole grains, brown rice
- Starches: Potatoes, chickpeas, pasta, and wheat
- Fiber:
    - Insoluble: Brans, seeds, vegetables, brown rice, potato skins
    - Soluble: Freshly fruit, oat, broccoli, and dried beans

The Role of Fiber in Your Health

We need fiber in our diet! Dietary fiber supports our bowel movements, lowers blood glucose and cholesterol levels, and reduces calorie intake. Unfortunately, more than 90 percent of women and 97 percent of men do not meet recommended intakes for dietary fiber. More than 85 percent of adults do not meet the recommended intakes of fruits, vegetables, and whole grains which would provide them with fiber. In addition, they eat a high amount of processed (refined) carbohydrates which reduce the natural fiber content.

A dietary fiber is a type of carbohydrate that cannot be broken down in the body; therefore, dietary fiber does not provide energy in the form of calories. However, consumption of dietary fiber is important for optimal gastrointestinal health, blood sugar and cholesterol control, and healthy weight maintenance.

Figure 7.2.1: Importance of Fiber

Soluble and Insoluble Fiber

Fiber is commonly classified as soluble, which dissolves in water, or insoluble, which doesn't dissolve. Soluble fiber dissolves in water to form a gel-like material. It can help lower blood cholesterol and glucose levels. Soluble fiber is found in oats, barley, nuts, seeds, beans, lentils, peas, and some fruits and vegetables. Insoluble fiber promotes the movement of material through your digestive system and adds bulk to the stool, so it can be of benefit to those who struggle with constipation or irregular stools. Insoluble fiber is found in foods such as wheat bran, vegetables, and whole grains.

Refined (Processed) versus Unrefined Carbohydrates

Refined grains are foods that have been processed to remove parts of the grains, which then also removes some of the nutrients that are good for your health. For example, do you choose to eat white rice or brown rice? White rice begins as brown rice and then it gets processed (refined) to remove the risk's husk, bran, and germ. When this happens, it removes important nutrients such as fiber, vitamins, and minerals. People sometimes refer to refined carbs as empty carbs or empty calories. The body processes refined carbs quickly, so they do not provide lasting energy, and they can cause a person's blood sugar to spike. Sometimes the white rice is "enriched" whereby fiber, vitamins, and minerals are added back into the rice.

To increase your fiber intake, choose whole grains that have not been refined (processed). To figure out whether a product has a lot of whole grain, check the ingredients list on the package and see if a whole grain is one of the first few items listed. You can also reference the Current Dietary Guidelines.

The Role of Sugar in Your Health

When looking at the food label you will notice data for total sugar and added sugars. Including added sugars was a part of the update to the new food labels. Previous to this update, only total sugar was included. The difference in the two numbers is the source of the sugar, whether it is a naturally occurring sugar or sugar that has been added. Most Americans exceed the recommended limits for added sugars in the diet. There is evidence that diets low in sugar are associated with a reduced risk of developing cardiovascular disease and diets higher in all sugars can increase the risk of developing cavities.

Natural Sugar versus Added Sugar

There are sugars that naturally present themselves in foods and sugars that are added to foods. Below are some examples of both. Sugars naturally present in food include:

- Dairy products (such as milk and yogurt)

- Fruit (fresh, frozen, dried, and canned in 100% fruit juice)
- 100% fruit and vegetable juice
- Vegetables

Added sugars include:

- Baked goods (such as cakes, cookies, pastries, and pies)
- Desserts (such as ice cream and puddings)
- Salad dressings, sauces, spreads, condiments, and gravies
- Sugar-sweetened beverages (such as energy drinks, fruit drinks, soft drinks, sports drinks, and sweetened coffee and tea)
- Sweets (such as candies, jams, sweet toppings, and syrups)
- Single-ingredient sugars (such as table sugar, maple syrup, or honey)

Tips for Consuming Carbohydrates

Here are some tips for consuming carbohydrates:

- Use the food label to understand whether the food you are consuming is considered high or low based on the Percent Daily Value. Note the total Percent Daily Value for carbohydrates, which will help you meet the Acceptable Macronutrient Distribution Range (AMDR) for carbohydrates. That is to consume between 45-65% of your calories from carbohydrates.
- Eat more whole grains (such as brown rice, bulgur, couscous, and quinoa) and choose whole grain versions of common carbohydrates such as breads, cereals, pasta, and rice.
- Look for options that are lower in added sugars, saturated fats, and/or sodium, such as: bread instead of croissants; English muffins instead of biscuits; and plain popcorn instead of buttered.
- Choose whole fruit (fresh, frozen, dried, and canned in 100% fruit juice) as snacks and desserts and use fruit to top foods like cereal, yogurt, oatmeal, and pancakes.
- Keep raw, cut-up vegetables handy for quick snacks. Choose colorful dark green, orange, and red vegetables (such as broccoli florets, carrots, and red peppers).
- Add beans and peas or unsalted nuts and seeds to salads, soups, and side dishes. These are great sources of dietary fiber and protein.
- Try unsweetened or no-sugar added versions of fruit sauces (such as applesauce) and plain, fat-free or 1% low-fat yogurt.
- More often, choose beverages such as water and fat-free or 1% low-fat milk. Less often, choose beverages that are high in calories but have few or no beneficial nutrients, such as energy drinks, fruit drinks, soft drinks, and sport drinks.
- Consume smaller portions of foods and beverages that are higher in added sugars or consume them less often.

7.2.1: Proteins (Amino Acids)

7.2.2: Fats (Lipids) and Cholesterol

7.2.3: Sodium

7.2.1: Proteins (Amino Acids)

A protein is a complex structure containing carbon, hydrogen, oxygen, and nitrogen. As we have learned our bodies need energy in the form of Calories. The protein we eat provides our body Calories Our bodies need protein from the foods we eat to provide us with energy (Calories). In addition, our bodies use protein to build, maintain, and repair bones, muscles, and skin. Protein is a component of every cell in the human body, found in almost all body fluids, and is important for many body processes, such as blood clotting, fluid balance, immune response, vision, and production of hormones, antibodies, and enzymes. Proteins are generally only utilized for energy if the body is not receiving enough calories from other dietary sources (i.e., carbohydrate or fat). Most Americans get the recommended amounts of protein to meet their needs.

Like carbohydrates, proteins provide us with 4 Calories of energy per gram consumed. Protein is found in both plant and animal foods. We commonly get proteins in our diet from meat, dairy products, nuts, and certain grains and beans.

Proteins are made up of amino acids. There are 20 different amino acids that can be combined to make every type of protein in the body. Imagine each amino acid was a Lego piece and by combining various amino acids together you make different proteins. Of the 20 amino acids, 9 of them are considered essential, meaning we need to bring them into our body through the food we eat. The other 11 amino acids are called non-essential because our body can produce them, so we do not need to consume them in our diet. A protein that contains all 9 essential amino acids is called a **complete protein**. Most complete proteins come from animal sources, such as dairy products, eggs, meats, poultry, seafood, and soy is a plant-based complete protein source. In complete proteins are either missing one or more of the 9 essential proteins or do not contain enough of one of them. Most plant foods such as beans, grains, nuts, peas, seeds, and vegetables are incomplete protein sources. Foods can be combined together to provide all 9 essential amino acids, this is called **complementary proteins**. For example, grains are low in the amino acid lysine, while beans and nuts (legumes) are low in the amino acid methionine. When grains and legumes are eaten together, such as rice and beans or peanut butter on whole wheat bread, they form a complete protein.

Tips for Consuming Protein

Here are some tips for consuming protein:

- The Daily Value for protein is 50 grams per day. This is based on a 2,000 calorie daily diet. Your personal Daily Value may be higher or lower depending on your calorie needs. Look at your food label to see whether the food you are eating is high or low in protein by looking at the Percent Daily Value. Note the total Percent Daily Value for proteins which will help you meet the AMDR for proteins which is to consume between 10-35% of your calories from proteins.
- Choose a variety of protein foods, such as beans and peas, eggs, fat-free or 1% low-fat dairy products, lean meats and poultry, seafood, soy products, and unsalted nuts and seeds.
- Choose seafood and plant sources seafood and plant sources of protein (such as beans and peas, tofu and other soy products, and unsalted nuts and seeds) in place of some meats and poultry.
- Add beans and peas to salads, soups, and side-dishes or serve them as a main dish.
- Substitute fat-free or 1% low-fat dairy products and fortified plant-based beverages (such as soy, rice, and almond) for whole and 2% reduced-fat dairy products.
- Select fresh meats, poultry, and seafood, rather than processed varieties.
- Trim or drain fat from meats before or after cooking and remove poultry skin before eating.
- Try baking, broiling, grilling, or steaming. These cooking methods do not add extra fat.

7.2.2: Fats (Lipids) and Cholesterol

The first nutrients on the food label are fats and cholesterol. Fats are also called lipids. We need both fats and cholesterol; however, too much of both can negatively impact your health.

We need fats in our diet for many reasons. First, fats provide us with energy. For every gram of fat you consume, you are provided with 9 Calories of energy. Fat is considered a high energy nutrient. Fat also provides us with long term energy storage, so if we do not consume energy our body can burn out stored body fat. Our body needs fat for other basic bodily function such as the synthesis of cell membranes, for growth and development, healthy skin and hair, blood clotting, nervous system function, reproduction, immune response, and to absorb important fat-soluble vitamins (vitamins A, D, E, and K). Fats also make food taste really good and help you feel full. Fat is found in foods from both plants and animals.

Types of Fats

As you can see on the food label, there are a few different kinds of fats. The foods you eat might have saturated fats, unsaturated fats, or trans fats.

Saturated Fat

Saturated fat is found in higher proportions in animal products. It is usually solid at room temperature. Saturated fats are commonly found in the following: animal fats, baked goods, condiments, gravies, dairy products (whole and 2% reduced-fat), desserts, meats and poultry, processed meats and poultry produces, pizza, salad dressings, sandwiches, snack foods, spreads, sweets, tropical plant oils, and vegetable shortening.

Trans Fat

Trans fats can be either natural or artificial. Small amounts of trans fats are found in dairy products, beef, and lamb. Artificial trans fats are typically found in products that have hydrogenated oils. If you see hydrogenated vegetable oil in the ingredients list, this means there are trans fats in that item. Although originally deemed safe, it was found that trans fats have detrimental effects on health and as of 2018 most trans fats have been removed from foods. Artificial trans fats were primarily found in a variety of foods, such as baked goods, coffee creamer, and ready to use frostings, snack foods, and stick margarine.

Unsaturated Fat

On the food label you will see unsaturated fats in two categories: monounsaturated and polyunsaturated fats. Unsaturated fats are found in higher proportions in plants. They are usually liquid at room temperature, such as oils. Unsaturated fats are commonly found in the following: avocados, fish, mayonnaise and oil-based salad dressings, nuts, olives, seeds, soft margarines, and vegetable oils.

Good and Bad Fats: Impact to Cholesterol

To understand whether a fat is considered good or bad we have to first understand what Cholesterol is. Although Cholesterol is commonly referred to negatively, it is not always bad for you. Our body, specifically our liver, produces cholesterol because we need it for cell membranes and to aid in the synthesis of substances that are vital for our health including steroid hormones, bile acids, and Vitamin D.

If you go to the doctor and get your cholesterol tested your doctor will give you three different numbers: Total Cholesterol, high density lipoprotein (HDL), and low density lipoprotein (LDL). Lipoproteins transport cholesterol in the body. The difference between HDL and LDL is the action of the lipoprotein. LDLs take cholesterol from the liver and transport it to tissues. HDLs do the opposite by transporting cholesterol from tissues to the liver, they are sometimes referred to as “reverse cholesterol transport.” HDL helps remove cholesterol from your arteries. When you have a lot of LDLs taking cholesterol to tissues it can cause a buildup of cholesterol on the walls of your blood vessels, which is bad, and can increase your risk of cardiovascular disease. Your total

cholesterol number is a measure of the total amount of cholesterol in your blood. It includes both LDL cholesterol and HDL cholesterol.

There is evidence that diets higher in saturated fat and trans fat are associated with increased levels of total cholesterol and/or LDL (bad) cholesterol which, in turn, areassociated with an increased risk of developing cardiovascular disease. As we have learned, cardiovascular disease is the leading cause of death in both men and women in the United States.

According to the Dietary Guidelines for Americans, many foods that are higher in dietary cholesterol are generally higher in saturated fat and diets higher in saturated fat are associated with an increased risk of developing cardiovascular disease. Therefore, it is recommended to keep the intake of dietary cholesterol as low as possible while maintaining a healthy diet.

Because of the relationship between saturated fats and high LDL, the Dietary Guidelines for Americans recommend consuming less than 10% of calories per day from saturated fat.

Tips for Consuming Fats

Here are some tips for consuming fats:

- Pay attention to the Percent Daily Value of fats on the food label, especially for saturated trans fats. You should note the total Percent Daily Value for fats. This will help meet the AMDR for fats which is to consume 20-35% of your calories from fats.
- Look for ways to replace saturated fat with unsaturated fats when possible and try to avoid artificial trans fat.
- Choose lean cuts of meat and poultry. Trim or drain fat from meats before or after cooking and remove poultry skin before eating.
- Try seafood and plant sources of protein (such as soy products and unsalted nuts and seeds) in place of some meats and poultry.
- Substitute fat-free or 1% low-fat dairy products and fortified plant-based beverages (such as soy, rice, and almond) for whole and 2% reduced -fat dairy products.
- Cook and bake with liquid oils (such as canola and olive oil) instead of solid fats (such as butter, lard, and shortening).
- Try baking, broiling, grilling, and steaming. These cooking methods do not add extra fat.
- Limit baked goods, desserts, fried fast foods, and snack foods.
- When eating out, ask which fats are being used to prepare your meal. You can also ask if nutrition information is available to help you make informed choices.

Figure 7.2.2.1: Avoid Trans Fat

7.2.3: Sodium

Although sodium and salt are often used interchangeably, sodium is a mineral found in salt. Sodium is an essential nutrient that the human body needs for many body processes, such as fluid balance, muscle contraction, and nervous system function. However, too much sodium increases your risk of developing high blood pressure, which can raise the risk of heart attacks, heart failure, stroke, kidney disease, and blindness.

Sodium comes from the foods we eat. It is estimated that most of the sodium a person consumes comes from packaged or prepared meals (i.e., restaurants and fast food). Sodium enhances the flavor of food and can also be used to cure meat or preserve food.

The Dietary Guidelines for Americans recommend limiting sodium intake to less than 2,3000 milligrams (mg) per day, which is equal to about 1 teaspoon of salt! MostAmericans eat about 3,4000 mg of sodium per day, well exceeding the recommended limits for sodium in the diet.

Look at your food label and see whether the food you are eating is a high contributor (>20% Percent Daily Value) to your recommended daily limit or a low contributor (<5 Percent Daily Value).

Tips for Consuming Sodium

- Look for light, low sodium, reduced sodium, or no-salt-added versions of packaged foods. Prepare your own food when you can limit packaged sauces and flavored products (such as rice and pasta mixes and instant noodles).
- Flavor foods with herbs and spices and no-salt seasoning blends instead of adding salt to foods when cooking, baking, and eating.
- Choose fresh meats, poultry, and seafood, rather than processed varieties. Also, check the package on fresh meats and poultry to see if salt water or saline has been added.
- Buy fresh, frozen (no sauce or seasoning), low sodium, or no-salt-added canned vegetables.
- Rinse sodium-containing canned foods, such as beans, tuna, and vegetables before eating.
- Try light or reduced sodium condiments, add oil and vinegar to salads rather than bottled dressings, and use only a small amount of seasoning from flavoring packets instead of the entire packet.
- Choose low sodium or no-salt-added nuts, seeds, and snack foods (such as chips and pretzels) or choose a healthier snack instead (such as carrot or celery sticks).
- Consume smaller portions of foods and beverages that are higher in sodium or consume them less often.
- When eating out, ask that your meal be prepared without salt and request that sauces and salad dressings be served “on the side,” then use less of them. You can also ask if nutrition information is available and then choose options that are lower in sodium.

7.3: Micronutrients

At the bottom of the food label you will see the select vitamins and minerals. Both vitamins and minerals are important for your health. The human body needs the right"mix" of nutrients for good health, each one has a different role in the health of the body. The majority of Americans get the recommended amounts of most vitamins and minerals to meet their needs; however, many people do not get the recommended amounts of vitamin D, calcium, iron, and potassium. These nutrients are considered "nutrients of public health concern" because low intakes are associated with potential health risks.

There are 14 vitamins and 14 minerals that may be included in the food label. These include the following vitamins:

- Vitamins A, C, D, E, K, and the B vitamins (thiamine, riboflavin, niacin, pantothenic acid, biotin, B6, B12, and folate)

The 14 minerals include:

- Calcium, chloride, chromium, copper, iodine, iron, magnesium, molybdenum, phosphorus, potassium, selenium, sodium, and zinc.

Vitamins

A vitamin is a complex organic compound that is naturally present in many plant and animal products. Vitamins are an essential part of a healthy diet and are required for optimal functioning of the body including in maintaining healthy tissue and aiding in nutrient absorption. However, vitamins are not an energy source and therefore do not contain calories.

Vitamin C and the B vitamins are called water-soluble vitamins. Vitamins A, D, E, and K are called fat-soluble vitamins. Most vitamins are essential and must be acquired through the foods we eat. The body can make a few vitamins such as Vitamins D, choline, and biotin.

Common Foods that are rich in vitamins include:

- Vitamin A - carrots, sweet potatoes
- Vitamin B, folate - starches, grains, cereals
- Vitamin C - citrus fruits, bell peppers
- Vitamin D - milk, dairy products, mushrooms, egg yolks
- Vitamin E- sunflower seeds, almonds, spinach
- Vitamin K - kale, broccoli

Many people do not consume enough vitamin D, calcium, iron, and potassium. Take some time to review the food sources of vitamin D, calcium, iron, and potassium so that you can help you increase your daily intake.

Minerals

A mineral is a chemical element found in nature and it is essential for living organisms. Minerals are inorganic substances that are found naturally in soil and water. Many minerals are required for bodily functions (i.e., proper water balance in the body, bone health, etc.); however, some minerals are needed in larger amounts than others. The minerals needed in small quantities are known as "trace minerals." Minerals do not provide energy (i.e., Calories) for the body.

Common foods rich in minerals include the following:

Calcium - milk, dairy products, dark leafy green vegetables

Iron - nuts, seeds, beef

Magnesium - seafood, legumes, whole grains

Potassium - potatoes, avocados, bananas

Tips for Consuming Vitamins and Minerals

- Look at your food label to understand how the food you are eating is providing you with vitamins and minerals, especially focusing on Vitamin D, iron, calcium, and potassium. Pay attention to the percentage of your Daily Value the food provides.
- Eat a variety of colorful vegetables (such as fresh, frozen, canned, and dried) and 100% vegetable juices. Buy frozen (without butter or sauce) and low sodium or no-salt-added canned vegetables. Try vegetables as snacks, salads, side dishes, and as part of main dishes.
- Focus on whole fruits (such fresh, frozen, dried, and canned in 100% fruit juice). Try fruits as snacks and desserts and add fruit to salads, side dishes, and to top foods like cereal, pancakes, and yogurt.
- Make at least half your grains whole grains. Look for foods with a whole grain listed as the first or second gran ingredient after water. Try whole grains (such as brown rice, couscous, and quinoa) as side dishes and switch from refined to whole grain versions of commonly consumed foods (such as breads, cereals, pasta, and rice).
- Vary your protein routine. Try beans and peas, fat-free or 1% low-fat dairy products, eggs, lean meats and poultry, seafood , soy products, nuts, and seeds. Choose seafood and plant sources of protein (such as beans and soy products) in place of some meats and poultry. Add beans or peas to salads, soups, and side dishes and try unsalted nuts or seeds as snacks.
- Substitute fat-free or 1% low-fat dairy products and fortified plant-based beverages (such as soy, rice, and almond) for whole and 2% reduced-fat dairy products.

7.4: Energy Requirements and Dietary Health

Energy Derived from Nutrients

Nutrients in food provide an individual with energy input (energy derived from consumption), and fuel energy expenditure (energy which is utilized to maintain bodily functions and physical activity).

Calories

A **Calorie** is a unit of energy in food. It refers to how much energy the food provides. Our bodies need energy (Calories) to keep us alive and our organs functioning normally. When we eat and drink, we put energy (Calories) into our bodies, and we use that energy in many ways. For example, we use that energy to keep our heart beating, to breathe, to digest food, to move throughout the day, to exercise, or to participate in sports.

Although the term Calorie is the term commonly used, the true unit of measure is a kilocalorie (kcal). One kilocalorie is the same as one Calorie (note the uppercase C). In technical terms, a kilocalorie is the amount of heat required to raise the temperature of 1 kilogram of water 1 degree Celsius.

The majority of energy (i.e., calories) contained in food (i.e., carbohydrates, proteins, fats) is absorbed into the body during digestion. The caloric value of 1 gram carbohydrate, protein, fat, and alcohol are listed below. Minerals and vitamins do not provide a measurable source of energy for the body.

- 1 gram of carbohydrate = 4 calories (kcal)
- 1 gram protein = 4 calories (kcal)
- 1 gram fat = 9 calories (kcal)
- 1 gram alcohol = 7 calories (kcal)

When looking at the amount of calories on your food label, it is important to recognize the amount of calories in the food you are eating compared to how many calories you should consume each day. Look at the very bottom of the food label and you should see an asterisk with a statement similar to “2,000 calories a day is used as a general guide for nutrition advice.” Although 2,000 calories is used, the total number of calories you need each day varies depending on a number of factors including your age, sex, height, weight, level of physical activity and pregnancy or lactation status. The total number of calories you should consume may also be determined by whether you would like to lose, maintain, or gain weight affects how many calories should be consumed. We will discuss in the next chapter how to calculate that.

As you look at the Calories on your food label compared to your recommended daily caloric intake, be mindful of your energy balance. Energy balance refers to the balance of calories consumed through eating and drinking compared to calories burned through daily activities and physical activity. If we consume more Calories (energy) than we use throughout the day, we store that energy for use at a later time as body fact. If we consume less Calories (energy) than we use throughout the day, we utilize our stored body fat for energy.

Estimated Energy Requirement (EER) Activity

Each individual has a vastly different nutritional and energy-intake needs based upon personal factors such as physical activity level and genetics. However, an equation to determine a generalized energy-intake range (i.e., an estimate of the daily calories needed to maintain current weight) may be found by inputting your personal data into the EER calculator. You may complete the EER activity from the Institute of Medicine. It should be noted that the EER activity provides a general estimate of how energy-intake needs may change based upon physical activity and is not intended as a diet plan. Dietary recommendations may only be made by a licensed healthcare professional.

Choosing Nutrient-Dense Foods

A nutrient-dense food is one that is high in nutrients, but comparatively low in calories. Nutrient-dense foods contain

micronutrients (vitamins and minerals) and macronutrients (complex carbohydrates, protein, and healthy fats). Common Nutrient-Dense Foods include: fruits and vegetables, whole grains, low-fat or fat-free milk products, seafood, lean meats, eggs, peas, beans, and nuts.

7.5: Nutrition and Reduction of Risk for Chronic Disease

An individual's diet may reduce the risk for certain conditions or diseases. Current literature suggests that dietary factors may play a role in the development of severalchronic diseases, including but not limited to the following: diabetes, cardiovascular disease, and cancer. The World Health Organization (WHO) has identified several harmful health outcomes which may be meaningfully influenced by diet: excess weight and obesity, low bone mineral density and osteoporosis, and poor dental health. Specific nutrients may combat harmful health conditions when they interact with metabolic processes. Metabolic pathways include the inactivation of carcinogens, reductions in inflammation, body fat, and insulin sensitivity, and improvements in the immune system. Recent research has focused upon an association between increased consumption of fruits and vegetables, and reductions in the risk for all-cause mortality and cardiovascular mortality. However, the literature regarding potential correlations between diet, disease, and risk reduction is vast, and therefore will not be explored in great detail within the confines of this chapter.

Figure 7.5.1: Dietary habits may meaningfully impact an individual's health and influence risk for chronic disease (i.e., cardiovascular disease, diabetes, etc.). Increasing intake of nutrient-dense foods, such as fruits and vegetables, is a good strategy to optimize dietary health. Photo by Raquel Martínez on Unsplash

7.6: Dietary Guidelines for Americans

The 2020-2025 Dietary Guidelines provides four overarching guidelines that encourage healthy eating patterns at each stage of life and recognize that individuals will need to make shifts in their food and beverage choices to achieve a healthy pattern. The four goals discuss dietary patterns and nutrient density. Before we get to the four overarching goals, let us define these terms.

A **dietary pattern** is the combination of foods and beverages that constitutes an individual's complete dietary intake over time. This may be a description of a customary way of eating or a description of a combination of foods recommended for consumption.

Nutrient-dense foods and beverages provide vitamins, minerals, and other health-promoting components and have little added sugars, saturated fat, and sodium. Vegetables, fruits, whole grains, seafoods, eggs, beans, peas, and lentils, unsalted nuts and seeds, fat-free and low-fat dairy products, and lean meats and poultry (when prepared with no or little added sugars, saturated fat, and sodium) are nutrient-dense foods.

The Four Overarching Goals of 2020-2025 Dietary Guidelines for Americans

Here are the four overarching goals of the 2020-2025 Dietary Guidelines for Americans:

1. Follow a healthy dietary pattern at every stage, it is never too early or too late to eat healthfully.
2. Customize and enjoy nutrient-dense food and beverage choices to reflect personal preferences, cultural traditions, and budgetary considerations. A healthy dietary pattern can benefit all individuals regardless of rage, race, or ethnicity, or current health status. The Dietary Guidelines provides a framework intended to be customized to individual needs and preferences, as well as the food ways of the diverse cultures in the United States.
3. Focus on meeting food group needs with nutrient-dense foods and beverages, and stay within calorie limits.
    1. An underlying premise of the Dietary Guidelines is that nutritional needs should be met primarily from foods and beverages, specifically nutrient-dense foods and beverages. Nutrient-dense foods providevitamins, minerals, and other health-promoting components and have no or little added sugars, saturated fat, and sodium. A healthy dietary pattern consists of nutrient-dense forms of foods and beverages across all food groups, in recommended amounts, and within calorie limits. The core elements that make up a healthy dietary pattern include:
        1. Vegetables of all types including dark green, red, and orang; beans, peas, and lentils; starchy; and other vegetables
        2. Fruits, especially whole fruit
        3. Grains, at least half of which are whole grain
        4. Dairy, including fat-free or low-fat milk, yogurt, and cheese, and/or lactose-free versions and fortified soy beverages and yogurt as alternatives
        5. Protein foods, including lean meats, poultry, and eggs; seafood; beans,peas, and lentils; and nuts, seeds, and soy products
        6. vi. Oils, including vegetable oils and oils in food, such as seafood and nuts
4. Limit foods and beverages higher in added sugars, saturated fat, and sodium, and limit alcoholic beverages.
    1. At every life stage, meeting food group recommendations, even with nutrient-dense choices, requires most of a person's daily calorie needs and sodium limits. A healthy dietary pattern does not have much room for extra added sugars, saturated fat, sodium, or alcoholic beverages. A small amount of added sugars, saturated fat, or sodium can be added to nutrient-dense foods and beverages to help meet food group recommendations, but foods and beverages high in these components should be limited. The limits are the following:
        1. Added sugars - less than 10 percent of calories per day starting at age 2. Avoid foods and beverages with added sugars for those younger than 2 years old.
        2. Saturated fat - less than 10 percent of calories per day starting at two years old.
        3. Sodium - less than 2,300 milligrams per day and even less for children younger than 14 years old.
        4. Alcoholic beverages - adults of legal drinking age can choose not to drink, or to drink in moderation by limiting intake to 2 drinks or less in a day for men and 1 drink or less in a day for women, when alcohol is consumed. Drinking less is better for health than drinking more. There are some adults who should not drink alcohol, such as women who are pregnant.

7.7: MyPlate - Implementation of the Dietary Guidelines

Have you ever heard of the Food Wheel, or the Food Guide Pyramid, or MyPyramid? Each of these were guides created by the USDA to help Americans eat a healthy diet. Since 1916, there have been iterations of the guides based on new learning and evidence. The most recent guide for eating a healthy diet is called MyPlate. Interested in learning more about the different guides? Check out the History of the USDA Food Guides.

Healthy eating is important at every stage of life and is unique to you as an individual. MyPlate was created to be used in various settings and adaptable to meet personal preferences, cultural foodways, traditions, and budget needs. My Plate works best when it is customized for the individual consumer to include eating style, food likes and dislikes, cultural foodways, and family favorites. The simplicity of MyPlate makes it a versatile and flexible tool for any audience.

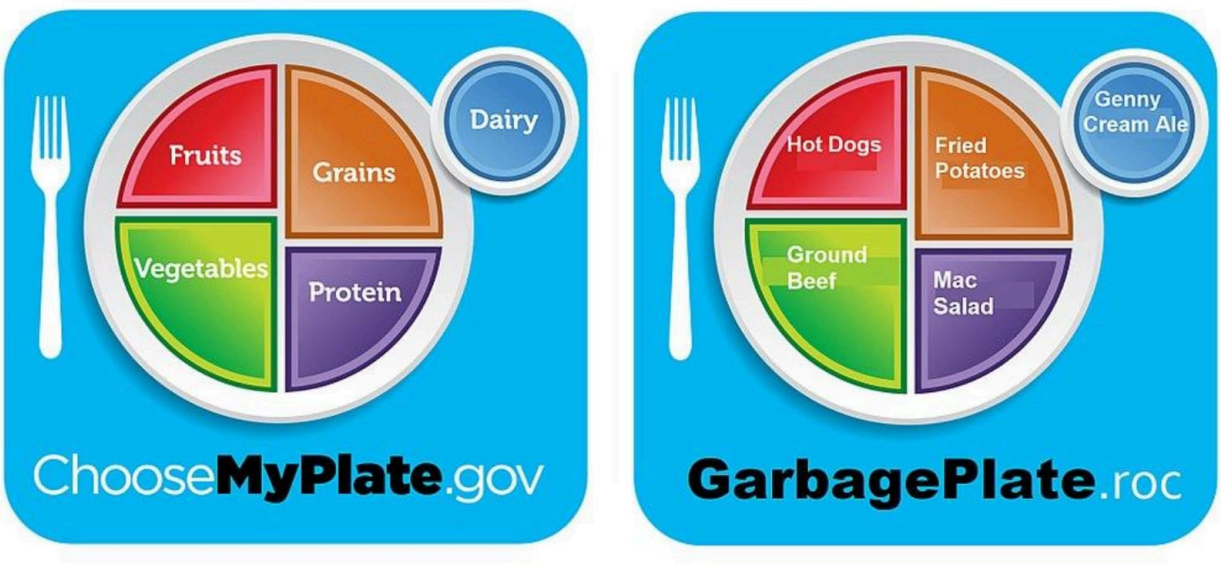


Figure 7.7.1: MyPlate versus Garbage Plate

Dietary Reference Intakes, Percent Daily Value, and Nutrition Facts Labels

Dietary Reference Intakes

Dietary Reference Intakes are nutrient-based reference values which are utilized in planning and assessing diet components. Dietary Reference Intakes include a variety of nutritional standards, and assess adequacy of nutrient intake. Dietary Reference Intakes do not inform individuals of what specific foods should be consumed.

Percent Daily Value

For each nutrient, you will see the Percent Daily Value. This percentage is very helpful for understanding how the food contributes to the recommended total amount you should consume. It is important to note that the Percent Daily Value does not add up to 100%, it is not telling you the breakdown of the item, but rather how much the food item contributes to what you should consume each day. For example, if you notice the Percent Daily Value for sodium is 50% this would mean the food you are eating contributes to half of your daily total for sodium. Percent Daily Value makes it easy for you to compare foods.

An easy way to use Percent Daily Value is to determine if a serving of the food is high or low in an individual nutrient. As a general guide:

- 5% of Percent Daily Value or less of a nutrient per serving is considered low.
- 20% of Percent Daily Value or more of a nutrient per serving is considered high.

The Percent Daily Value for each nutrient is calculated by comparing the nutrient to the Dietary Reference Intakes (DRIs). The DRIs represent the most current scientific knowledge on nutrient needs of healthy populations. Some DRIs are listed as a specific amount, such as number of grams, and others are based on energy they provide in relation to your entire diet. The Acceptable Macronutrient Distribution Ranges helps you to determine the amount of fats, proteins, and carbohydrates you should consume based on a percentage of your total calories.

Acceptable Macronutrient Distribution Ranges

- Carbohydrates: Consume 45-65% of calories from Carbohydrates
- Fats: Consume 20-35% of your calories from Fats
- Protein: Consume 10-35% of your calories from Protein

The Percent Daily Value is based upon several dietary reference intake values and can be found on nutrition labels. Daily Values are recommended averages, and are based upon a 2,000 calorie per day diet. Percent Daily Value is for the entire day, not just one meal or snack. Some individuals may need more or less than 2,000 calories per day (e.i., varying physical activity levels), or may have special dietary requirements (i.e., high blood pressure, leading to potential recommendations from a physician or dietician to limit sodium further and increase intake of magnesium and potassium). Therefore, percent daily value may need to be adjusted for the unique needs of the individual.

Nutrition Facts Labels (Food Labels)

Nutrition Facts Labels, also known as Food Labels, are a tool to help us understand more about the foods we choose to eat. By understanding the nutrition of our food, we can make better informed choices that contribute to our wellness.

Nutrition Facts Labels include percent daily value, serving size information, total calories per serving, and ingredient list. The label might also include: monounsaturated fat, polyunsaturated fat, soluble fiber, insoluble fiber, sugar alcohols, vitamins (biotin, choline, folate, niacin, pantothenic acid, riboflavin, thiamin, and vitamins A, B6, B12, C, E, and K) and minerals (chloride, chromium, copper, iodine, magnesium, manganese, molybdenum, phosphorus, selenium, and zinc). Processed or packaged foods often require a Nation Facts label; however, several exemptions include foods manufactured by small businesses and restaurants, ready-to-eat items (such as bakery items), or foods which do not contain a significant amount of nutrients (such as coffee). Recently, the United States Food and Drug Administration (FDA) developed a new design for the Nutrition Facts labels, based upon current scientific evidence linking components of the diet, such as added sugars or saturated fats, to chronic diseases such as obesity and heart disease. This new label is intended to assist consumers in making healthier nutritional choices. The prudent individual will carefully examine a Nutrition Facts label to assess if a particular food product fits into their healthy eating plan. Ultimately, by having a standard way to show nutrition facts, we are able to easily and quickly compare food choices to make informed decisions about the fuel we put into our body. Just like a car needs fuel to run, our bodies need food to provide us with energy.

Figure 7.7.1: Side by side comparison of new and old Nutrition Facts Label

When comparing the old and new label you will notice a few differences:

- The Serving has a larger and bolder type
- Serving sizes have been updated
- Calories is printed in larger type
- The Daily Values have been updated
- There is a new line for added sugars
- There is a change in some nutrients required
- The actual amounts are declared for the nutrients
- New footnote

Figure 7.7.2: New Nutrition Facts label with the changes made for new version

Ingredient List

The last item on the food label is the ingredient list. Looking at the ingredients is a helpful tool for understanding what is in the food you are eating. It is important to know that the ingredients are listed in descending order, so the first items on the ingredient list are the ones in the highest amount in the food. For example, if you see sugar listed as one of the first items it likely

means that it is a high sugar food. If you are looking to consume more whole grain, whole wheat, whole oat, etc as one of the first ingredients.If the first ingredients include refined grains, a type of sugar, or hydrogenated oils, you can assume that the product is unhealthy. Become familiar with the different names or terms used for common ingredients. For example, you will know an item has sugar if you see any of the following terms:

- Types of sugar: beat sugar, brown sugar, buttered sugar, cane sugar, caster sugar, coconut sugar, date sugar, golden sugar, invert sugar, muscovado sugar, organic raw sugar, raspadura sugar, evaporated can juice, and confectioner's sugar.
- Types of syrup: carob syrup, golden syrup, high-fructose corn syrup, honey, agave nectar, malt syrup, maple syrup, oat syrup, rice bran syrup, and rice syrup.
- Other added sugars: barley malt, molasses, cane juice crystals, lactose, corn sweetener, crystalline fructose, dextran, malt powder, ethyl maltol, fructose, fruit juice concentrate, galactose, glucose, disaccharides, maltodextrin, and maltose.

Servings

At the top of the Nutrition Facts label you should see information about the number of servings and the size of the servings. The data provided on the Nutrition Facts label is based on the serving size listed on the label. It is important to first identify how many servings you are consuming. If you are consuming two servings, then you will need to multiply the data on the nutrition label by two.

The serving size on a Nutrition Facts label is based on the amount of food that is typically eaten at one time and is not a recommendation of how much to eat. Many people found that serving sizes on the old Nutrition Facts labels, prior to 2016, were unrealistic. For example, a 12 ounce can of Coke used to be 1.5 servings and has now been adjusted to being 1 serving.

7.8: Elements and Labeling of Importance

Water

Water is not on the food label, but it is essential for your health. During 2015-2018, children and adolescents in the United States drank an average of 23 ounces of plain water daily and adults in the United States drank an average of 44 ounces.

Daily water intake requirements are individualized to each person's unique characteristics (i.e., body weight and sweat rate). Although there is no recommendationfor how much plain water everyone should drink daily, there are recommendations for how much daily total water intake should come from a variety of beverages and foods.

However, general recommendations from The Institute of Medicine (IOM) recommends total water intake from all foods for daily water intake (assuming normal environmental temperature and activity levels) for adults aged 19+ years have been set at 3.7 liters for males, and 2.7 liters for females (approximately 8-12 cups daily). Gender differences in water intake requirements may be due to differences in body composition between males (water is approximately 60% of body weight) and females (water is approximately 50% of body weight).

Water is your body's principle chemical component and makes up about 60% of your body weight. Every system in your body depends on water. For example, water flushes toxins out of vital organs, carries nutrients to your cells, and provides a moist environment for ear, nose, and throat tissues. Lack of water can lead to dehydration, a condition that occurs when you do not have enough water in your body to carry out normal functions. Even mild dehydration can drain your energy and make you tired.

Every day you lose water through your breath, perspiration, urine and bowel movements. For your body to function properly, you must replenish its water supply by consuming beverages and foods that contain water. It is important to drink plenty of water to prevent dehydration and aid in the digestion of food and absorption of nutrients.

Antioxidants

Another element to consider that is not directly noted on your food label is your intake of antioxidants. Antioxidants are substances we consume that may help to reduce cell damage. Antioxidants may come from the foods we eat or from dietary supplements. Examples of antioxidants include vitamins C and E, selenium, and carotenoids, such as beta-carotene, lycopene, lutein, and zeaxanthin. Vegetables and fruits are rich sources of antioxidants.

Antioxidants may help to reduce cell damage caused by free radicals. Free radicals are highly unstable molecules that are naturally formed when you exercise and when your body converts food into energy. Your body can also be exposed to free radicals from a variety of environmental sources, such as cigarette smoke, air pollution, and sunlight.

Free radicals have been shown to cause "oxidative stress" in the body thus damaging healthy cells. Although not conclusive, research shows that antioxidants work to reduce the chances of cellular damage. Because antioxidants help to reduce cell damage, it has been theorized that they in turn help to reduce chances of many diseases including cancer.

Organic and Genetically Modified Organism (Bioengineered)

Along with reviewing the food label on packages, you might also see statements such as "organic" or "non-GMO." It is helpful to understand what these statements mean.

Organic Labeling

Organic products must be produced using agricultural production practices that foster resource cycling, promote ecological balance, maintain and improve soil and water quality, minimize the use of synthetic materials, and conserve biodiversity. There are four organic labels. The first label is, "100 Percent Organic." This label is used to label any product that contains 100 percent organic ingredients (excluding salt and water, which are considered natural). Most raw, unprocessed or minimally processed farm crops can be labeled "100 Percent Organic."

The second label is, “Organic”. This label is used for any product that contains a minimum of 95 percent organic ingredients (excluding salt and water). Up to 5 percent of ingredients may be nonorganic agricultural products and /or nonagricultural products on the National List (non organic agricultural products and several nonagricultural products on the National LIst may only be used if they are not commercially available as organic).

The third label is, “Made with Organic ____.” This label is for products that contain at least 70 percent organically produced ingredients (excluding salt and water), with a number of detailed constraints regarding ingredients that comprise the non-organic portion.

The fourth label is “Specific Organic Ingredient Listings.” Specific Organic Ingredients may be listed in the ingredient statement of products containing less than 70 percent organic contents. For example a label could read like this, “Ingredients: water, barley, beans, organic tomatoes, salt.”

Genetically Modified Foods (Bioengineered)

The terms “Bioengineering,” “Genetically Modified Organism,” “GMO,” and “Genetic Engineering,” are often used interchangeably for marketing purposes, but “Bioengineered” is the appropriate term under the law. The National Bioengineered Food Disclosure Law, passed by Congress in July 2016, directed the U.S. Department of Agriculture to establish a national mandatory standard for disclosing foods that are or may be bioengineered. The Standard defines bioengineered foods as those thatcontain detectable genetic material that has been modified through certain lab techniques and cannot be created through conventional breeding or found in nature.

Curious what types of food are genetically modified or bioengineered? Check out this list of bioengineered foods.

7.9: Nutrition for Physical Activity

A healthy diet and proper intake of essential nutrients is critical for physical activity performance. Not surprisingly, the more you ask of your body in terms of physical activity, the more attention you will need to give to fueling it with nutrients. With optimal nourishment, your body will in turn reward you with improved performance and energy levels. Fueling a physically active body is based on the same principles we've been discussing throughout this chapter, but requirements for energy and some nutrients are increased.

Fuel Sources for Exercise

The human body uses carbohydrates, fats, and protein in food and from body stores for energy to fuel physical activity. These essential nutrients are needed regardless of the intensity of the activity you are doing. If you are lying down and reading a book or running a marathon, these macronutrients are always needed in the body. However, in order for these nutrients to be used as fuel for the body, their energy must be transferred into the high energy molecule known as adenosine triphosphate (ATP). ATP is the body's immediate fuel source and can be generated either with aerobic metabolism in the presence of oxygen or anaerobic metabolism without the presence of oxygen. The type of metabolism that is predominately used during physical activity is determined by the availability of oxygen and how much carbohydrate, fat, and protein are used. Anaerobic metabolism uses glucose as its only source of fuel. Aerobic metabolism is able to use carbohydrates, protein, or fats as fuel sources. Aerobic metabolism is a much slower process than anaerobic metabolism, but it can produce much more ATP and is the process by which the majority of the ATP in the body is generated.

Physical Activity Duration and Fuel Use

The respiratory system plays a vital role in the uptake and delivery of oxygen to muscle cells throughout the body. Oxygen is inhaled by the lungs and transferred from the lungs to the blood, where the cardiovascular system circulates the oxygen-rich blood to the muscles. The oxygen is then taken up by the muscles and can be used to generateATP. When the body is at rest, the heart and lungs are able to supply the muscles with adequate amounts of oxygen to meet the energy needs for aerobic metabolism. However, during physical activity, your muscles need more energy and oxygen. In order to provide more oxygen to the muscle cells, your heart rate and breathing rate will increase. The amount of oxygen that is delivered to the tissues via the cardiovascular and respiratory systems during exercise depends on the duration, intensity and physical conditioning of the individual.

During the first few steps of exercise, your muscles are the first to respond to the change in activity level. Your lungs and heart do not react as quickly, and during those beginning steps, they can't yet increase the delivery of oxygen. In order for our bodies to get the energy that is needed in these beginning steps, the muscles rely on a small amount of ATP that is stored in the resting muscles. The stored ATP is able to provide energy for only a few seconds before it is depleted.

About 15 seconds into exercise, the stored ATP is used up in the muscles. The heart and lungs have still not adapted to the increased oxygen need, so the muscles must begin to produce ATP by anaerobic metabolism (without oxygen). Anaerobic metabolism can produce ATP at a rapid pace but only uses glucose as its fuel source. The glucose is obtained from muscle glycogen. At around 30 seconds into the exercise, anaerobic pathways are operating at their full capacity, but because the availability of glucose is limited, it cannot continue for a long period of time.

As your exercise reaches two to three minutes, your heart rate and breathing rate have increased to supply more oxygen to your muscles. Aerobic metabolism is the most efficient way of producing ATP; it produces significantly more ATP for each molecule of glucose than anaerobic metabolism. Although the primary source of ATP in aerobic metabolism is carbohydrates, fatty acids and protein can also be used as fuel to generate ATP.

The fuel sources for anaerobic and aerobic metabolism will change depending on the amount of nutrients available and the type of metabolism.

Glucose may come from blood glucose (which comes from carbohydrates, the liver, and glucose synthesis) or muscle glycogen. Glucose is the primary energy source for both anaerobic and aerobic metabolism.

Fats - fats contain triglycerides, which is the main form of fat in the body and in food. Triglycerides have fatty acids in them. Triglycerides are in muscles, but about 90 percent of stored energy is found in adipose tissue. As low-to-moderate-intensity

exercise continues using aerobic metabolism, fats that are broken down into fatty acids become the predominant fuel source for exercising muscles.

Protein- although protein is not considered a major energy source, small amounts of amino acids are used while resting or doing an activity. The amount of amino acids used for energy metabolism increases if the total energy intake from your diet does not meet your nutrient needs or if you are involved in long endurance exercise. When amino acids are broken down into ATP through aerobic metabolism or it can also be used to make glucose. When exercise continues for many hours, amino acid use will increase as an energy source and for glucose synthesis.

Physical Activity Intensity and Fuel Use

Exercise intensity determines the contribution of different fuel sources used for ATP production. Both anaerobic and aerobic metabolism combine during exercise to ensure that muscles are equipped with enough ATP to carry out the demands placed on them. The contribution from each type of metabolism depends on the intensity of an activity. During low-intensity activities, aerobic metabolism is used to supply enough ATP to muscles. However, during high-intensity activities, more ATP is needed, so the muscles must rely on both anaerobic and aerobic metabolism to meet the body's demands.

Activity Intensity	Activity Duration	Preferred Fuel	Oxygen Needed?	Activity Example
Very high	30 seconds - 3 minutes	Glucose	No - anaerobic	Sprinting
High	3 minutes - 20 minutes	Glucose	Yes - aerobic	Jogging
Low to Moderate	>20 minutes	Fat	Yes - aerobic	Walking

Table 7.10.1: Summary of fuels used for activities of different intensities and durations.

During low-intensity activities, the body will use aerobic metabolism over anaerobic metabolism, because it is more efficient and produces larger amounts of ATP. Fatty acids are the primary energy source during low-intensity activity. With fat reserves in the body being almost unlimited, low-intensity activities are able to continue for a long time. Along with fatty acids, a small amount of glucose is used as well. Glucose differs from fatty acids, because glycogen storages can be depleted, and fatigue will eventually set in.

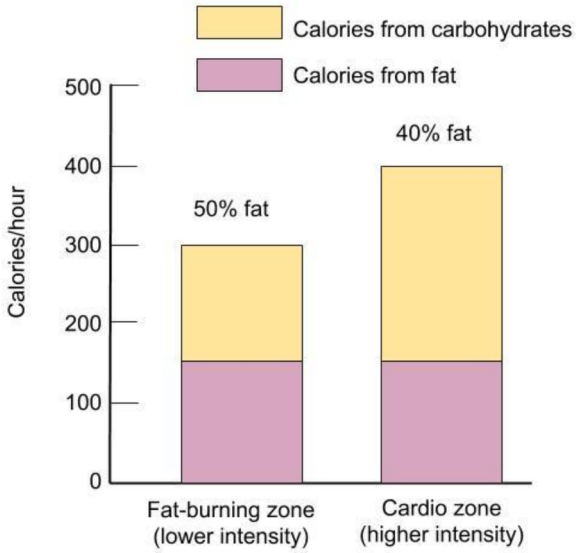


Figure 7.9.1: The fat-burning zone. While a greater percentage of calories burned in a lower intensity exercise come from fat, the overall total calorie burn is greater in higher intensity exercise.

7.10: Energy Needs for Athletes

To determine an athlete's nutritional needs, it is important to revisit the concept of energy metabolism. Energy intake is the foundation of an athlete's diet, because it supports optimal body functions, affects intake of macronutrients and micronutrients, and assists in maintaining body composition. Energy needs for athletes increase depending on their energy expenditure. The amount of energy expended during physical activity is contingent on the intensity, duration, and frequency of the exercise.

Competitive athletes may need 3,000 to over 5,000 calories daily compared to a typical inactive individual who needs about 2,000 calories per day. Energy needs are also affected by an individual's sex, age, and weight. Weight-bearing exercises, such as running, burn more calories per hour than non-weight-bearing exercises, such as swimming, since weight-bearing exercises require your body to move against gravity. Additionally, men typically burn more calories than women for the same activity, because men have more muscle mass which requires more energy to support and move around.

Macronutrient Needs

The composition of macronutrients in the diet is a key factor in maximizing performance for athletes. As discussed previously, carbohydrates, fat, and protein can all be utilized for energy production during exercise, though the amount utilized of each nutrient varies depending on the intensity and duration of the exercise.

Carbohydrates

Carbohydrates are an important fuel source for the brain and muscle during exercise. Carbohydrate storage in the liver and muscle is relatively limited, and therefore it is important for athletes to regularly consume enough carbohydrates from their diet. Carbohydrate needs should increase about 3-10 g/kg/day depending on the athlete's type and level of training and competition (Table 7.2).

Activity Level	Example of Exercise	Increase of Carbohydrate (g/kg of athlete's body weight/day)
Light	Low-intensity or skill-based activities	3-5
Moderate	Moderate exercise program (about 1 hour/day)	5-7
High	Endurance program (about 1-3 hours/day of moderate to high intensity exercise	6-10
Very high	Extreme commitment (4-5 hours/day of moderate to high intensity exercise)	8-12

Table 7.10.1: Athlete's daily needs for carbohydrate fuel

Fat

Fat is a necessary component of a healthy diet to provide energy and essential fatty acids to facilitate the absorption of fat-soluble vitamins. Athletes are recommended to consume the same amount of fat in the diet as the general population, 20 to 35% of their energy intake. Although these recommendations are in accordance with public health guidelines, athletes should individualize their needs based on their training level and body composition goals. Fat intakes below 20% of energy intake will reduce the availability of fat-soluble vitamins and essential fatty acids, especially omega-3 fatty acids.

Protein

Although protein accounts for only about 5% of energy expended, dietary protein is necessary to support metabolic reactions that generate ATP, which rely heavily on proteins such as enzymes and transport proteins. Additional protein also helps muscles with maintenance, growth, and repair. For these reasons, athletes have higher protein needs than the general population. It is recommended that athletes have higher protein needs than the general population. It is recommended that athletes consume 1.2

to 2.0 g/kg/day of protein in order to support these functions. Higher intakes may also be needed for short periods of intense training or when reducing energy intake.

It is important to consume adequate amounts of protein and to understand that the quality of the protein consumed affects the amount needed. Complete protein foods such as meats, dairy, and eggs contain all of the essential amino acids in relative amounts that most efficiently meet the body's needs for growth, maintenance, and repair of muscles. Vegetarian diets contain mostly incomplete protein sources, which have lower digestibility and amino acid patterns that do not match human needs as closely as most animal proteins. To compensate for this, vegetarian athletes need to consume more dietary protein than non-vegetarians and should target the upper end of the recommended protein intake.

In addition to the amount and quality of proteins consumed, timing of protein intake has been shown to impact muscle protein synthesis. Studies show that the synthesis of muscle protein is optimized with high quality protein consumption after exercise, ideally 15 to 25 grams of protein in the early recovery phase after a workout (0-2 hours after exercise). A similar amount of protein should be consumed every 3-5 hours, spread out across the day over multiple meals within the 24 hours post-workout, so that amino acids are always available for optimal protein synthesis. One recommended strategy is to aim for 0.4g/kg/meal across four meals in order to reach 1.6g/kg.day for muscle synthesis.

Although athletic training increases protein needs, athletes can meet their protein requirement through high quality food sources, and most do not need to consume protein supplements. Here are some examples of snacks or small meals that contain at least 15 to 25 grams of protein:

- ½ cup of granola plus ¼ cup almonds (16 grams protein)
- 7 oz. Greek yogurt (20 grams protein)
- Peanut butter sandwich (20 grams protein)
- 2 scrambled eggs and 1 cup of milk (20 grams protein)
- 3 oz. canned tuna (½ can) with ½ cup crackers (22 grams protein)
- Turkey and cheese sandwich (32 grams protein)

These whole food options have the benefit of coming packaged with other nutrients, including carbohydrates to replenish glycogen stores, fiber, and micronutrients, and are often less costly than most protein supplements. Like all dietary supplements, protein shakes and other supplements are not well-regulated; some contain unnecessary additives such as sweeteners and herbs, and some have been found to contain unsafe levels of heavy metals like arsenic and mercury. Protein supplements do have the benefit of being convenient and shelf-stable. If you choose to use a protein supplement, look for one certified by a third-party testing organization and with a simple ingredient list.

Micronutrient Needs

Vitamins and minerals are essential for energy metabolism, the delivery of oxygen, protection against oxidative damage, and the repair of body structures. When exercise increases, the amounts of many vitamins and minerals needed are also increased. Currently, there are no special micronutrient recommendations for athletes, but most athletes will meet their needs by consuming a balanced diet that meets their energy needs. Because the energy needs of athletes increase, they often meet their higher need for vitamins and minerals through the additional food they consume to meet energy needs. However, athletes who limit energy intake or utilize extreme weight-loss practices may put themselves at risk for vitamin and mineral deficiencies.

A Word on Dietary Supplements and Ergogenic Acids

Many athletes consider taking dietary supplements or ergogenic aids (i.e., substances used to enhance performance) in an effort to improve performance, increase energy levels, or make up for poor nutrition choices. However, it is important to remember that supplements and ergogenic aids are not regulated, leading to frequent use of false advertising and unsubstantiated claims by the supplement industry. Athletes must be careful not only in deciphering the claims of products, but also in researching their safety and efficacy, particularly in relation to any rules and regulations that govern the sport in which the athlete participates. Very few supplements that claim to have ergogenic benefits have sound evidence to back up those claims, and in some situations, consuming them could be dangerous. Most athletes can meet their nutritional needs without added supplements. Athletes who have nutritional concerns should consult with a sports dietitian or other sport science professional to make sure their individual needs are met safely.

Hydration, Dehydration, Electrolytes and Physical Activity

During exercise, being appropriately hydrated contributes to performance. Water is needed to cool the body, transport oxygen and nutrients, and remove waste products from the muscles. Water needs are increased during exercise due to the extra water losses through evaporation and sweat. Dehydration can occur when there are inadequate water levels in the body and can be very hazardous to the health of an individual. As the severity of dehydration increases, the exercise performance of an individual will begin to decline (see Figure 7.9). It is important to continue to consume water before, during, and after exercise to avoid dehydration as much as possible.

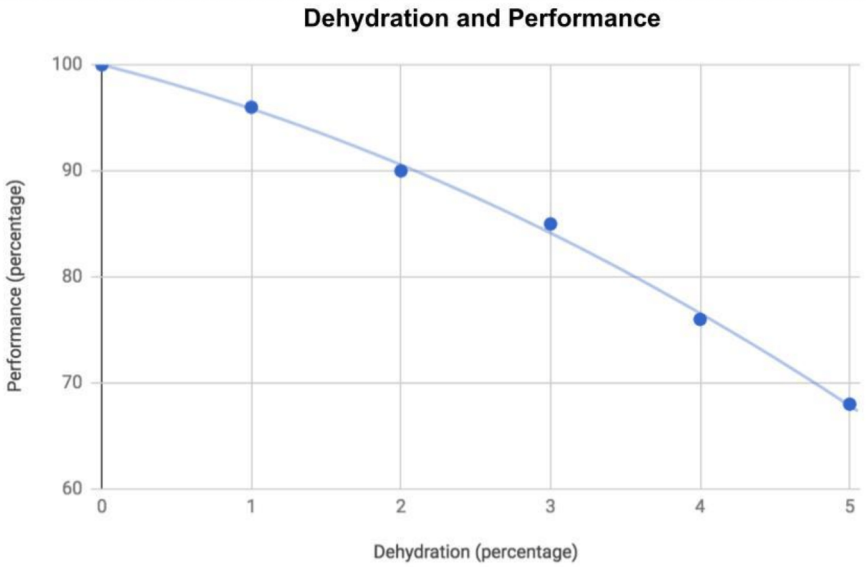


Figure 7.10.1: The effect of dehydration on exercise performance.

During exercise, thirst is not a reliable short-term indicator of the body's water needs, as it typically is not enough to replace the water lost. Even with constant replenishing of water throughout a workout, it may not be possible to drink enough water to compensate for the losses. Dehydration occurs when loss is so significant that total blood volume decreases, which leads to a reduction in oxygen and nutrients transported to the muscle cells. A decreased blood volume also reduces blood flow to the skin and the production of sweat, which can increase body temperature. As a result, the risk of heat-related illnesses such as heat exhaustion or heat stroke, increases. The external temperature during exercise can also play a role in the risk of heat-related illnesses. As the external temperature increases, it becomes more difficult for the body to dissipate heat. As humidity also increases, the body is unable to cool itself through evaporation. Warm or hot weather conditions may increase sweat rates to as high as 3-4 liters per hour.

Consequences of dehydration include, but are not limited to: degradation in performance, physiologic strain, reductions in mental/cognitive performance, and gastrointestinal distress. Even mild dehydration can drain your energy and make you tired.

Hyponatremia and Sports Drinks

Sweating during exercise helps our bodies to stay cool. Sweat consists of mostly water, but it also causes losses of sodium, potassium, calcium, and magnesium. During most types of exercise, the amount of sodium lost is very small, and drinking water after a workout will replenish the sodium in the body. However, during long endurance exercises, such as a marathon or triathlon, sodium losses are larger and must be replenished. If water is replenished without sodium, the sodium already in the body will become diluted. These low levels of sodium in the blood will cause a condition known as **hyponatremia**. When sodium levels in the blood are decreased, water moves into cells through osmosis, which causes swelling. Accumulation of fluid in the lungs and the brain can cause serious, life-threatening conditions such as seizure, coma, and death.

In order to avoid hyponatremia, athletes should increase their consumption of sodium in the days leading up to an event and consume sodium-containing sports drinks during their race or event. A well-concocted sports drink contains sugar, water, and sodium in the correct proportions so that hydration is optimized. The sugar is helpful in maintaining blood-glucose levels needed to fuel muscles, the water keeps an athlete hydrated, and the sodium enhances fluid absorption and replaces some of that lost in

sweat. The American College of Sports Medicine states that the goal of drinking fluids during exercise is to prevent dehydration, which compromises performance and endurance.

The hydration goal for obtaining optimal endurance and performance is to replace what is lost, not to over-hydrate. Perspiration rates are variable and dependent on many factors including body composition, humidity, temperature, and type of exercise. A person's sweat rate can be approximated by measuring weight before and after exercise. The difference in weight will be the amount of water weight you lost.

Who Needs Sports Drink?

Scientific studies show that, under certain circumstances, consuming sports drinks (instead of plain water) during high-intensity exercise lasting longer than one hour significantly enhances endurance, and some evidence also indicates it enhances performance. There is no consistent evidence that drinking sports drinks instead of plain water enhances endurance or performance in individuals exercising less than one hour at a time and at low to moderate intensities. Children and adult athletes exercising for more than one hour at high-intensity (tennis, rowing, rugby, soccer, etc.) may benefit from consuming a sports drink rather than water. However, consuming sports drinks provides no benefit over water to endurance, performance, or exercise recovery forthose exercising less than an hour. In fact, as with all other sugary drinks containing few to no nutrients, they are only another source of calories. Drinking sports drinks when you are doing no exercise at all is not recommended.

7.11: Barriers to Healthy Nutrition

Scientific studies which measure nutritional behaviors often derive findings from a survey known as the Healthy Eating Index (HEI). The HEI assesses the quality of an individual's diet, and determines whether or not the diet is in compliance with *Dietary Guidelines)*. Current HEI results indicate that approximately half of the United States population fails to meet the *Dietary Guidelines*. As previously noted, adherence to a balanced diet may improve health, and poor eating habits may contribute to the development of various chronic diseases and excess weight gain. Many individuals are aware of these consequences and desire to change their dietary behaviors, yet face daunting environmental and situational barriers to engaging in health eating patterns.

Common environmental and psychological barriers which college students cite include, but are not limited to, the following:

1. Limited time available to plan for and prepare healthy meals
2. High costs of healthy and nutritious food options
3. Lack of options for healthy food/meals on college campuses
4. Lack of social support, motivation, or self-control

Indeed, the barriers to healthy nutrition in college are numerous and complex. Despite these barriers, developing a healthy eating pattern is possible - and can even be quite enjoyable! The following section provides an array of dietary resources and tools for the interested individual.

Figure 7.11.1: Many college students cite the high cost of fresh fruits and vegetables as a barrier to establishing healthy eating habits. Several strategies to overcome this barrier are to price-compare and/use coupons when grocery shopping, buy in bulk and share with roommates/ friends, or buy produce that is in season. Photo by Anne Preble on Unsplash

8: BODY COMPOSITION

8.1: Introduction to Body Composition and Weight Management

It is highly likely that you have seen weight loss ads in the newspaper, magazines, or in your social media feed. With about 50% of the U.S. population saying they tried to lose weight in the last 12 months, it is not surprising that the weight loss industry is estimated to be over a $3 billion dollar industry.

Although this chapter will address those who are underweight, the predominance of information will relate to persons who are overweight or obese. Overweight and obesity are linked to more deaths worldwide than underweight; most of the world's population live in countries where overweight and obesity kills more people than underweight. In the United States, an estimated 1.5% of adults aged 20 and over are underweight compared to about 42% of adults who are considered obese. The goal is to strive for a healthy weight since persons who are underweight or overweight have negative health implications.

This chapter focuses on body weight and body composition. Both body weight and body composition are important measurements to understand your health. **Body weight** is typically measured in pounds or kilograms and is simply your body's total mass. As we learned in Chapter 3, **Body composition** is the percentage of the body composed of lean tissue (muscle, bone, fluids, etc.) and fat tissue. Body composition is typically measured as percentage. For example, a person might have a body weight of 200 lbs and a percentage body fat of 25%, in this example, 50lbs of their body weight comes from fat. Although body weight is the measurement most commonly used to assess the health of our body size, body composition is a more accurate look at our body size by understanding what the body is made up of. It is quick and easy to step on a scale and measure your body weight, but measuring body composition is much more challenging, thus body weight is the standard used to address overweight and obesity.

Fat is not bad, we need fat for healthy cellular function, energy, cushioning for vital organs, insulation, long term energy storage, and absorption of fat-soluble vitamins. The minimum amount of body fat needed by males is about 3% and females is about 12%. It is generally accepted that an overall range of 10-22% for men and 20-32% for women is considered satisfactory for good health. This necessary body fat for health is considered essential body fat. When the body stores additional body fat above the essential amount it is called non-essential body fat. A woman's essential fat range is naturally greater than a man's because of fat deposits in breasts, uterus, and sex-specific sites.

The Calorie Balance Equation and Metabolism

In Chapter 7, we discussed in great detail how our body uses calories for all aspects of life. The energy (calorie) balance equation is an equation that simply allows us to compare energy in versus energy out, or how many calories we are eating each day compared to the amount of calories we expend. If a person consumes an excess of 3,500 calories that is the equivalent of gaining one pound of weight. That means if you reduce your daily calorie intake by 500 calories or burn 500 more calories each day than you consume, you may be able to lose a pound a week. Caloric expenditure is most often associated with exercise; however, most of our daily caloric expenditure is to maintain bodily functions, like breathing, circulating our blood, and digesting food.

As a review from Chapter 5, the term used to describe the chemical process in the body that converts calories into energy is **metabolism**. Your body needs a minimum number of calories to sustain these functions. Basal Metabolic Rate (BMR) and Resting Metabolic Rate (RMR) are measurements used to estimate how many calories your body burns when you are not exercising. These two measurements are often used interchangeably; however, they do have a slight difference. A BMR measurement is slightly more accurate because it is measured when you are doing nothing, just upon waking up, while laying down in a dark room after sleeping for at least eight hours and fasting for 12 hours. RMR is taken without the strict conditions of the BMR; BMR is usually slightly lower than your RMR. Both BMR and RMR measure the amount of energy (calories) that your body needs to stay alive and function properly. It is helpful to understand your BMR/RMR since it accounts for about 60-80% of total energy expenditure each day. Your BMR/RMR is affected by your weight, height, age, gender, and genetics. A key component of your weight that impacts BMR/RMR is the amount of muscle you have; muscle mass increases BMR/RMR.

Definition of Overweight and Obese

The measurement used across the world to identify if a person is overweight or obese is called the Body Mass Index (BMI), which

is based on a person's weight versus their height. BMI is used because it is an inexpensive and easy screening method to identify weight categories (underweight, health weight, overweight, and obesity). It is important to recognize that BMI does not assess body composition or body fatness, it is simply a measurement of body size and is used as a screening tool. Although it may not be accurate for some of the population, for example athletes with high muscle mass, it has been shown to be correlated to other more accurate measures of body fatness and to various weight related diseases.

BMI is a person's weight in kilograms divided by the square of the height in meters:

BMI= weight (kg) / [height (m)]2

Table 8.1.1: BMI Indicators

BMI	Weight Status
Below 18.5	Underweight
18.5-24.9	Health weight
25.0-29.9	Overweight
30.0 and above	Obesity

Table 8.1.2: BMI Example for a Person Who is 5'9"

Height	Weight Range	BMI	Weight Status
5'9"	124 lbs or less	below 18.5	Underweight
5'9"	125 lbs to 168 lbs	18.5 to 24.9	Health weight
5'9"	169 lbs to 202 lbs	25.0 to 29.9	Overweight
5'9"	203 lbs to more	30 or higher	Obesity

As noted previously, BMI is the most commonly used tool to assess health weight, but for many people it is not an accurate measurement because it does not assess your body composition. For example, two people can have the exact same height and weight, thus the same BMI, but one could be a professional athlete who is very active with low body fat and other could be sedentary with high body fat. Using the example in Table 8.2, a person who is 5'9" and 203 pound professional weight lifter or a sedentary person with high body fat.

8.2: The Calorie Balance Equation and Metabolism

8.3: Obesity Epidemic

Obesity in the United States

The number of people with obesity has been increasing for decades. Results from the 2017-2018 National and Nutrition Examination Survey provide estimated percentages across time showing the growing trend. Data from the years 1988-1994 through 2017-2018, show obesity prevalence of adults in the United States increased from 22.9 to 42.4%. During the same time, the prevalence of severe obesity in adults increased from 2.8% to 9.2%. The data shows that children in the United States are also impacted by obesity with the percentage of obese children ages 2 through 19 in the United States increasing from 10% in 1988-1994 to 19.3% in 2017-2018 (refer to Tables 8.3 and 8.4).

Table 8.4.1: Prevalence of Overweight and Obesity Among Adults 20 and Over from 1988 through 2018. Selected data from the 2017-2018 National Health and Nutrition Examination Survey (NHANES)

Years	Percentage Overweight	Percentage Obese	Percentage Severely Obese
1988-1994	33.1	22.9	2.8
1999-2000	34	30.5	4.7
2005-2006	32.6	34.3	5.9
2011-2012	33.6	34.9	6.4
2017-2018	30.7	42.4	9.2

Table 8.4.2: Prevalence of Overweight and Obesity Among Children 2-19 from 1988 through 2018. Selected data from 2017-2018 National Health and Nutrition Examination Survey (NHANES)

Years	Percentage Overweight	Percentage Obese	Percentage Severely Obese
1988-1994	13	10	2.6
1999-2000	14.2	13.9	3.6
2005-2006	14.6	15.4	4.7
2011-2012	14.9	16.9	5.6
2017-2018	16.1	19.3	6.1

We can observe that in both adults and children in the United States that the percentage of individuals that are obese and percentage that are severely obese has increased over the years.

Obesity in the World

The United States is not the only country seeing a rise in obesity. Since 1975, obesity across the world has nearly tripled. Data from 2016 show that more than 1.9 billion (39%) adults around the world were overweight with 650 million (13%) obese. Most of the world's population live in countries where overweight and obesity kills more people than underweight.

The number of obese children and adolescents (aged 5 to 19 years) worldwide has risen tenfold in the past four decades. Obesity rates in the world's children and adolescents increased from less than 1% (equivalent to 5 million girls and 6 million boys) in 1975 to nearly 6% in girls (50 million) and nearly 8% in boys (74 million) in 2016. In 2016, there were 50 million girls and 74 million boys with obesity in the world, while the global number of moderately or severely underweight girls and boys was 75 million and 117 million respectively. If current trends continue, more children and adolescents will be obese than moderately or severely underweight by 2022.

Negative Health Implications of Obesity

People who have obesity, compared to those with a normal or healthy weight, are at increased risk for many serious diseases and health conditions, including the following:

- All-causes of death (mortality)
- High blood pressure (hypertension)
- High LDL (bad) cholesterol, low HDL (good) cholesterol, or high levels of triglycerides (dyslipidemia)
- Type 2 diabetes
- Coronary heart disease
- Stroke
- Gallbladder disease
- Osteoarthritis (a breakdown of cartilage and bone within a joint)
- Sleep apnea and breathing problems
- Many types of cancer
- Low quality of life
- Mental illness such as clinical depression, anxiety, and other mental disorders
- Body pain and difficulty with physical functioning

Understanding Diabetes

As we have learned so far in our studies, the body breaks down the food we eat to turn it into energy, this process is called metabolism. The disease that affects how your body turns food into energy is called diabetes. There are three main types of diabetes: Type 1, Type 2, and Gestational diabetes (diabetes while pregnant). More than 122 million Americans are living with diabetes (37.3 million, 11.3% of the United States population) or pre-diabetes (96 million, 38% of the adult United States population).

When discussing diabetes you will often hear people talk about insulin. Most of the food you eat is broken down into sugar (also called glucose) and released into your bloodstream. When your blood sugar goes up, it signals your pancreas to release insulin. Insulin acts like a key to let the blood sugar into your body's cells for use as energy. Without insulin, blood sugar can't get into cells causing the blood sugar to build up in the bloodstream. High amounts of blood sugar are damaging to the body and cause many of the symptoms and complications of diabetes.

If you have Type 1 diabetes, your pancreas does not make insulin or makes very little insulin. Approximately 5-10% of the people who have diabetes have Type 1. Type 1 diabetes is usually diagnosed in children, teens, and young adults. Type 1 diabetes is thought to be caused by an autoimmune reaction (the body attacks itself by mistake) that stops your body from making insulin.

If you have Type 2 diabetes, your cells do not respond normally to insulin. About 90-95% of people with diabetes have Type 2. It develops over many years and is usually diagnosed in adults (but more and more in children, teens, and young adults). Type 2 diabetes can be prevented or delayed with healthy lifestyle changes, such as losing weight, eating healthy food, and being active.

You're at risk for developing Type 2 diabetes if you:

- Have pre-diabetes
- Are overweight
- Are 45 years or older
- Have a parent, brother, or sister with Type 2 diabetes
- Are physically active less than 3 times a week
- Have ever had Gestational diabetes (diabetes during pregnancy) or given birth to a baby who weighed more than 9 pounds
- Are African American, Hispanic/Latino American, American Indian, or Alaska Native (some Pacific Islanders and Asian Americans are also at higher risk)

8.4: Assessing Body Composition

As noted previously, BMI is the measurement used as a screening tool to quickly and inexpensively identify whether a person is at a healthy weight, is underweight, overweight, or obese. BMI is not a measure of body composition, it will not tell you whether you are overfat, it will only tell you whether you are overweight. Understanding what the body is made up of (muscle, bone, water, and fat) is a better predictor of health; however, the tools used to measure body composition can be expensive, intrusive, not widely available, or difficult to standardize across observers or machines. Due to the challenges with measuring body composition, BMI is considered the best method.

When evaluating body composition, there are two general types of evaluations, body fat distribution and body fat percentage.

Body Fat Distribution

Fat is stored as subcutaneous fat, which is fat stored just under the skin, and visceral fat, which is fat stored deeper in the body around the organs. We are all different and one difference we have is where we store body fat. Body fat distribution, meaning where a person stores their fat, has health implications. Visceral fat tends to be stored around the abdomen and research indicates high amounts of visceral fat leads to negative health implications including all-cause mortality.

One method for evaluating body composition is to look in the mirror at the outline of the body. People are often described as being either apple shaped, carrying body fat around the abdomen, or pear shaped, carrying body fat around the hips. People who are apple-shaped, thus carrying excess visceral fat around the abdomen, are at higher risk of developing health issues.

Besides looking in the mirror, body fat distribution can be measured by calculating a person's waist circumference, waist-to-hip ratio, and waist-to-height ratio.

Waist Circumference

To measure your waist circumference, stand and place a tape measure around your middle, just above your hip bones. Measure your waist in inches just after you breathe out. Your waistline may be telling you that you have a higher risk of developing obesity-related conditions. You may be at a higher risk of developing obesity-related conditions if you are a man whose waist circumference is more than 40 inches or if you are a non-pregnant woman whose waist circumference is more than 35 inches.

Waist-To-Hip Ratio

You can calculate your waist-to-hip ratio by taking your waist circumference and dividing it by your hip circumference. The World Health Organization categorizes high risk as a ratio above 0.85 for women and more than 0.90 for men.

Waist-To-Height Ratio

You can calculate your waist-to height ratio by dividing your waist circumference by your height. A waist-to-height ratio of more than 0.5 may put you at higher risk for heart disease and diabetes. Waist-to-height ratio has been shown to be a good predictor of both body fat percentage and visceral fat mass in men and women.

Body Fat Percentage

Body fat percentage is attempting to measure the percentage of your body that is fat-free mass versus fat mass. There are several measurement tools to estimate body fat percentage, each having pros and cons mostly related to difficulty, cost, and availability.

Bioelectrical Impedance Analysis

Bioelectrical Impedance Analysis is likely the measuring method you are most familiar with. Have you ever used a scale that told you your body fat percentage? If so, you have used Bioelectrical Impedance Analysis. Bioelectrical Impedance Analysis 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-programed equation is used to estimate body fat percentage. 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. The most accurate Bioelectrical Impedance Analysis devices use electrodes on the feet and hands to administer the point-to-point electrical current. Because Bioelectrical Impedance Analysis 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 Calipers

Skinfold analysis is a widely used method of assessing body composition because of its simplicity, portability, and affordability. Some call the skinfold test the “pinch test” because the skin and underlying subcutaneous fat is pinched with calipers to measure the thickness. The assumption of skinfold measurement is that the amount of subcutaneous fat is proportionate to overall body fat. These numbers are plugged into an equation to generate an estimate of body fat percentage. The skinfold test is fairly accurate when administered properly.

Hydrostatic Weighing (Underwater Weighing)

Hydrostatic weighing is a difficult process, but has long been considered the “gold standard” for assessing body composition. A person is weighed when dry and then enters a water tank and is weighed while underwater. 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. This method is also challenging for people who are afraid of water, don’t feel comfortable in bathing suits, or would be fearful of exhaling all air and sitting underwater without moving for a short time.

Air Displacement (Plethysmography)

Air Displacement works similarly to hydrostatic weighing however measures the displacement of air instead of water. The Bod Pod is the most commonly referenced machine. During the test, 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 personal Air Displacement requires limited accessibility. Additionally, its accuracy is slightly less than underwater weighing.

Dual X-Ray Absorptiometry (DXA)

Replacing underwater weighing as the new “gold standard,” DXA provides a quick and pain free method for measuring body fat by scanning the body. The patient lays down and is scanned by the DXA machine which takes about 6 minutes. Major disadvantages to this method are its high coast and the need for a well trained professional to operate the equipment and analyze the results.

8.5: Factors Contributing to Obesity

Although weight is often simplified to the Calorie Balance equation, it is much more complicated than just the amount of energy consumed versus expended. There are many factors that contribute to overweight and obesity. Some factors can be changed, such as unhealthy lifestyle habits and environments, and others cannot be changed, such as age, family history and genetics, race and ethnicity, and sex.

Unhealthy Lifestyle Factors

We make healthy and unhealthy choices every day and many of those choices impact our likelihood of becoming overweight or obese. These include lack of physical activity, unhealthy eating patterns, not enough sleep, and high amounts of stress.

Lack of Physical Activity

Lack of physical activity increases your risk of obesity and Type 2 Diabetes. Strong scientific evidence shows that physical activity helps people maintain a stable weight over time and can reduce the risk of excessive weight gain and incidence of obesity. Healthy lifestyle changes, such as being physically active and reducing screen time, can help you aim for a healthy weight.

Unhealthy Eating Behaviors/Unhealthy Diet Patterns

Some unhealthy eating behaviors can increase risk for overweight and obesity. Some of those unhealthy eating behaviors include:

- Eating more calories than you use
- Eating too much saturated and trans fats
- Eating foods high in added sugars
- Not eating enough fibre

Not Enough Sleep

Many students have seen a high BMI in people who do not get enough sleep. Some studies have seen a relationship between sleep and the way our bodies use nutrients for energy and how lack of sleep can affect hormones that control hunger urges.

High Amounts of Stress

Acute stress and chronic stress affect the brain and trigger the production of hormones, such as cortisol, that control our energy balances and hunger urges. Acute stress can trigger hormone changes that make you not want to eat. If the stress becomes chronic, hormone changes can make you eat more and store more fat.

Environmental Factors

Geography, food availability, transportation, and work environments are environmental factors that can increase your risk for overweight and obesity.

Geography

Where you live may impact your risk of obesity. In the United States, the South and Midwest have the highest level of obesity among adults. There is also an increase in BMI in rural areas, which is said to be contributing to approximately 55% of global increases in BMI. The increase of BMI in rural areas may be due to having farther distances between residences and supermarkets, clinical settings, and recreational opportunities.

Food Availability

The food that is available in your community may impact your risk of obesity. Historical data has shown a relationship between the amount of fast food available in a community and the rate of obesity. The lack of affordable healthy food is termed a “food desert.” Communities that have been designated as a “food desert” have higher rates of obesity. These ease and availability of high sugar drinks, large portion sizes, and highly processed snack foods all relate to increased risk of obesity.

Transportation

How your community is designed may impact your risk of obesity. A neighborhood purposefully developed to allow for people to be able to walk instead of drive reduces your risk of obesity; high neighborhood walkability has been found to be associated with decreased prevalence of overweight and obesity. Neighborhoods that provide recreational facilities, access to sidewalks and paths that remove pedestrians from traffic hazards, and access to parks, have all been reported to be facilitators of physical activity.

Work Environment and Advances with Technology

Have you considered how jobs have changed with advances in technology? From 1960 to 2010, jobs in the United States private industry shifted from 50% requiring at least moderate to vigorous physical activity to less than 20% requiring this level of activity intensity. National Health and Nutrition Examination Survey data has documented an association between decreases in work related energy expenditure and weight gain over the same time period. The changes in energy expenditure may be due to advances in technology, an easy example is the use of email to quickly transmit documents rather than walking them to a colleague.

Individual Factors

Although environmental factors have been shown to impact obesity rates, people can have the same environmental factors and still have variances in obesity, fat distribution, and health issues. Thus, it is important to understand how individual characteristics, such as their genetics, impact their risk of obesity.

Race or Ethnicity

Although environmental factors have been shown to impact obesity rates, people can have the same environmental factors and still have variances in obesity, fat distribution, and health issues. Thus, it is important to understand how individual characteristics, such as their genetics, impact their risk of obesity.

Sex

In the United States, obesity is more common in black or Hispanic women than in black or Hispanic men. A person’s sex may also affect the way the body stores fat. For example, men store more unhealthy fat around the abdomen than women. Overweight and obesity is also common in women with polycystic ovary syndrome. This is an endocrine condition that causes large ovaries and prevents proper ovulation, which can reduce fertility.

Age

Many people gain weight as they age. The risk of unhealthy weight gain increases as you age. Adults who have a healthy BMI often start to gain weight in young adulthood and continue to gain weight until 60 to 65 years old, when they start to lose weight. Childhood obesity remains a serious problem in the United States and children who have obesity are more likely to have obesity as adults.

Genetic Influences

The relationship of genetics to obesity has been studied for over 100 years. Although over 50 genes have been shown to have an association with obesity, in most obese people, no single genetic cause can be identified. In a study comparing identical and

fraternal twins who either grew up together or apart showed that their genetics was more substantially related to their BMI than the environment that they grew up in. Most obesity seems to be multifactorial, that is, the result of complex interactions among many genes and environmental factors.

Medical Conditions

Several genetic syndromes are associated with overweight and obesity, including Prader-Willi syndrome, Bardet-Biedl syndrome, Alstrom syndrome, and Cohen syndrome. Endocrine disorders, such as hypothyroidism and Cushing's syndrome also impact overweight and obesity. Medical problems, such as arthritis, also can lead to decreased activity, which may result in weight gain.

Medicines

Some medications can lead to weight gain including: antipsychotics, antidepressants, antiepileptics, and antihyperglycemics.

Physical Activity Improved Ability to Maintain Healthy Body Composition and Weight Status

Currently, obesity rates among adults in the United States are approximately 35-36%, with approximately 17-18% of youth also classified as obese. Overweight and obesity are often categorized according to body mass index (BMI). **BMI** calculates an individual's mass in kilograms, and divides this number by the individual's height in meters-squared (BMI = kg/m2). According to BMI criteria, overweight is defined as a BMI > 25 to 29.29 kg/m2, while obesity is defined as BMI > 30 kg/m2 and severe obesity including values >35 kg/m2. Individuals should be aware that BMI does not account for body composition (i.e., lean muscle mass or body fat percentage), and thus is in some ways a flawed measure. However, it is relatively easy and inexpensive to evaluate an individual's height and weight, and thus BMI is a personal metric commonly utilized in determining health trends within the population.

Comorbidities common to obesity are numerous and include, but are not limited to: increased risk of cancer, cardiovascular disease, decreased mobility, diabetes, hypertension, arthritis, and stroke. Additionally, obese individuals suffer from increased risk for psychological comorbidities and all-cause mortality compared to their health-weight counterparts, with obesity implicated as the fifth highest cause of all deaths globally. Fortunately, studies indicated that regular physical activity participation may result in reduced body fat and improved weight control. Prior to starting an exercise regimen with a goal of weight loss, individuals are encouraged to consult with their healthcare provider to create an appropriate program. Each individual possesses unique needs related to exercise prescription for weight control, with these unique needs important to consider when implementing the exercise regimen.

8.6: Physical Activity Improved Ability to Maintain Healthy Body Composition and Weight Status

8.7: Weight Loss Strategies

In addition to exercise, there are some other factors to take into consideration when developing a weight loss strategy. We know that a majority of our population should implement strategies to lose weight and we know that over 50% of Americans have indicated they would like to lose weight. We have learned in the previous chapters of the book that the Dietary Guidelines for Americans and the Physical Activity Guidelines for Americans provide numerous tips for adjusting diet and exercise to support a health weight.

Let's look at some additional strategies.

Commit to a Weight Loss Plan

You first need to make a commitment to lose weight and write out your "why" for wanting to lose weight. After you establish your "why", you are ready to set some goals and assess where you are at.

We have learned early on in our book that setting goals is important for behavior change to occur. You can choose to write SMART goals and/or F.I.T.T goals for your weight loss plan.

Take time to assess your current health and lifestyle. You want to focus your assessments on nutrition and activity in your life. One way to do this would be to record what you eat and how much you exercise for a week. Then review the journal to help you recognize the changes you could make to help you lose weight. You can use the information that we discovered in our assessment to help us create and/or modify our SMART goals.

There are many tools, resources, information, and support out there to help you along your journey. The Body Weight Planner could be a helpful tool for assisting you in making personalized calorie and physical activity plans to reach your goal weight within a specific time period and to maintain your weight loss afterwards.

As you begin to work towards your goals, record your progress. Then celebrate and acknowledge the hard work you put in to make the progress that you have.

How to Assess Safe and Effective Weight Loss Programs

With so many different weight loss programs out there, it may be difficult to choose which program is right for you.

A great place to start is by talking with your healthcare provider. As we have learned, there are individual factors that influence weight and body composition. Your healthcare provider is a fantastic resource to help you on your journey. You can share your concern regarding your weight and ask if they have suggestions for you. They can also refer you to a weight loss program or specialist that would be best for you.

When reviewing weight loss programs, look for ones that are not just focused on eating a specific food, but rather take more of a holistic view of your overall health and lifestyle habits.

The National Institute of Diabetes and Digestive and Kidney Disease offers guidelines of what should be included for a safe and successful weight-loss program. These programs should include:

- Behavioral treatment, also called lifestyle counseling, can teach you how to develop and stick with healthier eating and physical activity habits. For example, keeping a food and activity journal.
- Information about getting enough sleep, managing stress, and the benefits and drawbacks of weight-loss medicines.
- Ongoing feedback, monitoring, and support throughout the program, either in person, by phone, online, or through a combination of these approaches.
- Slow and steady weight-loss goals. This is usually 1-2 pounds per week, though keep in mind that weight loss may be faster at the start of a program.
- A plan for keeping the weight of, including goal setting, self-checks such as keeping a food journal, and counseling support.

If you prefer an online program, it should include the following:

- Organized, weekly lessons, offered online or by podcast, and tailored to your personal goals.
- Support from a qualified staff person to meet your goals.
- A plan to track your progress on changing your lifestyle habits, such as healthy eating and physical activity, using tools such as cellphones, activity counters, and line journals.
- Regular feedback on your goals, progress, and results provided by a counselor through email, phone, or text messages.
- The option of social support from a group through bulletin boards, chat rooms, or online meetings.

When choosing a weight-loss program, many advertise how great their program is to encourage people to sign-up. Here are some weight-loss program promises that you should avoid:

- Lose weight without diet or exercise!
- Lose weight while eating as much as you want of all your favorite foods!
- Lose 30 pounds in 30 days!
- Lose weight in specific problem areas of your body!
- Other warning signs to look out for include
  - Very small print, asterisks, and footnotes, which may make it easy to miss important information.
  - Before-and-after photos that seem too good to be true.
  - Personal endorsements that may be made up.

Dietary Approaches to Weight Loss

We have talked about nutrition at great lengths in our previous chapter. Here are some tips to remember when considering how to approach weight loss with diet. They include:

- Emphasize fruit, vegetables, whole grains, and fat-free or low-fat milk and milk products
- Include a variety of protein foods such as seafood, lean meats and poultry, eggs, legumes (beans and peas), soy products, nuts, and seeds.
- Reduce saturated fats, trans fats, cholesterol, salt (sodium), and added sugars.

One way to help you do this is through meal planning. Since high-calorie foods are everywhere, it is important to take time to plan ahead to make sure you have healthy food options available and are building in the recommendations into your meals.

In addition, stay within your daily calorie needs. Replace some higher calorie foods with foods that are lower in calories and fill you up. You can also choose smaller portion sizes. Research shows that people unintentionally consume more calories when faced with larger portions.

When you are eating out, oftentimes there are larger portion sizes, take half of your meal home. If you order a salad, order your salad dressing on the side so that you can control how much dressing you add. A great technique is to dip your fork into the dressing instead of pouring lots onto the salad. A salad or broth-based soup can be a great substitute for French fries or chips as a side. When customizing a sandwich, add extra vegetables such as cucumbers, lettuce, tomato, and onions rather than adding extra meat or cheese. Most times you can check a menu ahead of time if you know where you are going to give you more time to find the healthier options before you arrive.

We have also learned how valuable hydration is to our body. It is important we are consuming water throughout our day, especially over sugary drinks like soda. A way to help us with that is by carrying a water bottle with you and refilling it throughout the day. If you prefer ice cold water, freeze a water bottle ahead of time so that your ice melts throughout the day. Some other tips would be ordering water rather than soda when eating out or during meal times at home. You could also add fruit such as a lemon or lime to your water to help improve the taste.

It is also important to plan healthy snack options and to have them ready for when you get hungry throughout the day. Some great “grab-and-go” fruits are apples, oranges, bananas, canned fruit without added sugars, and raisins. You could also wash and chop vegetables to bring as well. Some easier options include celery, carrots, and cucumbers. When deciding on dairy options, choose low-fat and fat-free milk products. Check food labels to see if there are any added sugars, especially in yogurt, milk, and low-fat cheeses. It is also good to consider choosing whole-grain crackers and breads when packing food for on the go. Make sure to also include good protein options for snacks such as low-fat deli turkey slices, almonds, and other nuts and seeds.

We all have our favorite comfort foods that we enjoy eating and that is ok! Often though, these comfort foods are higher in calories. When considering losing weight and our favorite higher caloric comfort foods, some tips would include eating those foods less

often. If you normally eat these foods every day, cut back to once a week and eventually to once a month. You can also eat smaller amounts. For example, if your favorite high calorie food is a chocolate bar, have a smaller size or only half a bar. You could also try a lower-calorie version. These often use lower-calorie ingredients or prepare the food in a different way. For example, if your macaroni and cheese recipe includes whole milk, butter, and full-fat cheese, try remaking it or finding a recipe that includes non-fat cheese, non-fat milk, less butter, low-fat cheese and add some vegetables such as fresh spinach and tomatoes. Just remember that if you do make modifications by swapping out ingredients, make sure not to increase your portion size.

Diets

The Dietary Guidelines for Americans stresses the importance of developing a healthy eating pattern. For some people, it can be helpful to follow a specific diet. If you are interested in following a diet, it is important to recognize that even if a particular diet may be successful for one person, it may not be effective for another due to individual differences in genes and lifestyle. Harvard School of Public Health provides detailed reviews of the following diets for your consideration:

- Anti-Inflammatory Diet
- DASH Diet
- Gluten-Free for Weight Loss
- Intermittent Fasting for Weight Loss
- Ketogenic Diet for Weight Loss
- Mediterranean Diet
- Mindful Eating
- Paleo Diet for Weight Loss

Before beginning any diet, it is almost important to check with your healthcare provider.

Bariatric Surgery

Weight loss surgery, also known as bariatric surgery, is an operation that makes changes to the digestive system. In the United States, surgeons most often perform three types of operations: gastric sleeve, gastric bypass, and adjustable gastric band. Bariatric surgery may be an option if you have extreme obesity (over 40 BMI) or are at lower levels of obesity (over 30 BMI) but you have serious health problems, such as Type 2 diabetes or sleep apnea, related to obesity. Bariatric surgery can improve many of the medical conditions linked to obesity, especially Type 2 diabetes. Side effects of the surgery may include bleeding, infection, leaking from the surgery site, diarrhea, and blood clots.

A longitudinal study of bariatric surgery (gastric bypass and gastric band) was conducted to understand immediate and long term effects. The study included people who had bariatric surgery between 2005-2009. Researchers met with the participants before surgery, 30 days after, 6 months after, and then annually until 2015.

Thirty days after bariatric surgery, researchers found that

- Death rates were low. Only 2.1 percent of participants who had open gastric bypass and 0.2 percent of participants who had laparoscopic gastric bypass died. No participants who had gastric band surgery died.
- Only 4.1 percent of participants had at least one major bad outcome, such as death, development of blood clots, repeat surgeries, or failure to be released from the hospital.
- No significant differences in complication risk were found based on the type of gastric bypass procedure.
- Participants with the highest BMI values had the greatest risk of complications.
- Participants with a history of deep vein blood clots or sleep apnea had a higher risk of complications.

At the 7-year follow-up, researchers found that:

- Participants lost an average of 28.4 percent of their body weight after gastric bypass surgery and 14.9 percent of their body weight after laparoscopic gastric band surgery.
- Most participants maintained their weight loss. Three to 7 years after surgery, participants who had gastric bypass surgery regained an average of 3.9 percent of their body weight, and participants who had gastric band surgery regained on average 1.4 percent of their body weight.
- High cholesterol was less common after gastric bypass and gastric band surgery.
- Diabetes and high blood pressure were less common after gastric bypass surgery. Over time, diabetes reoccurred in some

patients, but numbers of new cases were low.
- Alcohol use disorders increased after gastric bypass surgery but not after gastric band surgery.
- Pain and physical function improved after bariatric surgery.

8.8: Body Image, Eating Disorders, and Low Body Weight

Imagine looking in the mirror and seeing a reflection that shapes not only how you view yourself but also how you feel and act. Body image is a powerful concept that influences our thoughts, perceptions, and behaviors regarding our bodies. It can be a source of confidence and positivity or a trigger for anxiety and dissatisfaction. In today's world, factors like social media, family, and societal pressures play a significant role in shaping our body image.

Understanding body image is crucial because it directly impacts our mental and physical health. Positive body image fosters self-acceptance and confidence, while negative body image can lead to serious issues like depression, low self-esteem, and eating disorders. Eating disorders, such as anorexia nervosa, bulimia nervosa, and binge-eating disorder, are complex conditions that affect millions of people and can have life-threatening consequences.

In this section, we will explore the multifaceted nature of body image, the factors that influence it, and the severe impact of eating disorders. As we look further into these topics, we aim to understand how to foster a healthy body image and recognize the signs and risks associated with eating disorders.

Body Image

When you look in the mirror, how do you see yourself and feel about your body (e.g., height, shape, and weight)? Your body image is what you think, feel, perceive, and behave regarding your body. Body image is a multidimensional concept that includes:

- Cognitive: thoughts and beliefs about the body
- Perceptual: how people perceive the size and shape of their body and body parts
- Affective: feelings about the body
- Behavioral: the actions that people perform to check on, tend to, alter, or conceal their body

Factors affecting body image and body image disorders include: BMI, family, social pressures, media, social media, self esteem, chronic illness, depression, and sexual

abuse.

A person with a positive body image has a clear and true perception of their body; seeing the various parts of your body as they really are. Body positivity (or body satisfaction) involves feeling comfortable and confident in your body, accepting your natural body shape and size, and recognizing that physical appearance says very little about one’s character and value as a person.

A person with a negative body image or a distorted perception for their body, has feelings of shame, anxiety, and self-consciousness. People who experience high levels of body dissatisfaction feel their bodies are flawed in comparison to others, and they are more likely to suffer from feelings of depression, isolation, low self-esteem, and eating disorders.

Eating Disorders

While there is no single cause of eating disorders, research indicates that body dissatisfaction is the best-known contributor to the development of eating disorders and body dysmorphic disorder. Body dysmorphic disorder (BDD) is a distressing preoccupation or a markedly excessive concern with one or more perceived or slight defects in physical appearance, associated with significant distress and functional impairment.

Eating disorders are serious and often fatal illnesses that are associated with severe disturbances in people’s eating behaviors and related thoughts and emotions. They are associated with a wide range of adverse psychological, physical, and social consequences. A person with an eating disorder may start out just eating smaller or larger amounts of food, but at some point, their urge to eat less or more spirals out of control. Severe distress or concern about body weight or shape, or extreme efforts to manage weight or food intake, also may characterize an eating disorder.

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

Anorexia Nervosa

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

Symptoms of anorexia nervosa include:

- Extremely low body weight
- Severe food restriction
- Relentless pursuit of thinness and unwillingness to maintain a normal or healthy weight
- Intense fear of gaining weight
- Distorted body image and self-esteem that is heavily influenced by perceptions of body weight and shape, or a denial of the seriousness of low body weight
- Lack of menstruation among girls and women. Some who have anorexia nervosa recover with treatment after only one episode. Others get well but have relapses. Still others have a more chronic, or long-lasting, form of anorexia nervosa, in which their health declines as they battle the illness.

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

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

Bulimia Nervosa

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

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

Other symptoms include:

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

Binge-Eating Disorder

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

Low Body Weight (Underweight)

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 insufficient fat reserves can cause health issues. It is estimated that 1.6% of U.S. adults aged 20 and over are underweight. Poor nutrition or underlying health conditions can result in adults being underweight. A healthy body fat percentage for men is 10-22% body fat (minimum required is 3-5% fat) and women is 20-32% body fat (minimum required is 8-12%). Using a BMI, if your BMI is less than 18.5, it falls within the underweight range.

Persons who are underweight may experience:

- Osteoporosis
- Skin, hair, and teeth problems
- Immune System disorders (get sick more)
- Low energy (tired or fatigued all the time)
- Reproductive disorders: Irregular menstrual cycle and premature births
- Respiratory disorders
- Slow or impaired growth due to lack of nutrients
- Mental health issues such as Depression
- Increased mortality from external causes like accidents, injuries, and suicide

9: CHRONIC DISEASE

9.1: Introduction to Chronic Disease

Chronic disease such as heart disease, diabetes, and stroke are among the leading causes of sickness, disability, and death in America according to the Centers for Disease Control and Prevention (CDC). The CDC broadly defines **chronic disease** as "conditions that last 1 year or more and require ongoing medical attention or limit activities of daily living or both." Chronic diseases are widely present in the United States with 6 in 10 Americans having at least one chronic disease and 4 in 10 having two or more chronic diseases. This has a massive financial impact on the country. The CDC estimates that $4.5 trillion dollars are spent on health care costs each year.

Not all chronic diseases are preventable; however, the CDC has linked the following risk factors that preventable chronic diseases have in common. They are: smoking, poor nutrition, physical inactivity, and excessive alcohol use.

These four factors have serious ramifications according to the CDC:

- All four factors can lead to cancer, heart disease, stroke and other chronic diseases
- In addition, smoking causes lung disease, diabetes, and chronic obstructive pulmonary disease (COPD), which includes emphysema and chronic bronchitis. This is of serious concern with over 16 million Americans are living with a disease caused by smoking and more than 480,000 people die each year from it
- Poor nutrition and physical activity can lead to obesity and additional chronic diseases not listed above including type 2 diabetes and depression
- Excessive alcohol can significantly impact a person's mental health that can lead to other complications. It can also lead to high blood pressure and liver disease

Prevalence and Financial Impact of Chronic Diseases

Let's dig deeper into the CDC data to help us understand the national impact that chronic diseases are having on Americans. The number of Americans that are battling one or more chronic diseases are staggering. The most common chronic diseases that Americans die from each year is heart disease and stroke with more than 944,800 dying of one of the two each year. To help put that number in perspective, that is more than one in three deaths.

When people are battling these diseases, it has a huge financial impact on the country. When people are sick, they cannot work or need more time off. The CDC estimates that $168 billion is lost in job productivity each year due to people battling chronic disease. This also has huge economic consequences to the health care system. The CDC also estimates that $254 billion is spent on health care costs and the cost is expected to hit around $2 trillion by 2050.

The second leading cause of death in the United States according to the CDC is cancer. It is estimated that 1.7 million people are diagnosed with cancer each year and 600,000 people die from it. Cancer also has a huge financial health care impact with estimating that cancer treatment will exceed $240 billion by 2030.

Let's take a look at what cardiovascular disease and cancer really is.

9.2: Introduction to Cardiovascular Disease

Take a moment to think about how the plumbing in a house or building works. When it works well, water comes into the house freely and waste from flushing the toilet or washing dishes flows out of the house. However, if the plumbing in the house gets blocked by debris, then a backup can occur. Just like in a house, debris that blocks blood flow in our body causes problems.

As we learned in Chapter 4, the cardiovascular system is an intricate system and each part of the system plays an important role in ensuring your body receives the oxygen and nutrients it needs. Cardiovascular diseases are diseases that affect various elements of the heart and diseases impacting the ability of blood to move through the blood vessels.

The term “heart disease” refers to several types of heart conditions. The most common type of heart disease in the United States is coronary artery disease (CAD). The coronary artery is the artery that feeds oxygenated blood to the heart muscle itself. If the coronary artery is partially or fully blocked, it affects the blood flow of the heart. When the heart muscle does not get oxygenated blood the heart has an event called a heart attack. We will go more into detail about this later in the chapter.

A person can have heart disease without knowing it due to its “silent” symptoms and not get diagnosed until a person experiences signs or symptoms of a heart attack, heart failure, or an arrhythmia.

When a person has a heart attack they can experience: chest pain or discomfort, upper back or neck pain, indigestion, heartburn, nausea or vomiting, extreme fatigue, upper body discomfort, dizziness, and shortness of breath. Heart failure has symptoms that include: shortness of breath, fatigue, or swelling of the feet, ankles, legs, abdomen, or neck veins. A heart arrhythmia is when someone experiences fluttering feelings in the chest, which is also known as palpitations.

The risk factors for the majority of cardiovascular diseases are high blood pressure, high blood cholesterol, and smoking. About half of the people in the United States (47%) have at least one of these three risk factors. There are also several other medical conditions and lifestyle choices can also put people at a higher risk for heart disease including:

- Diabetes
- Overweight and Obesity
- Unhealthy diet
- Physical inactivity
- Excessive alcohol use

Coronary Artery Disease (CAD)

CAD is the leading cause of death worldwide and the most common type of heart disease in the United States. It is sometimes called coronary heart disease or ischemic heart disease. CAD is caused by plaque buildup in the walls of the arteries that supply blood to the heart and other parts of the body, this build up is called **Atherosclerosis**. As the coronary blood vessels become occluded, the flow of blood to the tissues will be restricted, a condition called ischemia. Ischemia causes the cells to receive insufficient amounts of oxygen, which is called hypoxia. **Angina,** or chest pain and discomfort, is the most common symptom of CAD. Angina can happen when too much plaque builds up inside arteries, causing them to narrow. Narrow arteries can cause chest pain because they can block blood flow to your heart muscle and the rest of your body. Although angina is the most common symptom of CAD, for some people, the first sign of CAD is when they have 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 it should.

Arteriosclerosis and Atherosclerosis

Both atherosclerosis and arteriosclerosis negatively impact the ability of blood to flow freely through the body. **Arteriosclerosis** is known as the hardening of the artery and **atherosclerosis** is known as the thickening of the artery. As we age, our arteries lose elasticity and flexibility over time. This is a common factor in arteriosclerosis.

Atherosclerosis is caused by an accumulation of plaque deposits of cholesterol and other substances in the artery. Plaque buildup causes the inside of the arteries to narrow over time, which can partially or totally block the blood flow. Atherosclerosis

progresses slowly and often begins in childhood and gradually progresses throughout life.

There are lifestyle choices that can also be common factors that contribute to the thickening of the artery due to plaque that is building up in the artery. These risk factors include: smoking, family history, hypertension, obesity, diabetes, high alcohol consumption, lack of exercise, stress, and hyperlipidemia, which is high levels of lipids (fat) that circulates in the blood.

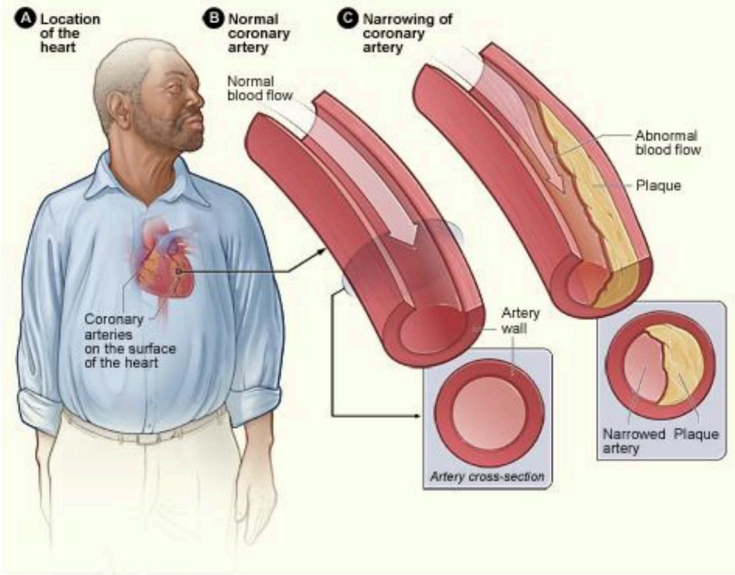


Figure 9.2.1: Atherosclerosis

Myocardial Infarction (“Heart Attack”)

Myocardial infarction (MI) is the formal term for what is commonly referred to as a heart attack. It normally results from a lack of blood flow (ischemia) and oxygen (hypoxia) to a region of the heart, which then causes death of the cardiac muscle cells. An MI often occurs when a coronary artery is blocked by the buildup of atherosclerotic plaque. It can also occur when a portion of unstable atherosclerotic plaque travels through the coronary arterial system and lodges in one of the smaller vessels. The resulting blockage restricts the flow of blood and oxygen to the myocardium and causes death of the tissue. MIs may be triggered by exercise, in which the partially occluded artery is no longer able to pump sufficient quantities of blood, or severe stress, which may induce spasm of the smooth muscle in the walls of the blood vessel.

As mentioned above, the first clue for many people that they have CAD is a heart attack. The symptoms of a heart attack include:

- Chest pain or discomfort (angina)
- Weakness, light-headedness, nausea (feeling sick to your stomach), or a cold sweat
- Pain or discomfort in the arms or shoulder
- Shortness of breath

MI may trigger cardiac arrest, but the two are not synonymous.

Cardiac Arrest and Arrhythmia

Cardiac arrest occurs when the heart suddenly and unexpectedly stops pumping. If this happens, blood stops flowing to the brain and other vital organs. The main cause of cardiac arrest is having an arrhythmia. An **arrhythmia**, or irregular heartbeat, is a problem with the rate or rhythm of your heartbeat. When a person sufferers from cardiac arrest, there are a number things that could potentially be happening to their heart which include: having a rapid heart rhythm (tachycardia), a disorganized electrical rhythm that doesn’t allow heart muscles to contract (fibrillation), or they could have no electrical current passing through their heart (asystole).

Have you watched a show or a movie where a doctor grabs paddles, rubs them together, yells “clear,” and then shocks or zaps the patient? They are using a machine called a defibrillator that sends an electrical shock to the heart to try and get the electrical

signals in the heart to contract in their regular rhythm. Although you might believe the defibrillator is restarting the heart, it is actually stopping the heart in order to try to get the hearts' electrical signal to reset and resume beating in a normal rhythmic way.

Cardiac arrests are very serious. Nine out of ten people who have a cardiac arrest outside a hospital die often within minutes.

It is important for people to know the risk factors of cardiac arrest before one occurs. These risk factors include: CAD, heart valve disease, congenital heart defects, and arrhythmias caused by faulty genes. Although as mentioned in our introduction, half of cardiac arrests happen to people who did not know they had a heart problem.

Congenital Heart Defects

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 Valve Defects

Heart valves present the backward flow of blood. They are located between the chambers of the heart and where the blood cleaves and returns to the heart. Healthy heart valves can fully open and close the valve during the heartbeat, but diseased valves might not fully open and close. If the heart valves are diseased, the heart can't effectively pump blood throughout the body and must work harder to pump, either while the blood is leaking back into the chamber or against a narrowed opening. This can lead to heart failure, sudden cardiac arrest (when the heart stops beating), heart palpitations (rapid, fluttering, or pounding), shortness of breath, or swelling in your legs and feet.

Valvular disorders are often caused by carditis, which is the inflammation of the heart. One common trigger for this inflammation is rheumatic fever, or scarlet fever, an autoimmune response to the presence of bacterium, Streptococcus pyogenes, normally a disease of childhood.

Congestive Heart Failure

Heart failure is often called congestive heart failure because of the fluid buildup in the lungs, liver, legs, and feet. 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 the muscle is too weak to pump enough blood. Most heart failure causes 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.

Stroke ("Brain Attack)

A stroke is sometimes called a "brain attack" and is formally known as a Cerebrovascular Accident (CVA). Like a heart attack, a brain attack (stroke) occurs because oxygen cannot get to the brain. With a stroke, the oxygen may not be getting to the brain because of a blockage in the blood vessel (likely due to atherosclerosis) or due to a rapture of the blood vessel. In either case, parts of the brain become damaged or die. To work properly, your brain needs oxygen. Your arteries deliver oxygen-rich blood to all parts of your brain. If something happens to block the flow of blood, brain cells start to die within minutes because they can't get oxygen. This is what causes a stroke.

During a stroke, every minute counts. Time lost is brain loss. The brain controls our movements, stores our memories, and is the source of our thoughts, emotions, and language. The brain also controls many functions of the body, like breathing and digestion. The impact of a stroke is dependent on the part of the brain that is not getting the oxygen it needs. A stroke can cause lasting brain damage, long-term disability, or even death.

Ischemic stroke and hemorrhagic stroke are the two types of major stroke. Ischemic stroke is the most common type of stroke. An ischemic stroke occurs when blood clots or other particles block the blood vessels to the brain. Plaque can also cause blockages by building up in the blood vessels.

This Ted-Talk by Vaibhav Goswami will show you what happens during a stroke. Please take note of the following:

- What happens during a stroke?
- What are signs that someone is having a stroke?
- Why is it important to get medical care as fast as possible?
- What is given to patients as soon as possible?
- What is the F.A.S.T. Test?

What happens during a stroke? - Vaibhav Goswami (4 min 59 second)

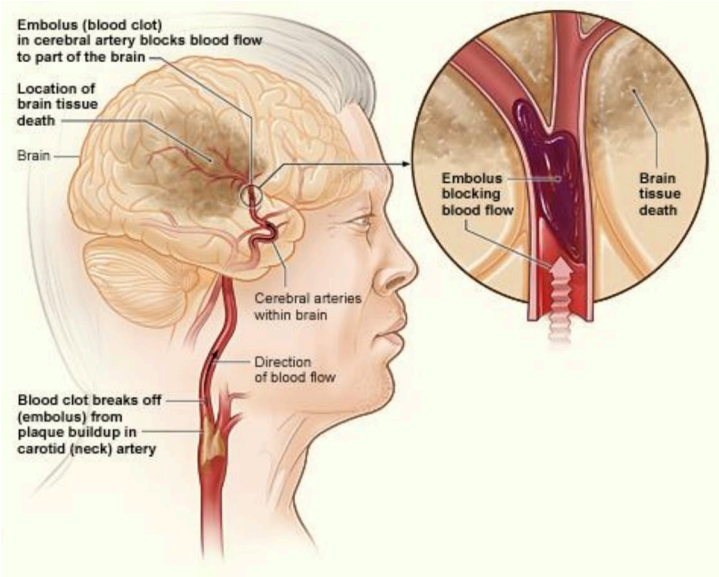


Figure 9.2.2: Ischemic Stroke

This differs from a hemorrhagic stroke. A hemorrhagic stroke happens 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 are examples of conditions that can cause a hemorrhagic stroke. Aneurysms are balloon-like bulges in an artery that can cause the artery to stretch and burst.

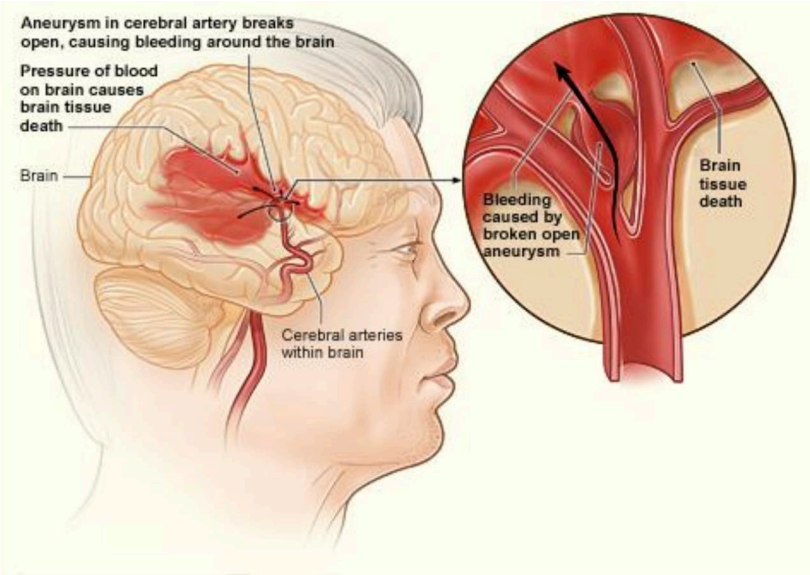


Figure 9.2.3: Hemorrhagic Stroke

A transient ischemic attack (TIA) is sometimes called a “mini-stroke” or a “warning stroke.” It is different from the major types of stroke because blood flow to the brain is blocked for only a short time. Usually this occurs for no more than 5 minutes. Like

ischemic strokes, blood clots often cause TIAs.

A TIA is a warning sign of a future stroke. It is a medical emergency just like a major stroke. Major strokes and TIAs require emergency care. If you or you see signs in someone else, call 9-1-1 right away. There is no way to know in the beginning whether symptoms are from a TIA or from a major type of stroke. More than a third of people who have a TIA and don't get treatment have a major stroke within 1 year. As many as 10%-15% of people will have a major stroke within 3 months of a TIA.

What to Do if You Think You or Someone You Know is Having a Stroke

As we have learned so far, strokes are very common. It is important that you know how to recognize whether you or someone around you is having a stroke. Here are some signs that we learned in the video in the introduction. We learned that oxygen deprivation can have sudden effects including, but not limited to slurred speech and/or weakness on one side of the body. It is important to act fast and get the person medical attention as soon as possible.

A hospital will be able to give the person Tissue Plasminogen Activator (TPA) within four and a half hours of when the stroke occurred. This medication is used to help blood flow return to where the damaged artery is. This medication greatly increases the likelihood of a person surviving a stroke and helps to reduce the side effects. There are times where this medicine will not be advised based on the clot and/or a person's current use of other medications, in those cases, it is possible that the person will go through a surgery to help remove the clot and return blood flow to the damaged area.

Don't forget the acronym F.A.S.T., which stands for:

F- Face - ask the person to smile. If their smile is crooked, then this could be sign of a stroke.

A - Arm - ask the person to raise their arms. If their arms are not at the same height or you notice weakness on one side, then this could be a sign of a stroke

S - Speech - If you notice slurred speech or the person is having trouble communicating, this could be a sign a person is having a stroke

T - Time - If you see any of the signs above, get medical help as soon as possible by calling 9-1-1.

9.3: Treatment for Cardiovascular Disease

The best treatment for cardiovascular diseases is prevention. By living a healthy lifestyle, you can help keep your blood pressure, cholesterol, and blood sugar levels normal and lower your risk for heart disease and heart attack.

You have to choose to make healthy habits. This includes: choosing to eat healthy foods, maintaining a healthy weight, exercising regularly, and not smoking.

You must also understand your own health. It is important to go to your doctor regularly.

Many of the diseases of the cardiovascular system, like blood pressure, have no symptoms. You will not know you have it without being tested. It is important to also have your cholesterol and sugar levels checked regularly.

In some cases with cardiovascular disease, medication, surgery, or other procedures may be required for treatment.

Medications

There are many types and combinations of drugs used to treat CAD. Your doctor or health care provider will decide the best treatment combination for your situation. There are a few medications available with different roles.

Anticoagulants are used to decrease the clotting, also known as coagulating, ability of the blood. Anticoagulants are also known as “blood thinners.” This differs from antiplatelet agents which are used to keep blood clots from forming by preventing blood platelets from sticking together. Angiotensin-Converting Enzymes (ACE) Inhibitors are used to expand blood vessels and are used to decrease resistance. This allows the blood to flow more easily and makes the heart’s work easier or more efficient. Lastly, beta blockers are used to decrease the heart rate and force of contraction. The result is the lowering of blood pressure and that makes the heart beat more slowly with less force.

Surgery and Procedures

Angioplasty is a procedure to improve blood flow in coronary arteries that have become narrow or blocked by mechanically widening the artery with a balloon. A specialized catheter with an expandable tip to insert into the blocked vessel. The balloon is inflated to compress the plaque material and to open the vessel to increase blood flow. Then, the balloon is deflated and retracted. A stent consisting of a specialized mesh is typically inserted at the site of occlusion to reinforce the weakened and damaged walls. Stent insertions have been routine in cardiology for more than 40 years.

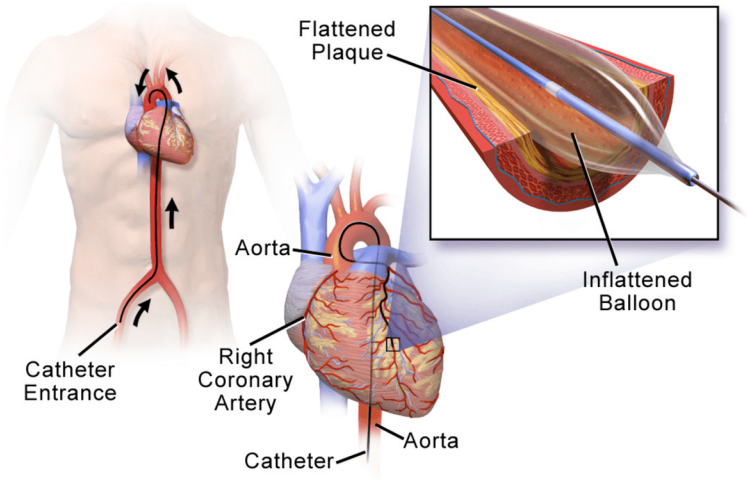


Figure 9.3.1: Balloon-tipped Catheter

Sometimes arteries become so damaged that they cannot be healed or fixed. When this occurs, the only option is to create a new artery and bypass the damaged one. This is known as coronary bypass surgery. You might have heard of someone having a “quadruple bypass.” This is when a surgeon had to create four new blood vessels to replace four coronary arteries that were blocked.

The surgery creates a new path for blood flow to the heart. The surgeon takes a healthy piece of vein from the leg or artery from the chest or wrist. Then the surgeon attaches it to the coronary artery, just above and below the narrowed area or blockage. This allows blood to bypass (get around) the blockage.

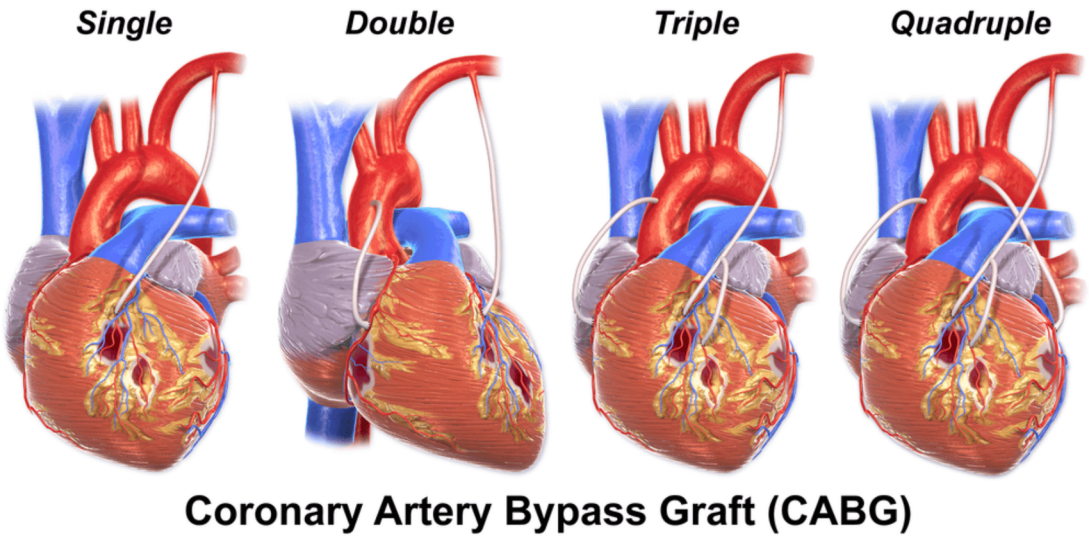


Figure 9.3.2: Coronary Artery Bypass Graft

Risk Factors to Cardiovascular Disease

Metabolic syndrome is a group of conditions that together raise your risk of coronary heart disease, diabetes, stroke, and other serious health problems. Metabolic syndrome is common in the United States. About one in three adults have metabolic syndrome. The good news is that it is largely preventable.

You might have metabolic syndrome if you have three or more of the following conditions: a large waistline, high blood pressure,

high blood sugar levels, high blood triglycerides, and low high-density lipoprotein (HDL) cholesterol.

Large Waistline

When a person has a large waistline, also known as abdominal obesity, their body “has an apple shape.” The extra fat that is in the stomach area has been shown to be a bigger risk factor for heart disease than extra fat in other parts of the body.

High Blood Pressure

High blood pressure can damage a person’s heart and blood vessels if the high blood pressure is sustained for a long period of time. High blood pressure can also cause plaque, which we learned is a waxy substance, to build up in arteries. As a reminder, plaque can cause heart and blood vessel disease such as heart attack or stroke.

High Blood Triglycerides

Triglycerides are a type of fat found in your blood. High levels of triglycerides can raise your levels of low-density lipoprotein (LDL) cholesterol, which is also known as bad cholesterol. This increases your risk of heart disease.

Low HDL Cholesterol

Blood cholesterol levels are important for heart health. LDL is also sometimes referred to as the “bad cholesterol” because it can cause plaque buildup in your blood vessels. “Good” HDL cholesterol can help remove “bad” LDL cholesterol from your blood vessels.

9.4: Metabolic Syndrome Additional Risk Factors

Your risk of metabolic syndrome increases as you get older. In older adults, women have a higher risk of metabolic syndrome than men. This is because changes in hormone levels after menopause can raise the risk of a large waistline, high blood sugar levels, and low levels of “good” HDL cholesterol. In addition, your family history and genetics can affect your weight or how your body responds to insulin. You have a higher risk of metabolic syndrome if others in your family have had metabolic syndrome, diabetes, or any of its risk factors. Your environment can also increase your risk. Low socioeconomic status can lead to an unhealthy diet, an inactive lifestyle, and can cause you to not get enough sleep.

There are also additional medical conditions that can increase your risk of metabolic syndrome. Overweight and obesity are the main risk factors for Metabolic Syndrome because they can raise the “bad” LDL cholesterol, blood triglycerides, and blood pressure. It can also lower the “good” HDL cholesterol. Overweight and obesity during pregnancy can raise your child’s risk of metabolic syndrome. In infants, a low birth weight and rapid weight gain after birth can raise the risk of metabolic syndrome later in life.

Polycystic ovary syndrome (PCOS) is a condition that causes fluid-filled sacs called cysts to grow on the ovaries. The hormone changes that cause PCOS can also cause you to have a large waistline, high blood sugar levels, high triglyceride levels, and low levels of “good” HDL cholesterol.

Problems with your immune system can cause some skin diseases such as psoriasis, which raise your risk of metabolic syndrome. There are also certain cancer treatments that affect your immune system and raise your risk.

There are also some medicines that are used to treat allergies, bipolar disorder, depression, HIV, and schizophrenia also raises your risk of metabolic syndrome.

9.5: 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 is the second leading cause of death in the United States after Cardiovascular Disease. In 2019 in the United States, 1,752,735 new cancer cases were reported and 599,589 people died of cancer. For every 100,000 people, 439 new cases were reported and 146 people died of cancer.

Cancer has a major impact on society in the United States and across the world. Thankfully, in the United States, the likelihood of dying from cancer has dropped steadily since the 1990s. Five year survival rates for some cancers, such as breast, prostate, and thyroid cancers, now are 90 percent or better. In addition, the 5 year survival rate for all cancers combined is currently about 67 percent. According to the National Cancer Institute, the cancer death rates have decreased on average 2.3% in men and 1.9% for women from 2015 to 2019.

From 2014-2018, there has been some cancers in men and women that have decreased and some that have increased. The eight cancers that decreased in among men were lung and bronchus, larynx, urinary bladder, stomach, thyroid, colon and rectum, non-Hodgkin lymphoma, and brain and other nervous system. Pancreas, kidney and renal pelvis, and testis cancer increased in men. In women, seven cancers decreased: thyroid, ovary, colon and rectum, lung and bronchus, urinary bladder, non-Hodgkin lymphoma, and brain and other nervous system. Also in women, 7 of the 18 most common incidence rates increased including: melanoma, liver and intrahepatic bile duct, myeloma, kidney and renal pelvis, pancreas, breast, and oral cavity and pharynx. It should be noted that also during 2014-2018, cancer incident rates in people between the ages of 15-39 increased on average by 0.9%. We will look as to what factors influenced these changing trends in a little bit.

Cancer can start almost anywhere in the human body when just one of the trillions of cells changes and begins to grow uncontrollably and spread to other parts of the body. Normally, human cells grow and multiply through cell division to form new cells as the body needs them. When 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**.

Tumors

Tumors can be benign or malignant. A benign tumor is not cancerous. Benign tumors do not spread to other parts of the body, also known as **metastasis**. Benign tumors are usually left in the body unless it is causing pain or is life threatening, such as benign tumors in the brain. When benign tumors are removed, they usually do not grow back, whereas malignant tumors sometimes do.

Malignant (cancerous) tumors 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. It is important to note that not all cancers form tumors. For example, leukemia is a cancer of the blood cells that build up in the blood and sometimes in the bone marrow.

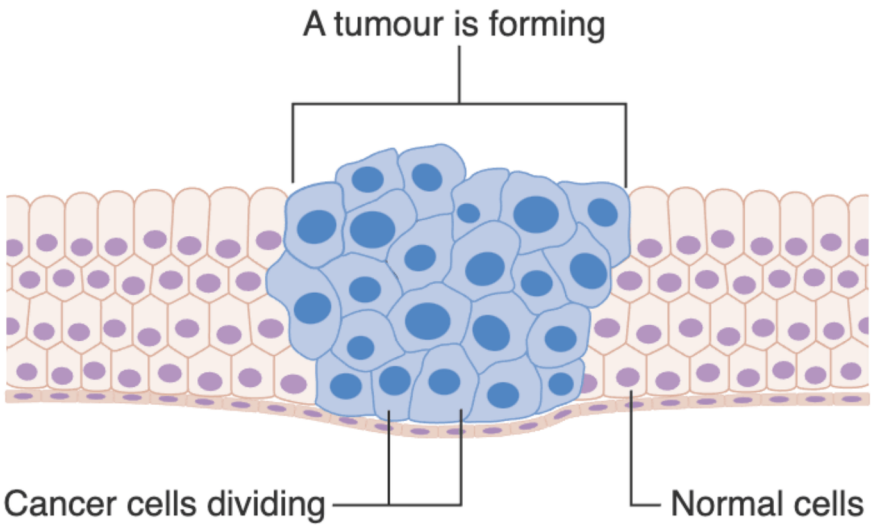


Figure 9.5.1: Diagram showing how cancer cells keep on reproducing to form a tumor

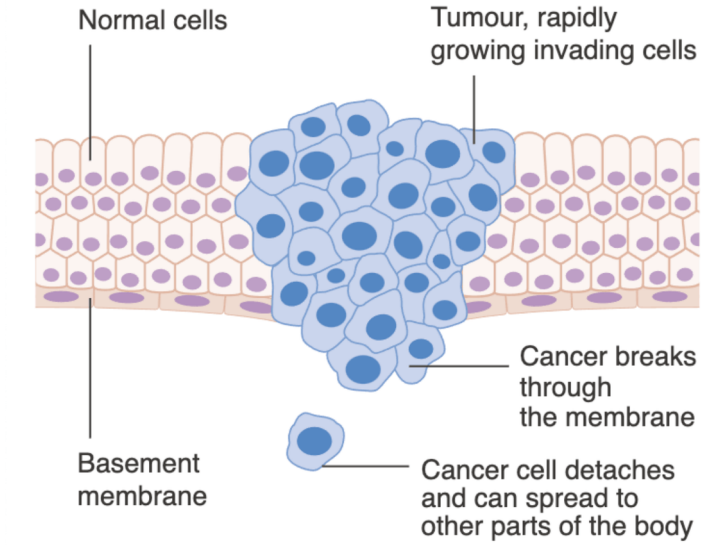


Figure 9.5.2: Diagram showing how cancer cells can detach from a tumor and spread to other parts of the body

Metastasis

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. A cancer that has spread from the place where it first started to another place in the body is called metastatic cancer. As we learned earlier in this chapter, metastasis is the process by which cancer cells spread to other parts of the body.

Cancer can metastasize to several places in the body; however, it will be known by the primary site where the initial cancer cell began. For example, if a person has breast cancer that has spread to the lung, they will be determined to have breast cancer with lung metastases, not as 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

The cancer stage refers to the extent of your cancer, such as how large the tumor is, and if the cancer has spread to other parts of your body. Almost always, a cancer is referred to by the stage it was given at diagnosis.

Stage 0

In Stage 0, abnormal cells are present but have not spread to nearby tissue. Also called carcinoma in situ, or CIS. CIS is not cancer, but may become cancer.

Stage 1, Stage 2, and Stage 3

Cancer is present. The higher the number, the larger the cancer tumor and the more it has spread into nearby tissues.

Stage 4

The cancer has spread to distant parts of the body.

Cancer Screening and Symptoms

Before learning about the various types of cancer, it is important to note that many cancers have no symptoms, rather they are asymptomatic. It is important to get annual checkups and screenings to detect cancer. For example, women should get pap tests annually and mammograms after 40 (or earlier if their doctor recommends it due to breast cancer running in their family or other factors). Men and women should get a colonoscopy every 10 years starting at age 45. People should always follow their doctor's recommendations.

Early detection is key for cancer survival. The acronym CAUTION is a helpful reminder of the most common symptoms of cancer that you should watch out for. If you see any of the following symptoms, please make an appointment with your primary care physician as soon as possible.

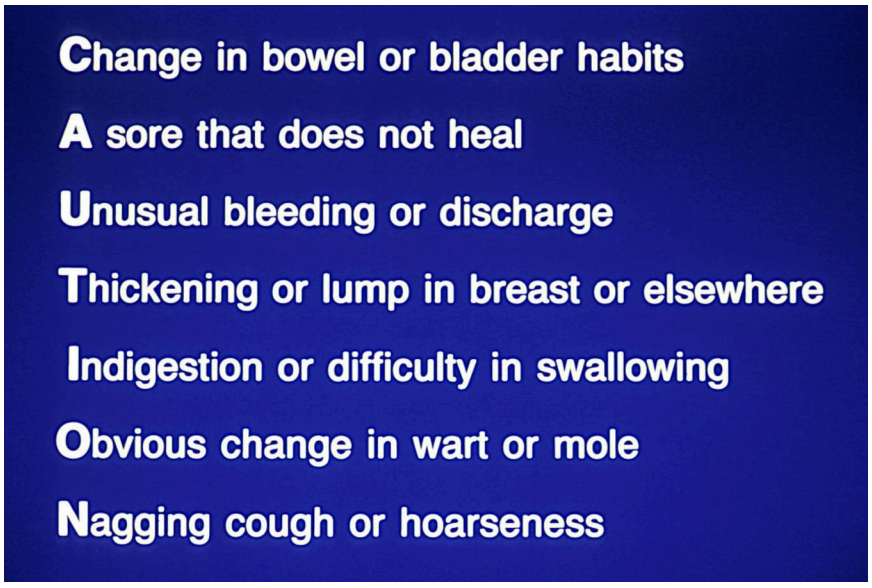


Figure 9.5.3: CAUTION Acronym

Change in bowel or bladder habits

A sore that does not heal

Unusual bleeding or discharge

Thickening or lump in breast or elsewhere

Indigestion or difficulty in swallowing

Obvious change in wart or mole

Nagging cough or hoarseness

Types of Cancer

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

Skin Cancer

Did you know that the skin is the largest organ in the human body? Our skin has many purposes including protection against the heat, sun, injury, and infection. It also stores water, fat, Vitamin D, and helps us control our body temperature. Our skin consists of many layers including the epidermis. The epidermis consists of three kinds of cells: basal, squamous, and melanocytes. These three places are the three places that skin cancer occurs.

Skin cancer can occur in both men and women. It is the most common type of cancer. The main types of skin cancer include basal cell carcinoma, squamous cell carcinoma, and melanoma. Melanoma is not as common; however, it is the type of skin cancer that most people die from. It is also more likely to spread to other parts of the body compared to the other types of skin cancer. On average, melanoma occurs in 21.2 per 100,00 men and women per year. The death rate between 2017-2021 was 2 per 100,000.

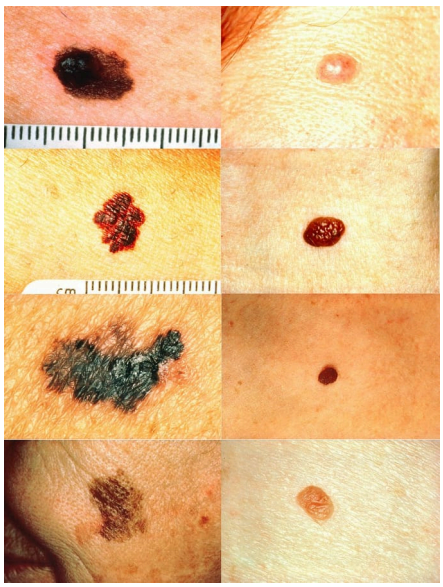


Figure 9.5.4: Different Examples of Skin Cancer

Skin cancer has risk factors that should be taken into consideration and avoided when possible. People should limit exposure to ultraviolet radiation from the sun or artificial sunlight, such as a tanning bed. Individuals with a fairer complexion are also at higher risk for developing skin cancer. This also includes: people who do not tan or do not tan well, have freckles, are more likely to sunburn, light colored eyes, and blond or red hair. Other risk factors include having a family history of skin cancer, history of sunburns, and having many moles. Sunscreen is recommended to help prevent sunburns, which is also known as sun damaged skin.

Though not all skin cancer can be easily detectable, self checks are a helpful way to help prevent 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” of Melanoma can help you remember what to watch for:

- Asymmetry – the shape of one half does not match the other
- Border – the edges are ragged, blurred or irregular
- Color – the color is uneven and may include shades of black, brown and tan
- Diameter – there is a change in size, usually an increase (larger than 6 millimeters or about 1/4 inch)
- Evolving – the mole has changed (in size, color, shape; it may start to itch or bleed) over the past few weeks or months

You should always consult a doctor if you have any concerns. To help prevent skin cancer while still having fun outdoors, protect yourself by seeking shade, applying sunscreen, and wearing sun-protective clothing, a hat, and sunglasses.

For more information, visit Reducing Risk for Skin Cancer.

Breast Cancer

Breast cancer can occur in both men and women. It is the second most common type of cancer in women with skin cancer being the most common. In 2024, there were an estimated 310,720 new cases of breast cancer. It has a 91.2% 5 year relative survival rate when looking from 2014-2020. Breast cancer is rare in men. Breast cancer occurs when the cells in the breast grow out of control. The type of breast cancer is determined by the type of cell that turned into cancer with the most common types being invasive ductal carcinoma and invasive lobular carcinoma (~10-15% of cases).

In most types of breast cancer, the cancer begins in the ducts of the breast, which is the tube part of the breast that carries milk to the nipple. Some other symptoms of breast cancer could include:

- New lump in the breast or underarm (armpit).
- Thickening or swelling of part of the breast.
- Irritation or dimpling of breast skin.
- Redness or flaky skin in the nipple area or the breast.
- Pulling in of the nipple or pain in the nipple area.
- Nipple discharge other than breast milk, including blood.
- Any change in the size or the shape of the breast.
- Pain in any area of the breast.

Screening through mammograms and self-exams help look for signs of cancer even before symptoms occur. Mammograms and self-exams can help identify breast cancer. Mammograms can reveal lumps and sometimes thicker connective tissues. Self-exams of the breast and underarm can help find lumps and/or thicker areas on the breast or under the arm. In men, a lump on the breast is often felt when there is breast cancer.

There are many different types of treatment for breast cancer with new treatments that are being tested through clinical trials. Some of the types of treatment include:

- Surgery
- Radiation therapy
- Chemotherapy
- Hormone therapy
- Targeted therapy
- Immunotherapy

There are side effects and it is best to discuss plans for treatment with your doctor to come up with the best treatment for you and your specific cancer.

9.6: Cancer Risk and Prevention

Cancer prevention are actions you can take to lower the chance of getting cancer. 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.

It is usually not possible to know exactly why one person develops cancer and another doesn't; however, research has shown that certain risk factors may increase a person's chances of developing cancer. Understanding the risk factors can help you make lifestyle choices to try and prevent or lower your risk of cancer.

Cancer Screening

Here are some additional screening tests of cancers not mentioned in detail above that you should be aware of if you are someone you know are between the ages of 21-50.

Colon Cancer Testing

Find out if you are at higher than average risk for colon cancer because of family history, genetic disorders, or other factors. If not, then testing is not needed at this time. If you are at increased risk, talk to a health care provider about when you need to start testing and what tests are right for you.

All people at average risk should start testing at age 45. There are several testing options. Talk with a health care provider about which tests are best for you and how often testing should be done.

Cervical Cancer Testing

No test is needed before age 25.

Starting at age 25 and through age 65, all people with a cervix should have a primary HPV test* every 5 years. If a primary HPV test is not available in your area, then acceptable options include a co-test (an HPV test done at the same time as a Pap test) every 5 years or a Pap test alone every 3 years. (*A primary HPV test is an FDA approved test that is done by itself for screening.) The most important thing to remember is to get screened regularly, no matter which test you get. Follow testing recommendations even if you've been vaccinated against HPV. You don't need testing after surgery that removed the cervix as long as it was done for reasons not related to cervical cancer or pre-cancer.

Prostate Testing

Starting at age 45, men at higher than average risk of prostate cancer should talk with a doctor about the uncertainties, risks, and potential benefits of testing so they can decide if they want to be tested. This includes African American men and men with close family members (father, brother, son) who had prostate cancer before age 65. Men with more than one close relative who had prostate cancer before age 65 are at even higher risk and should talk with a doctor about testing starting at age 40.

Age

Advancing age is the most important risk factor for cancer overall and for many individual cancer types. The incidence rates for cancer overall climb steadily as age increases, from fewer than 25 cases per 100,000 people in age groups under age 20, to about 350 per 100,000 people among those aged 45–49, to more than 1,000 per 100,000 people in age groups 60 years and older.

Alcohol

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. The risk of cancer is much higher for those who drink alcohol and also use tobacco.

Environmental Carcinogens

People can avoid some cancer-causing exposures, such as tobacco smoke and the sun's rays. But other ones are harder to avoid, especially if they are in the air we breathe, the water we drink, the food we eat, or the materials we use to do our jobs. Being exposed to chemicals and other substances in the environment has been linkedto some cancers. A few carcinogens in our environment include: Arsenic, formaldehyde, asbestos, radon, wood dust, mineral oils, and soot.

Chronic Inflammation

In chronic inflammation, the inflammatory process may begin even if there is no injury, and it does not end when it should. It is not always known why the inflammation continues. Chronic inflammation may be caused by infections that don't go away, abnormal immune reactions to normal tissues, or conditions such as obesity. Over time, chronic inflammation can cause DNA damage and lead to cancer.

Diet

In Chapter 7 we learned that an individual's diet may reduce the risk for certain conditions or diseases. Current literature suggests that dietary factors may play a role in the development of several chronic diseases, including but not limited to the following: diabetes, cardiovascular disease, and cancer. The World Health Organization (WHO) has identified several harmful health outcomes which may be meaningfully influenced by diet: excess weight and obesity, low bone mineral density and osteoporosis, and poor dental health. Specific nutrients may combat harmful health conditions when they interact with metabolic processes. Metabolic pathways include the inactivation of carcinogens, reductions in inflammation, body fat, and insulin sensitivity, and improvements in the immune system. Recent research has focused upon an association between increased consumption of fruits and vegetables, and reductions in the risk for all-cause mortality and cardiovascular mortality.

The literature regarding potential correlations between diet, disease, and risk reduction is vast, and therefore will not be explored in great detail within the confines of this class. Many studies have looked at the possibility that specific dietary components or nutrients are associated with increases or decreases in cancer risk, however results have been inconclusive or need further research. It is hard to study the effects of diet on cancer because a person's diet includes foods that may protect against cancer and foods that may increase the risk of cancer. Although the research is inconclusive, dietary relations to cancer have included:

- Antioxidants may lower cancer risk by blocking the activity of free radicals that damage cells.
- Artificial sweeteners have been shown to cause bladder cancer in animals.
- Higher intakes of calcium and may reduce risks of colorectal cancer.
- Charred meat increases exposure to chemicals that can cause cancer in animals.
- Red meat is associated with an increased risk of colon and rectum cancer.
- Cruciferous vegetables may have anticancer effects.
- Fluoridated water helps decrease tooth decay, but may increase cancer risk.
- Tea may lower cancer risk by blocking the activity of free radicals that damage cells.
- Higher intakes of vitamin D or higher levels of vitamin D in the blood may be associated with a reduced risk of colorectal cancer.

Hormones

Estrogens, a group of female sex hormones, are known human carcinogens. Although these hormones have essential physiological roles in both females and males, they have also been associated with an increased risk of certain cancers.

Immunosuppression

Many people who receive organ transplants take medications to suppress the immune system so the body won't reject the organ. These "immunosuppressive" drugs make the immune system less able to detect and destroy cancer cells or fight off infections that cause cancer.

Infectious Agents

Certain infectious agents, including viruses, bacteria, and parasites, can cause cancer or increase the risk that cancer will form.

Obesity

Overweight is defined as a body mass index (BMI) of 25 to 29, and obesity is defined as a BMI of 30 or higher. Research has shown that being overweight or obese substantially raises a person's risk of getting endometrial (uterine), breast, prostate, and colorectal cancers.

Radiation

Radiation of certain wavelengths, called ionizing radiation, has enough energy to damage DNA and cause cancer.

Sunlight

The sun, sunlamps, and tanning booths all give off ultraviolet (UV) radiation. Exposure to UV radiation causes early aging of the skin and damage that can lead to skin cancer. Exposure to ultraviolet (UV) rays from the sun and tanning beds appears to be the most important environmental factor involved with developing skin cancer.

To help prevent skin cancer while still having fun outdoors, protect yourself by seeking shade, applying sunscreen, and wearing sun-protective clothing, a hat, and sunglasses. For more information, visit What Can I Do to Reduce My Risk of Skin Cancer?

Tobacco and Secondhand Smoke

Lung cancer is the leading cause of cancer death, and cigarette smoking causes almost all cases. Cigarette smoking is the number one risk factor for lung cancer. In the United States, cigarette smoking is linked to about 80% to 90% of lung cancer deaths. People who smoke cigarettes are 15 to 30 times more likely to get lung cancer or die from lung cancer than people who do not smoke.

Smoking also causes cancer of the mouth and throat, esophagus, stomach, colon, rectum, liver, pancreas, voice box (larynx), trachea, bronchus, kidney and renal pelvis, urinary bladder, and cervix, and causes acute myeloid leukemia.

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.

Physical Activity

As we learned in Chapter 3, living an active lifestyle is one of the most important things people can do to improve their health. Physical activity is beneficial for everyone. We have learned so far in our studies that being active improves your health in

numerous ways in generally healthy people, in people at risk of developing chronic diseases, and in people with current chronic conditions or disabilities. We learned that that many studies have been done for diverse groups and have seen how physical activity plays in many health outcomes including:

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

Numerous studies have shown associations between reduced risk for colon and breast cancer and physical activity participation. In detail, physically active men and women exhibited a 30-40% risk reduction for colon cancer, and physically active women presented with a 20-30% risk prediction for breast cancer compared with their inactive counterparts. Systematic reviews spanning decades of research indicate that moderate-intensity physical activities produce a greater protective effect than low-intensity activities.

Diabetes

Some studies show that having diabetes may slightly increase the risk of having several different types of cancer.

9.7: Diabetes

As we have learned, diabetes is a disease when your blood glucose levels, which is also referred to as blood sugar, is too high. Our blood glucose is the main source of energy coming from what you eat. Diabetes is a chronic health condition that has three main types: type 1, type 2, and gestational diabetes. For the purpose of this chapter, we will be focused on type 1 and type 2 diabetes. 90-95% of individuals with diabetes have type 2.

The CDC reports that diabetes is the eighth leading cause of death in the United States. This is concerning because 1 in 5 of the 38 million adults that have diabetes do not know that they have it. Diabetes has lasting serious effects including being the number one cause of kidney failure, lower-limb amputations, and adult blindness. The number of people in the United States with diabetes continues to rise having more than doubled in the last 20 years. This leads to $413 billion dollars per year for health care costs and lost work and wages in individuals with diabetes. These statistics do not include the prediabetics. 1 in 3 adults in the United States have prediabetes with 8 out of 10 people not aware that they are. This is concerning because prediabetes increases a person's risk for chronic diseases including type 2 diabetes, heart disease, and stroke.

Researchers do not know how type 1 diabetes can be prevented; however, we do know that type 2 diabetes can be prevented through lifestyle changes.

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 on a person also makes a difference. Extra belly fat is linked to insulin resistance, type 2 diabetes, and heart and blood vessel disease.

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.

9.8: How Can We Prevent Chronic Diseases?

Earlier in the chapter, we discussed how there are four common risk factors that are identified by the CDC for most chronic diseases. These included: tobacco use, poor nutrition, physical inactivity, and excessive alcohol use. We will address each of these four first and add a few additional prevention steps.

Avoid Tobacco

If you are currently using tobacco, stop smoking. If you have never started, don't. As we have learned, by stopping or never using tobacco, it will lower your risk of: heart disease, cancer, type 2 diabetes, lung disease, and premature death. If you have started smoking and are trying to quit, you don't need to do it alone. There is free support offered through 1-800-QUIT-NOW.

Eat a Balanced Diet

We learned in Chapter 7 that it is important to have a healthy and balanced diet. We spent time learning how ChooseMyPlate was a great resource to help with that. Eating a balanced diet will help reduce our risk of being overweight and obese. It will also help to prevent heart disease, type 2 diabetes, and other chronic diseases. If you or someone you know has a chronic disease, eating a balanced diet will help manage that disease.

Participate in Regular Physical Activity

As we have learned throughout this class, participating in regular physical activity is vital to our personal health and wellbeing, as well as, in our prevention of chronic diseases. As a reminder, regular physical activity is defined as participating in moderate to intense physical activity for at least 150 minutes a week and muscle strength training activities twice a week.

Decrease or Abstain from Alcohol Consumption

If you are like many Americans, you drink alcohol at least occasionally. For many people, moderate drinking is probably safe. It may even have health benefits, including reducing your risk of certain heart problems. Moderate drinking is one drink a day for women or anyone over 65, and two drinks a day for men under 65. Some people should not drink at all, including alcoholics, children, pregnant women, people on certain medicines and people with some medical conditions. Anything more than moderate drinking can be risky. Binge drinking—drinking five or more drinks at one time—can damage your health and increase your risk for accidents, injuries and assault. Years of heavy drinking can lead to higher blood pressure, various cancers, heart disease, stroke, and liver disease. It can also cause problems at home, at work and with friends.

Visit Your Doctor and Dentist Regularly

There are many screening tests that your doctor can do to help you lower your risk of developing a chronic disease. These tests are also used to help detect if you already have a chronic disease and can detect them early. The earlier it is detected, the earlier you can begin treatment. It is also important to make sure that your doctor is aware of your family history. Make sure to include information if you or your family members have chronic diseases such as heart disease, stroke, cancer, or diabetes. Though there are risk factors that we can control, our genetics can also be a risk factor as discussed earlier in this chapter.

It is also vitally important to visit your dentist regularly. Your dentist will screen you for oral diseases including cavities, gum disease, and oral cancer.

Get a Good Night's Sleep

Sleep can be easily overlooked. The CDC recommends that adults should get at least 7 hours of sleep each night. Getting less sleep than that at night can lead to additional problems that can be linked to diabetes, heart disease, obesity, and depression. Sufficient sleep is also important for chronic disease management.

Risk Factors That We Cannot Control

As we learned in Chapter 1, part of learning how to take charge of one's health requires understanding risk factors for different diseases. Risk factors are things in life that increase your chances of getting a certain disease. Some risk factors are beyond your control. A person may be born with them or have exposure with no fault assigned.

As we have discussed so far, many of the risk factors for Cardiovascular Disease and Cancer are related to your lifestyle choices you make may impact your chances of being diagnosed with Cardiovascular Disease and Cancer. Part of learning how to take charge of your health requires understanding your risk factors for different diseases. Risk factors are aspects in your life that increase your chances of getting a certain disease. Some risk factors are beyond your control. For example, you may be born with genetic factors or exposed to risk factors that you do not have control over.

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

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

Above we discussed the risk factors that you can control. You can have one risk factor or many and any combination of ones that you can and cannot control.

People with a family health history of chronic disease may have the most to gain from making lifestyle changes. You cannot change your genes; however, you can make the decision to stop smoking or to choose to go on daily walks no matter how busy your schedule is. Another change you can make is to have screening tests, such as mammograms and colorectal cancer screening. These screening tests help detect disease early. People who have a family health history of a chronic disease may benefit the most from screening tests that look for risk factors or early signs of disease. You can talk to your primary care doctor to find out what health screenings would be best for you. Finding disease early, before symptoms appear, can mean better health in the long run.

9.9: Developing Health Literacy

The U.S. Department of Health and Human Services (HHS) defines **health literacy** as "The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions." In a recent report by the HHS, improved consumer health literacy was determined to be an important component of health communication, medical product safety, and oral health. Health literacy includes the ability to understand instructions on prescription drug bottles, appointment slips, medical education brochures, doctor's directions and consent forms, and the ability to negotiate complex health care systems. Health literacy is not simply the ability to read. It requires a complex group of reading, listening, analytical, and decision-making skills, and the ability to apply these skills to health situations. Health literacy varies by context and setting and is not necessarily related to years of education or general reading ability. A person who functions adequately at home or work may have marginal or inadequate literacy in a health care environment. With the move towards a more "consumer-centric" health care system as part of an overall effort to improve the quality of health care and to reduce health care costs, individuals need to take an even more active role in health care related decisions. To accomplish this people need strong health information skills.

Skills Needed for Health Literacy

When people are seeking medical care, they are often faced with complex information and treatment decisions. Some of the specific tasks patients are required to carry out may include:

- evaluating information for credibility and quality,
- analyzing relative risks and benefits,
- calculating dosages,
- interpreting test results, or
- locating health information.

In order to accomplish these tasks, individuals may need to be:

- visually literate (able to understand graphs or other visual information),
- computer literate (able to operate a computer),
- information literate (able to obtain and apply relevant information), and
- numerically or computationally literate (able to calculate or reason numerically).

Oral language skills are important as well. Patients need to articulate their health concerns and describe their symptoms accurately. They need to ask pertinent questions, and they need to understand spoken medical advice or treatment directions. In an age of shared responsibility between physician and patient for health care, patients need strong decision-making skills. With the development of the Internet as a source of health information, health literacy may also include the ability to search the Internet and evaluate websites. According to the American Medical Association, poor health literacy is "a stronger predictor of a person's health than age, income, employment status, education level, and race." In *Health Literacy: A Prescription to End Confusion*, the Institute of Medicine reports that ninety million people in the United States, nearly half the population, have difficulty understanding and using health information. As a result, patients often take medicines on erratic schedules, miss follow-up appointments, and do not understand instructions like "take on an empty stomach."

Vulnerable populations include:

- Elderly (age 65+) - Two thirds of U.S. adults age 60 and over have inadequate or marginal literacy skills, and 81% of patients age 60 and older at a public hospital could not read or understand basic materials such as prescription labels
- Minority populations
- Immigrant populations
- Low income - Approximately half of Medicare/Medicaid recipients read below the fifth grade level
- People with chronic mental and/or physical health conditions

Reasons for limited literacy skills include:

- Lack of educational opportunity - people with a high school education or lower

- Learning disabilities
- Cognitive declines in older adults
- Use it or lose it - Reading abilities are typically three to five grade levels below the last year of school completed. Therefore, people with a high school diploma, typically read at a seventh or eighth grade reading level.

The relationship between literacy and health is complex. Literacy impacts health knowledge, health status, and access to health services. Health status is influenced by several related socioeconomic factors. Literacy impacts income level, occupation,education, housing, and access to medical care. The poor and illiterate are more likely to work under hazardous conditions or be exposed to environmental toxins.

Economic Impact of Low Health Literacy

In addition to the effects of low health literacy on the individual patient, there are economic consequences of low health literacy to society. After adjusting for health status, education level, socioeconomic status, and other demographics factors, people with low functional literacy have less ability to care for chronic conditions and use more health care services.

Why Does Health Literacy Matter?

Every day, people confront situations that involve life-changing decisions about their health. These decisions are made in places such as grocery and drug stores, workplaces, playgrounds, doctors' offices, clinics and hospitals, and around the kitchen table. Obtaining, communicating, processing, and understanding health information and services are essential steps in making appropriate health decisions; however, research indicates that today's health information is presented in ways that are not usable by most adults. "Limited health literacy" occurs when people can't find and use the health information and services they need.

- Nearly 9 out of 10 adults have difficulty using the everyday health information that is routinely available in our healthcare facilities, retail outlets, media and communities.
- Without clear information and an understanding of the information's importance, people are more likely to skip necessary medical tests, end up in the emergency room more often, and have a harder time managing chronic diseases like diabetes or high blood pressure.

Who Does Limited Health Literacy Affect? Who is Affected?

People of all ages, races, incomes, and education levels can find it difficult to obtain, communicate, process and understand health information and services. Literacy skills are only a part of health literacy. Even people with strong reading and writing skills can face health literacy challenges when:

- They are not familiar with medical terms or how their bodies work.
- They have to interpret or calculate numbers or risks that could have immediate effects on their health and safety.
- They are voting on a critical local issue affecting the community's health and are relying on unfamiliar technical information.
- They are diagnosed with a serious illness and are scared or confused.
- They have health conditions that require complicated self-care.

9.10: Health Promotion and Self Care

Ideally we adopt behaviors and practices that promote health and prevent chronic disease. Through education and health promotion we learn behaviors and practices to manage our own basic health care. Health promotion involves education, policy, and support that helps us to make health choices and promote positive behavior and self-care. Self-care and health promotion involve the following:

- health prevention practices, which help limit our need for formal interventions; we manage minor health concerns informally using self-care.
- primary prevention such as brushing our teeth, breast and testicular self exam, vaccinations, etc.
- managing uncomplicated injuries or illnesses with self diagnosis and treatment
- using home remedies and over the counter drugs.

Self-Care versus Formal Care

Self-Care

The World Health Organizations defines self-care in the following way:

"**Self-Care** is what people do for themselves to establish and maintain health, and to prevent and deal with illness. It is a broad concept encompassing hygiene (general and personal), nutrition (type and quality of food eaten), lifestyle (sporting activities, leisure etc), environmental factors (living conditions, social habits, etc.) socio-economic factors (income level, cultural beliefs, etc.) and self-medication."

Self-care improves as we come to know our body and pay attention to the signals it gives us so we can take appropriate actions. Self-care helps us rely less on formal medical intervention. When we are more knowledgeable about our body and health issues we are better able to make better decisions about self-care and seeking formal care

Examples of self-care are:

- Recognition of symptoms or conditions that occur frequently but may not require a doctor's visit
- Performing monthly breast and testicular self-exams
- Learning first aid for common, uncomplicated injuries and conditions
- Checking blood pressure, pulse, and temperature
- Using home pregnancy tests, ovulation kits and HIV test kits
- Doing periodic checks for blood cholesterol
- Using home stool test kits for early colon cancer detection
- Using self-help books, tapes, websites, and videos
- Benefiting from relaxation techniques, including meditation, nutrition, rest, and exercise

Formal Care

Health care professionals often need to be consulted if there is a serious accident or injury, severe trauma, sudden onset of symptoms, or if any symptoms are unusual and recur over time. Formal Care is accessing a local provider through a community or privatized hospital, clinic or medical practice. Formal Care is best and most effective when you are an active participant and informed. A partnership between the patient and health care provider is desirable. The goal should be an exchange of information and coordination on interventions and solutions. Formal Care is enhanced through health literacy.

10: WHAT IS STRESS AND HOW DOES IT AFFECT WELLNESS?

10.1: Introduction

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.

What is Stress?

Stress is defined as the body's physical, mental, and emotional response to a particular stimulus, called a **stressor**. The **stress 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 hard working 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.

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, emotional, and behavior responses) to a stressor. The body's physical response to stress is termed the "Fight or Flight" reaction. It is a natural and unavoidable part of life, and it can be empowering and motivating, or harmful and potentially dangerous.

Common Stressors

Stress may be recurring, short-term, or longer-term and may include things like commuting to and from school or work every day, traveling for a yearly vacation, or moving to another home.

Here are some examples for common causes of short-term stress:

- Needing to do a lot in a short amount of time
- Having a lot of small problems in the same day, like getting stuck in a traffic jam or running late
- Getting ready for a work or school presentation
- Having an argument

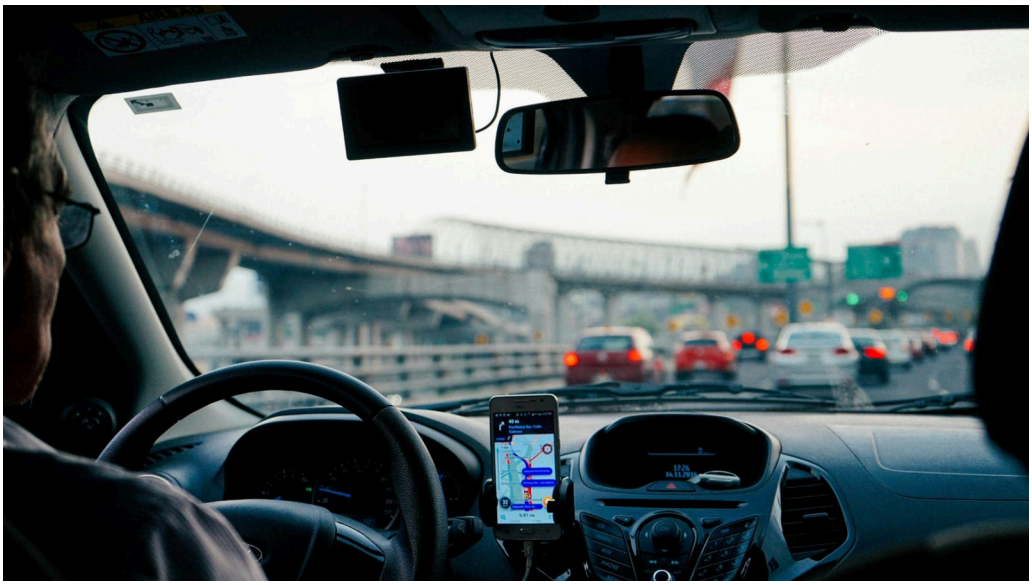


Figure 10.1.1: Photo by Dan Gold on Unsplash

Here are some examples for common causes of long-term stress:

- Having problems at work or at home
- Having money problems
- Having a long-term illness
- Dealing with the death of a loved one

Change is a leading cause of stress. Changes can be positive or negative, as well as real or perceived. Changes can be mild and relatively harmless, such as winning a race, watching a scary movie, or riding a rollercoaster. Some changes are major, such as marriage or divorce, serious illness, or a car accident. Other changes are extreme, such as exposure to violence, and can lead to traumatic stress reactions.

Physical Response: The Fight or Flight Response

Imagine how you would feel if you were driving to school and you saw a car accident occur right in front of you and you had to serve and avoid crashing into the cars. How would you feel if the phone rang and it was the police. They inform you that something has happened to a loved one. What would it feel like to be on a quiet morning walk and suddenly an aggressive dog comes running toward you?

In any of these situations you might feel any or all of the following: rapid heartbeat, sweaty palms, tense muscles or shaking, rapid breathing, and nausea. The symptoms that you feel in these types of situations are a product of the body's automatic physical reaction to stressors called the **Fight or Flight Response**. The Fight or Flight Response is very important for our survival as it enables the body to take action quickly, and is intended to keep us out of physical harm's way.

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. These stress hormones prepare the body to either fight off the stressor or flee from the stressor. Your heart rate increases to get more oxygenated blood to your muscles so you can prepare for action. Your breathing increases to get more oxygen. An increase in perspiration (sweating) keeps your body cool. These physiological effects are valuable when faced with a potentially dangerous situation.

Figure 10.1.2: Photo by il vano on Unsplash

Regardless of whether the stress experienced is negative or positive, small or extreme, the physical effects on the body are the same. For example, the stress hormones are produced whether you are stressed because of ongoing financial struggles or are stressed because you almost got in a bad car accident. Unfortunately, most of the stressors people face-work, school, finances, relationships- are part of everyday life, and thus, inescapable. In modern life, we do not get the option of “flight” very often. We have to deal with those stressors all the time and find a solution. When you need to take the SAT there is no way for you to avoid it; sitting in the test room for five hours is the only choice. Living with the “flight” option in the stress-response process leads to higher stress levels in modern society. Living with constant stress that is constantly triggering a physical stress response can cause physical issues such as: an upset stomach, headaches, sleep problems, weight gain or loss, muscle aches, and heart disease.

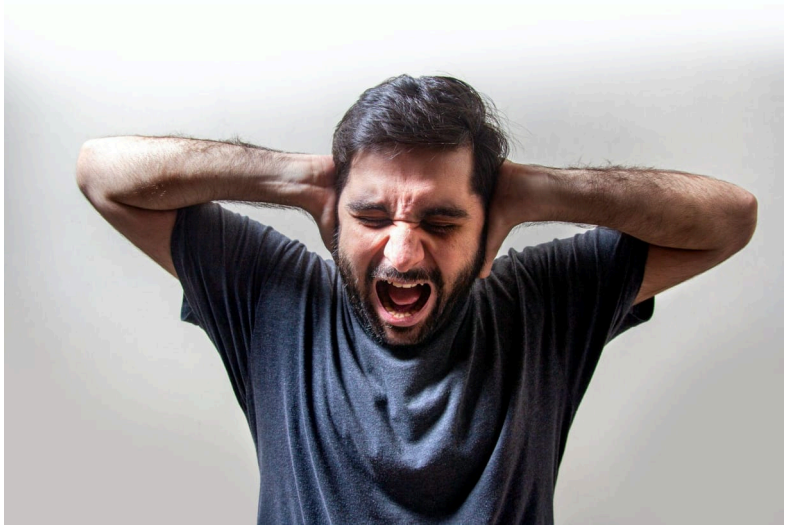


Figure 10.1.3: Photo by Usman Yousaf on Unsplash

Emotional Response

People respond to stress differently. For example, some people experience mainly digestive symptoms, while others may have headaches, sleeplessness, depressed mood, anger, and irritability. Your emotional and behavioral responses to stressors in your life might include the following:

Psychological, emotional, or cognitive symptoms:

- Feeling heroic, euphoric, or invulnerable
- Denial
- Anxiety or fear
- Worry about safety of self or others
- Irritability or anger
- Restlessness
- Sadness, moodiness, grief, or depression
- Vivid or distressing dreams
- Guilt or “survivor guilt”
- Feeling overwhelmed, helpless, or hopeless
- Feeling isolated, lost, lonely, or abandoned
- Apathy
- Over identification with survivors
- Feeling misunderstood or unappreciated
- Memory problems/forgetfulness
- Disorientation
- Confusion
- Slowness in thinking, analyzing, or comprehending
- Difficulty calculating, setting priorities, or making decisions
- Difficulty concentrating
- Limited attention span
- Loss of objectivity
- Inability to stop thinking about the disaster or an incident

Behavioral or social symptoms:

- Change in activity levels
- Decreased efficiency and effectiveness
- Difficult communicating
- Increased sense of humor/gallows humor
- Irritability, outbursts of anger, frequent arguments
- Inability to rest, relax, or let down
- Change in eating habits
- Change in sleep patterns
- Change in job performance
- Periods of crying
- Increased use of tobacco, alcohol, drugs, sugar, or caffeine
- Hyper-vigilance about safety or the surrounding environment
- Avoidance of activities or places that trigger memories
- Accident prone
- Withdrawing or isolating from people
- Difficulty listening
- Difficulty sharing ideas
- Difficulty engaging in mutual problem solving
- Blaming
- Criticizing
- Intolerance of group process
- Difficulty in giving or accepting support or help
- Impatient with or disrespectful to others

10.2: Stress and Disease

The relationship between stress and health is complex. Each person perceives and responds to stress differently and there are different types of stresses, both good and bad. For some people, it happens before having to speak in public. For other people, it might be before a first date. What causes stress for you may not be stressful for someone else. With so much variation in stress, it is challenging to determine the exact relationship of stress and disease. However, since about the 1940s, scientists and researchers have been working to better understand the relationship.

People experience both eustress and distress. A person experiences **eustress**, also referred to as "good stress," when the stressor helps the body enhance performance or overcome lethargy, it is their optimal level of stress. **Distress**, or what we view as "bad stress", is when the body cannot cope with the stressor and leads to fatigue, or behavioral and physical problems. Stress can be helpful if it encourages you to meet a deadline or get things done; however, feeling stressed for an extended amount of time can take a toll on your mental and physical health.

Optimal Stress

Although we tend to associate stress and health negatively, there is also a positive association between stress and health. Some stress can be good for you and help you to reach optimal performance. The relationship between stress and optimal performance is called the Yerkes-Dodson law, which was developed in 1908. Although this is called a law, it is actually a concept explaining that we need a certain amount of stress (arousal) to reach optimal (strong) performance. If we have too little stress or too much stress our performance will weaken. If we are under-aroused, we become bored and will seek out some sort of stimulation. On the other hand, if we are over-aroused, we will engage in behaviors to reduce our arousal/stress.

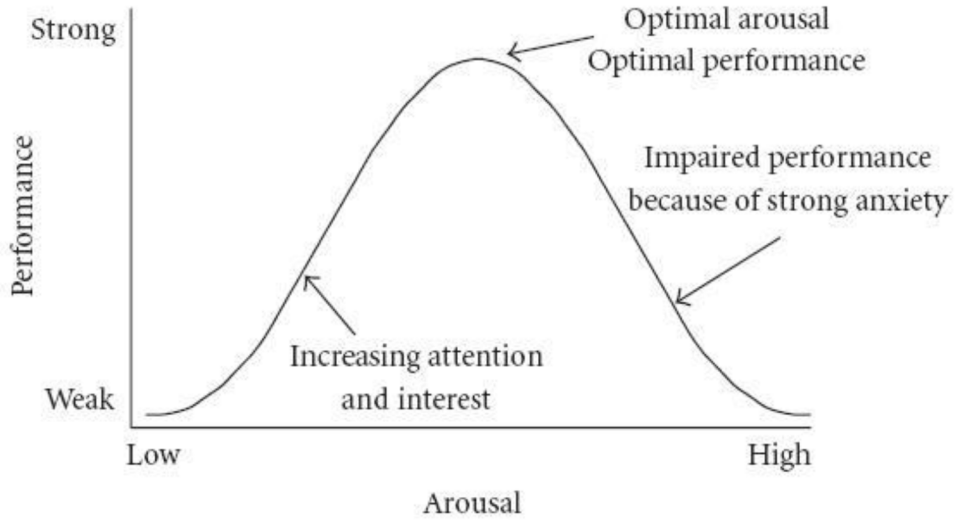


Figure 10.2.1: Yerkes-Dodson Theory of Optimal Arousal

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

General Adaptation Syndrome

In the 1930's, a young medical student named Hans Selye became very interested in the relationship of stress and disease and

for the next 50 years he systematically studied its relationship. One of his biggest contributions to the field of study was his development of the General Adaptation Syndrome. Selye found that there seemed to be a common or typical stress response pathway that people experienced when confronted with a stressor.

The pathway is simplified into three stages: Stage 1- Alarm, Stage 2- Resistance, and Stage 3- Exhaustion. This pathway begins when a person is exposed to a stressor and they are at first taken off guard and the body launches the Fight or Flight response (alarm stage). If the perceived stress continues, they attempt to maintain homeostasisby resisting the change (resistance stage). Our body wants to stay in homeostasis, which is a state of physiological calmness or balance, and occurs when our bodily functions are running smoothly in conjunction with low stress levels. Finally, they eventually fall victim to exhaustion due to prolonged exposure to the stressor and depleting the body's ability to cope to maintain homeostasis (exhaustion stage). Reaching the exhaustion stage leads to illness due to the resulting wear and tear on the body which leads to suppressing the immune system and causing bodily functions to deteriorate. This can lead to a variety of health issues and illnesses, including heart disease, digestive problems, depression, and diabetes.

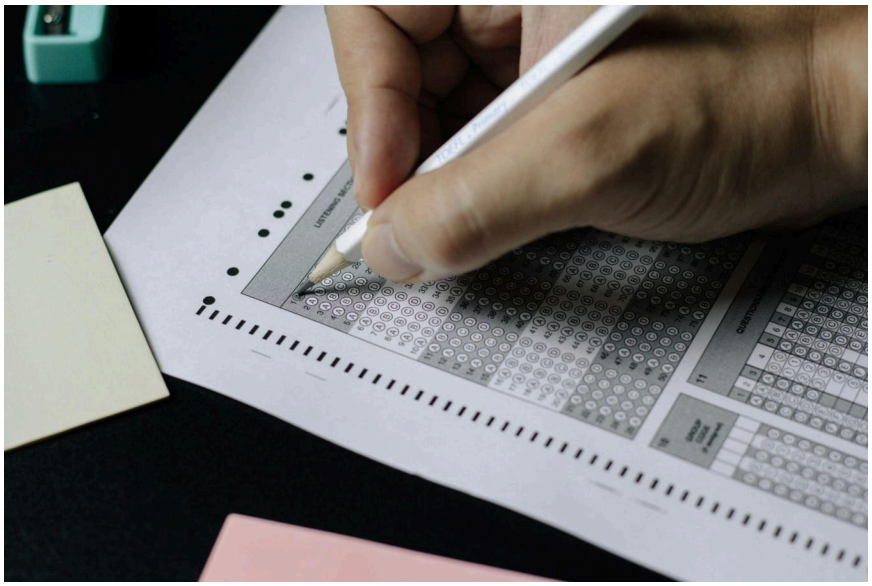


Figure 10.2.2: Photo by Nguyen Dang Hoang Nhu on Unsplash

Let's look at an example. You just found out that you have to pass a certification test in 2 months in order to keep your job and have not started studying. Your first reaction might be shock, anger, feelings of hopelessness, or anxiousness. This is the first stage, the alarm stage. You could choose to quit your job and flee from the stress, however, you know how important it is, so you make a plan to prepare for the test and includedeep breathing exercises. You are resisting the stress with coping mechanisms in this stage. As the certification test gets closer, you once again begin feeling stressed. You might feel like you are doomed to fail this test and feel desperate, feeling constantly anxious, have difficulty falling asleep and waking up in the morning. This is the exhaustion stage and where you will be more susceptible to getting sick. The exhaustion of this stage will have deleterious effects on your health by depleting your body resources which are crucial for the maintenance of normal functions. Your immune system will be exhausted and function will be impaired.

Psychoneuroimmunology (PNI)

Unlike the Yerkes-Dodson Law or the General Adaptation Syndrome, Psychoneuroimmunology (PNI) is not a model or framework, but rather a discipline of study. People who study the discipline of PNI study the relationship between the endocrine system, the nervous system, and the immune system to better understand the connection between the mind and the body.

For example, in the 1980's, there was a married couple, one a psychologist and the other an immunologist. They began to become aware of the growing body of research in PNI and realized they had a unique opportunity to bring their disciplines and perspectives together to add to the research on the relationship of stress and disease. Rather than continue with research using animals, as many had before them, they wanted to study the connection between stress and immunity under more natural circumstances. This began years of researching medical students before, during, and after taking a very stressful 3-day exam. They found that the stressful exam brought about a decline in the students' Natural Killer cells, one of the main immune cells that fight off disease.

There is a wealth of research on how stress impacts immune functioning leading to the belief that every one of the hormones/transmitters secreted by these nervous system regions has been shown to have potential, either in vivo or in vitro, to alter some aspect of immunity. It has been found that chronic stress is immunosuppressive, meaning that it suppresses the immune system, not allowing the body to have an efficient and effective immune response. It is now well established that psychological factors, especially chronic stress, can lead to impairments in immune system functioning in both the young and older adults.

10.3: Coping with Stress

We know that everyone has stress in their lives and a little stress may be helpful, but too much stress can lead to illness. It is important to recognize the stress in your life, then take action to handle stress in a positive way, and keep it from making you sick.

Cognitive Strategies to Reduce Stress

Cognitive strategies to reduce stress are focused on how you think. These strategies can help you to develop a new attitude in regards to stress in your life.

The first strategy is to become a problem solver. Make a list of the things that cause you stress. From your list, figure out which problems you can solve now and which are beyond your control for the moment. From your list of problems that you can solve now, start with the little ones. Learn how to calmly look at a problem, think of possible solutions, and take action to solve the problem. Being able to solve small problems will give you confidence to tactile the big ones. As you grow in solving problems, it will grow your confidence in problem solving and that will help you feel less stressed.

The second strategy is to be flexible. Sometimes, it is not worth the stress to argue about. Be willing to prefer someone else's preference once in a while or meet someone halfway.

The third strategy is to get organized. Think ahead about how you are going to spend your time. Write a to-do list. Figure out what is most important to do and do those things first. You can also get in the habit of using a calendar to help you keep track of the various appointments and meetings that you have. This will also help you see where you have additional time that can be used for the things on your to-do list.

Figure 10.3.1: Photo by Unseen Studio on Unsplash

The fourth strategy is to set limits. Figure out what you can really do when it comes to things like work, friends, and family. There are only so many hours in the day. Set limits for yourself and others. Do not be afraid to say no to requests for your time and energy. You cannot do everything all the time.

That leads to the fifth strategy of setting priorities. Decide what must get done and what can wait. Learn to say no to new tasks if they are putting you into overload. Before you say no to new tasks, make sure that you are using your time well and are being efficient. Sometimes we think we do not have time; however, we need to look at how we are spending the time we do have.

The sixth strategy is to reward accomplishments. It is important to recognize what you have accomplished at the end of the day

and not focus on what you have been unable to do. If you haven't accomplished all that you want to that day, make sure to add those things to your to-do list to make sure that those things will get done.The last cognitive strategy to reduce stress is to build your resilience. Resilience refers to the ability of an individual, family, organization, or community to cope with adversity and adapt to challenges or change. Everyone will experience hardships in life from everyday challenges to traumatic events and each person reacts to the challenges differently. Being resilient does not mean that a person does not experience difficulty or distress, but it may help you adapt well over time to stressful situations.

Resilience is the ability to:

- Bounce back
- Take on difficult challenges and still find meaning in life
- Respond positively to difficult situations
- Rise above adversity
- Cope when things look bleak
- Tap into hope
- Transform unfavorable situations into wisdom, insight, and compassion
- Endure

Relaxation Strategies to Reduce Stress

Taking time to relax is a helpful response to stress in your life. There are many ways you can purposefully relax. Here are a few techniques to try.

Stretching and Massage

Stretching can help relax your muscles and make you feel less tense. As we learned in Chapter 6, staying in one position for long periods of time, repetitive movements, and other everyday stressors can result in stiff muscles and knots, also called trigger points. Regular stretching decreases anxiety, blood pressure, and breathing rate, which help to relax muscles and aches and pains related to neuromuscular tension (stress). Flexibility has also been prescribed successfully to treat dysmenorrhea, which is painful menstruation. It also relieves muscle cramps that can occur during exercise or participation in sports.

Figure 10.3.2: LOGAN WEAVER | @LGNWVR on Unsplash

You could also consider getting a massage. Having someone massage the muscles in the back of your neck and upper back can help you feel less tense.

Do Something You Love

Take time to do something you want to do. We all have lots of things that we have to do, but often we don't take the time to do the things that we really want to do. It could be listening to music, reading a good book, or going to a movie. When we do something that we really want to do on occasion, we should not feel guilty.

Practice Deep Breathing

When we become stressed, one of our body's automatic reactions is shallow, rapid breathing which can increase our stress response. Taking deep, slow breaths is an antidote to stress and is one way we can "turn-off" our stress reaction and "turn-on" the relaxation response. Deep breathing is the foundation of many other relaxation exercises.

Here's a deep breathing activity that you can try. Get into a comfortable position, either sitting or lying down. Put one hand on your stomach, just below your rib cage. Slowly breathe in through your nose. Your stomach should feel like rising and expanding outward. Exhale slowly through your mouth, emptying your lungs completely and letting your stomach fall. Repeat several times until you feel relaxed. Practice several times a day.

Use Guided Imagery

In guided imagery, you picture objects, scenes, or events that are associated with relaxation or calmness and attempt to produce a similar feeling in your body.

Here's an example of how to use guided imagery to help battle stress in your life. Sit or lie down in a comfortable position with your eyes closed. Start by just taking a few deep breaths to help you relax. Picture a setting that is calm and peaceful. This could be a beach, a mountain setting, a meadow, or a scene that you choose. Imagine your scene, and try to add some detail. For example, is there a breeze? How does it feel? What do you smell? What does the sky look like? Is it clear or are there clouds? It often helps to add a path to your scene. For example, as you enter the meadow, imagine a path leading you through the meadow to the trees on the other side. As you follow the path farther into the meadow you feel more and more relaxed. When you are deep into your scene and feeling relaxed, take a few minutes to breathe slowly and feel the calm. Think of a simple word or sound that you can use in the future to help you return to this place. Then, when you are ready, slowly take yourself out of the scene and back to the present. Tell yourself that you will feel relaxed and refreshed and will bring your sense of calm with you. Count to 3 and open your eyes. Notice how you feel right now.

Practice Progressive Muscle Relaxation

In Progressive Muscle Relaxation you reduce muscular tension and negative feelings by learning how to relax and relieve the muscular tension. The key to the relaxation process is taking some deep breaths and then proceeding to tense, then relax a group of muscles in a systematic order.

Here's an example of how you can practice Progressive Muscle Relaxation. Sit in a comfortable position with your eyes closed. Take a few deep breaths, expanding your belly as you breathe air in and contracting it as you exhale. Begin at the top of your body and go down. Start with your head, tensing your facial muscles, squeezing your eyes shut, puckering your mouth and cleaning your jaw. Hold, then release and breathe. Tense as you lift your shoulders to your ears, hold, then release and breathe. Make a fist with your right hand, tighten the muscles in your lower and upper arm, hold, then release. Breathe in and out. Repeat with your left hand. Concentrate on your back, squeezing shoulder blades together. Hold, then release. Breathe in and out. Suck in your stomach, hold, then release. Breathe in and out. Tighten your right hamstring, hold then release. Breathe in and out. Repeat with your left hamstring. Flex your right calf, hold, then release. Breathe in and out. Repeat with your left calf. Tighten toes on your right foot, hold, then release. Breathe in and out. Repeat with your left foot.

Practice Meditation

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

To practice meditation, sit in a comfortable position with your eyes closed. Set a time limit such as 5 to 10 minutes. Notice how your body feels. Focus on your breath. Follow the sensation of your breath as it goes in and as it goes out. Notice when your mind has wandered and simply return your attention back to your breath. It is normal for your mind to wander, just come back. When time is up, take a moment and notice any sounds in the environment. Notice how your body feels right now. Notice your thoughts and emotions. Show yourself kindness and appreciation.

Behavioral Strategies to Reduce Stress

It is important to take care of your body, especially when you are experiencing a lot of stress in your life.

Listen to Your Body

Recognize signs of your body's response to stress. Some examples of this are difficulty sleeping, increased alcohol and other substance use, being easily angered, feeling depressed, and having low energy.

Get Enough Sleep

Getting enough sleep helps you recover from the stresses of the day. Also, being well-rested helps you think better so that you are prepared to handle problems as they come up. Most adults need 7 to 9 hours of sleep a night to feel rested.

Figure 10.3.3: Photo by Brett Jordan on Unsplash

Eat Right

Try to fuel up with fruits, vegetables, beans, and whole grains. Don't be fooled by the jolt you get from caffeine or high-sugar snack food. Your energy will wear off and you could wind up feeling more tired than you did before.

Get Moving

As we have learned, getting physically active cannot only help you relax your tense muscles, but improve your mood. Research shows that physical activity can help relieve symptoms of depression and anxiety.

Avoid Counterproductive Actions

Don't deal with stress in unhealthy ways. This includes drinking too much alcohol, using drugs, smoking, or overeating. Explore stress coping programs, which may incorporate meditation, yoga, tai chi, or other gentle exercises.

Social Strategies to Reduce Stress

Connecting with others is a helpful strategy for stress reduction.

Share Your Stress

Talking about your problems with friends or family members can sometimes help you feel better. They might also help you see your problems in a new way and suggest solutions that you hadn't thought of.

Figure 10.3.4: Photo by Christina @ wocintechchat.com on Unsplash

Get Help From a Professional If You Need It

If you feel that you can longer cope, talk to your doctor. She or he may suggest counseling to help you learn better ways to deal with stress. Your doctor may also prescribe medicines, such as antidepressants or sleep aids. Get proper health care for existing or new health problems.

Help Others

Volunteering in your community can help you make new friends and feel better about yourself.

11: MAKING HEALTHY LIFESTYLE CHOICES IN OUR EVERYDAY LIVES

11.1: Introduction

In Chapter 1, we learned that the World Health Organization (WHO) defines health as, “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (illness)” and defines wellness as, “the optimal state of health of individuals and groups,” which may be expressed as “a positive approach to living.” The National Wellness Institute explains wellness as, “an active process through which people become aware of, and make choices toward, a more successful existence.”

The National Wellness Institute states that there is general agreement that:

1. Wellness is considered a conscious, self-directed, and evolving process of achieving full potential.
2. Wellness is multidimensional and holistic, encompassing lifestyle, mental and spiritual well-being, and the environment.
3. Wellness is positive and affirming.

The primary difference between health and wellness is that health is your state of being or a goal to achieve and wellness is the active process of achieving it through growth and change. Through wellness we hope to reach our fullest potential of health and well-being.

We also learned about the Nine Dimensions of Wellness. We learned that they are: Physical, Emotional, Social, Environmental, Financial, Intellectual, Occupational, Spiritual, and Cultural.We have learned how important physical wellness is throughout our entire lifetime. We need to prioritize regular and physical activity, choose to eat healthy foods, go to the doctor, and get adequate sleep to help us function at our best and to help prevent chronic diseases.

Let’s look at some additional factors that influence well-being. We will also look at how some of these factors are linked to some of the additional dimensions of wellness.

11.2: Factors That Influence Psychological Well-Being

Figure 11.2.1: Photo by Simi Iluyomade on Unsplash

There are many factors that influence a person's psychological well-being. Some of those factors include how a person was raised and a person's personality. In this section, we will look at a few additional factors including: individual attributes and behaviors, social and economic circumstances, begin to look at environmental factors, and see how being physically active can improve a person's mental health.

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'). As we learned, emotional wellness means that a person copes effectively with life and expresses emotions in an appropriate manner. When a person is emotionally well, they will maintain a high level of self-esteem. They will also have a positive body-image and the ability to regulate their feelings. A person who is emotionally well will also know where to seek support regarding their mental health.

Individual attributes and behaviors 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

Social and economic circumstances are the capacity for people to develop and flourish and are deeply influenced by their immediate social surroundings. This includes 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.

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 financial goals.

People who are focused on their social wellness are striving for positive relationships, developing a sense of connection, belonging, and sustained support system. They will build 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 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.

This is closely related to environmental wellness. Environmental wellness includes a desire to positively impact our planet Earth and also our local community by striving to occupy pleasant, healthy, and safe environments that support well-being and positively impact the quality of our surroundings (including protecting and preserving nature). 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.

Physical Activity and Improved Mental Health

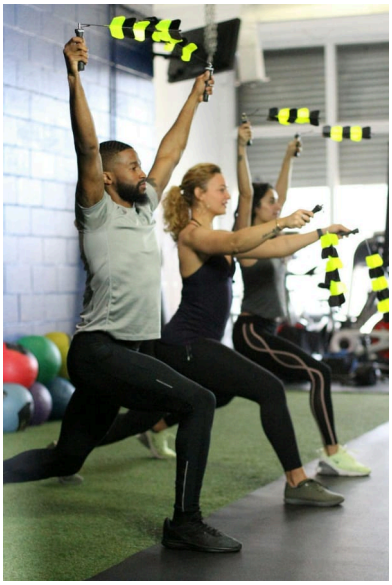


Figure 11.2.2: Photo by Phillip Davies on Unsplash

As we have learned, physical activity throughout a lifetime has many benefits including improvement of overall mental health.

Physically active adults have lower risk of depression and cognitive decline (declines with aging in thinking, learning, and judgment skills). Physical activity also may improve the quality of sleep. Whether physical activity reduces distress or anxiety is currently unclear.

Mental health benefits have been found in people who do aerobic or a combination of aerobic and muscle-strengthening activities 3 to 5 days a week for 30 to 60 minutes at a time. Some research has shown that even lower levels of physical activity also may provide some benefits.

Regular physical activity appears to reduce symptoms of anxiety and depression for children and adolescents.

In addition to physical activity improving overall mental health, there are numerous benefits related to cognitive function including, but not limited to: heightened academic performance, improved brain function, and reduced risk of age-related cognitive impairment and disease.

Improved Academic Performance

Research has shown a consistent relationship between physical activity participation and enhanced academic performance (i.e., learning and cognitive outcomes) in children, with aerobic exercise producing the greatest benefits (Fedewa & Ahn, 2011). Several cognitive outcomes positively impacted by physical activity throughout childhood and young adulthood include: perceptual skills, intelligence quotients, and verbal and mathematical tests (Hillman, Erickson, & Kramer, 2008). However, further research is needed to examine the potential academic benefits in college-age and older populations.

Enhanced Brain Function

Oxidative stress, caused in part by the buildup of harmful free radicals within the body, may result in damage to brain functions. Current research indicates that regular physical activity participation increases the body's ability to resist oxidative stress. Optimal protection is provided via increased antioxidant activity when exercise is performed at specific intensity levels. Notably, habitual engagement in moderate-intensity aerobic physical activity appears to provide the greatest benefit for brain function (Camiletti-Moirón, Aparicio, Aranda, & Radak, 2013).

Decreased Incidence and Risk for Age-Related Cognitive Impairment and Disease

Several studies have found a reduced risk for Alzheimer's disease and dementia in individuals who engage in greater amounts of physical activity versus those who are more sedentary (Kramer & Erickson, 2007). Frequency of exercise engagement appears important, as older adults who engage in three or more sessions of physical activity per week are significantly less likely to be diagnosed with dementia than their counterparts who engage in fewer sessions per week (Larson et al., 2006). When examining only adults who have not been diagnosed with Alzheimer's or dementia, a reduction in risk for cognitive decline is apparent when physical fitness levels are improved (Barnes, Yaffe, Satariano, & Tager, (2003).

11.3: Climate Change

Introduction

Average life expectancy in 1900 was 48 years, and today that has increased to about 78 years. We have made incredible advances that have contributed to an increase in our life expectancy. For example, infant mortality rates have decreased dramatically during the 20th century, from 165 deaths per 1,000 births in 1900 to 7 deaths per 1,000 births today, advances in fertility treatments have provided new opportunities for conceiving children, and people have lived safer healthier lives with advances like clean drinking water, car safety belts, and work hard hats. These advances have helped to increase our worldwide population. The world population reached 1 billion people in 1803 and in just over 100 years, that population doubled to 2 billion people in 1928. It then took only about 50 years to double the population again to 4 billion people by 1975. With these trends in growth the population is likely to reach 8.5 billion in 2030 and 9.7 billion in 2050.

Many believe overpopulation is the root cause of environmental health issues we are facing today.

Climate Change and Global Warming

“Climate change” and “global warming” are often used interchangeably but have distinct meanings. Global warming is the long-term heating of Earth’s climate system observed since the pre-industrial period (between 1850 and 1900) due to human activities, primarily fossil fuel burning, which increases heat-trapping greenhouse gas levels in Earth’s atmosphere. Climate change is long-term changes in the average weather patterns that have come to define Earth’s local, regional and global climates.

Energy Use: Fossil Fuels to Renewable Energy

All forms of electricity generation have an environmental impact on our air, water and land, but it varies. Of the total energy consumed in the United States, about 40% is used to generate electricity, making electricity use an important part of each person’s environmental footprint. The total amount of greenhouse gases that are emitted into the atmosphere each year by a person, family, building, organization, or company are called the carbon footprint.

Producing and using electricity more efficiently reduces both the amount of fuel needed to generate electricity and the amount of greenhouse gases and other air pollution emitted as a result. Electricity from renewable resources such as solar, geothermal, hydropower, and wind generally do not contribute to climate change or local air pollution since no fuels are combusted.

Clean energy includes renewable energy, energy efficiency and efficient combined heat and power.

Waste

We all play a role in helping to prevent and remove trash in the environment. You can take action at home, school, and work to ensure a cleaner community and healthier waters.

Most of the trash that pollutes our rivers, lakes, estuaries, and oceans comes from sources on land. Plastic trash, in particular, threatens human health, aquatic ecosystems, and the economy. The most effective way to prevent trash from polluting our waterways is to reduce the amount of waste you create.

Impacts of Climate Change on Human Health

Figure 11.3.1: Photo by Online Marketing on Unsplash

Climate change is a significant threat to the health of the American people and every American is vulnerable to the health impacts associated with climate change. The U.S. Global Change Research Program's (USGCRP's) National Climate Assessment (NCA) process has published a scientific assessment on the impact of climate change on human health.

With climate change, the frequency, severity, duration, and location of weather and climate phenomena, like rising temperatures, heavy rains and droughts, and some other kinds of severe weather, are changing. This means that areas already experiencing health-threatening weather and climate phenomena are likely to experience worsening impacts, it also means that some locations will experience new climate-related health threats. Climate changes that impact human health include: wildfires, heat waves, drought, cold waves and winter storms, sea level changes, hurricanes, floods, extreme precipitation, and rising temperatures. Changes in the environment may have numerous impacts to existing health conditions and the development of new diseases.

The following sections provide key findings from the "The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment." In the official report, each key finding is notated with a level of confidence, from medium to high levels of confidence based on scientific analyses.

Temperature-Related Death and Illness

By the end of the century, an increase of thousands to tens of thousands of premature heat-related deaths in the summer and a decrease of premature cold-related deaths in the winter are projected each year as a result of climate change. Some populations are more vulnerable to death or illness due to high temperatures such as children, older adults, people working outdoors, the socially isolated and economically disadvantaged, those with chronic illnesses, as well as some communities of color.

Air Quality Impacts

Changes in the climate affect the air we breathe, both indoors and outdoors. Changes in climate, specifically rising temperatures, altered precipitation patterns, and increasing concentrations of atmospheric carbon dioxide, are expected to contribute to increases in the levels of some airborne allergens and associated increases in asthma episodes and other allergic illnesses. Climate change is projected to increase the number and severity of naturally occurring wildfires in parts of the United States, increasing emissions of particulate matter and ozone precursors and resulting in additional adverse health outcomes.

Water-Related Illness

Increases in water temperatures associated with climate change will alter the seasonal windows of growth and the geographic range of suitable habitat for freshwater toxin-producing harmful algae, certain naturally occurring Vibrio bacteria, and marine

toxin-producing harmful algae. These changes will increase the risk of exposure to waterborne pathogens and algal toxins that can cause a variety of illnesses. In addition, increases in some extreme weather events and storm surges will increase the risk that infrastructure for drinking water, wastewater, and stormwater, will fail due to either damage or exceedance of system capacity, especially in areas with aging infrastructure. As a result, the risk of exposure to water-related pathogens, chemicals, and algal toxins will increase in recreational and shellfish harvesting waters, and in drinking water where treatment barriers break down.

Runoff from more frequent and intense extreme precipitation events will increasingly compromise recreational waters, shellfish harvesting waters, and sources of drinking water through increased introduction of pathogens and prevalence of toxic algal blooms. As a result, the risk of human exposure to agents of water-related illness will increase.

11.4: Unintentional Injuries at Home

Figure 11.4.1: Photo by Online Marketing on Unsplash

Unintentional injuries are often referred to as “accidents,” meaning something that was not intended. These include falls, drowning, motor vehicle crashes, fires, and poisoning.

Falls

For adults over 65 years, falls are the leading cause of death due to injury. In 2019 older adult falls caused 34,000 deaths, 3 million visits to the emergency room, and over 800,000 hospitalizations attributing to over $50 billion in medical costs annually. It is estimated that more than one out of four older people fall each year with one out of five falls causing serious injury. Traumatic brain injuries (TBI) and hip fractures are the most common serious injuries. The injuries associated with falls impact a person's quality of life making it hard for a person to get around, do everyday activities, or live on their own. Many people who fall, even if they’re not injured, become afraid of falling. This fear may impact their quality of life by causing a person to cut down on their everyday activities. When a person is less active, they become weaker and this increases their chances of falling.

Falls can be prevented at home by being aware of items that can be easily tripped on and moving them. Grab bars can be installed inside and outside of your bathtub or shower. You can also add non-stick mats outside of the bathtub and shower. Grab bars can also be added next to the toilet. If you have stairs at your house, install a handrail to assist people going up and down the stairs. Reduce the needs for a step stool by keeping items that you use often on lower shelves that are easier to reach. It is also important to assess that your home has adequate lighting.

Drowning

Drowning is the process of experiencing respiratory impairment from submersion or immersion in liquid. Drowning can happen in seconds and is often silent. It can happen to anyone, any time there is access to water. Drowning kills nearly 4,000 people each year in the United States and is the leading cause of injury death for children 1 to 4 years of age. For every child who dies from drowning, another eight receive emergency department care for non-fatal drowning. Not all drownings are fatal, drowning injuries can cause brain damage and other serious outcomes, including long-term disability.

There are many ways to prevent drowning with the first major step of prevention is participating in formal swim lessons whether you are an adult or for a child you know. It is also important to ensure that there are effective fences around home pool areas. There should always be supervision when someone is in water. Drowning can happen quickly and quietly anywhere there is water, especially to unsupervised children. It happens in lakes and oceans, pools, bathtubs, and even buckets of water. Drowning

can occur when lifeguards are present. Use the buddy system! Always swim with another person. Also, it is important to wear lifejackets.

Motor Vehicle Crashes

In 2020, more than 40,000 people died in motor vehicle crashes in the United States, that is more than 110 people killed in crashes every day. There were over 2.1 million emergency department visits for injuries from motor vehicle crashes in 2020. Deaths from crashes in 2020 resulted in over $430 billion in total costs—including medical costs and cost estimates for lost quality of life and lives lost. Motor vehicle injuries are often associated with distracted, impaired, or inexperienced drivers.

Distracted driving is doing another activity that takes the driver's attention away from driving that can increase the chance of a motor vehicle crash. There are three main types of distracted driving: visual (taking your eyes off the road), manual (taking your hands off the wheel), and cognitive (taking your mind off driving).

Do not multitask while driving. Whether it's adjusting your mirrors, selecting music, eating, making a phone call, or reading a text or email—do it before or after your trip, not during.

Drivers and passengers should always wear a seatbelt. It is imperative that all children in the vehicle have age- and size-appropriate car seats, booster seats, and seat belts. Appropriate age and size car seats, booster seats, and seat belts reduce serious and fatal injuries by up to 80%.

Every day, 29 people in the United States die in motor vehicle crashes that involve an alcohol-impaired driver, this is one death every 50 minutes. Never drive under the influence of alcohol or drugs.

Fires

Fire is fast, in less than 30 seconds a small flame can turn into a major fire. In 2019, there were 1,291,500 fires which caused 3,704 deaths, 16,600 injuries, and accounts for $14.8 billion.

Home fires can be prevented by having smoke alarms on every level of your home inside and outside of all sleeping areas. It is important to test your smoke alarms to make sure they work and replace them after 10 years.

When cooking in the kitchen, make sure to not leave the burners on and that all flammable materials are moved away from the burners that you are cooking with. It is also important to move all flammable objects away from fireplaces, wood stoves, space heaters, or radiators.

Have an emergency action plan with the people that are living with you so that everyone knows where and how to escape the house if a fire did occur.

Poisoning

Poisoning is one of the top three causes of fatal unintentional injuries. In response to public health concerns regarding poisoning, in 1980 the National Capital Poison Center

(NCPC) was founded, which is an independent, not-for-profit 501(c)(3) organization.

There are 2 ways to get help from Poison Control: online at webPOISONCONTROL® or by phone at 1-800-222-1222.

Common types of poisoning include food poisoning, poisonous plants, and carbon monoxide poisoning. Everyone is at risk for Carbon monoxide (CO) poisoning. CO, an odorless, colorless gas, that can cause sudden illness and death. CO can build up indoors and poison people and animals who breathe it. The most common symptoms of CO poisoning are headache, dizziness, weakness, upset stomach, vomiting, chest pain, and confusion. It is important to use Carbon Monoxide detectors to know if CO is present.

11.5: Violence

Figure 11.5.1: Photo by Online Marketing on Unsplash

There are many forms of intentional injury, or violence. The CDC approaches violence using the “Social-Ecological Model: a Framework for Prevention”. The framework encourages viewing violence and violence prevention as a multifaceted interconnected dynamic including the individual, their relationships, their community, and our society.

- The Individual
  - Individuals factors such as age, education, income, substance use, or history of abuse impact the risk of violence. A focus on attitudes, beliefs, behaviors, along with training on conflict resolution, safe dating, and healthy relationships may positively impact their risk of violence.
- Relationships
  - A person’s closest social circle-peers, partners and family members-influences their behavior and contributes to their experience. Parenting, mentors, effective communication, and problem solving may support effective relationships to prevent violence.
- Community
  - Where a person lives, works, or goes to school can impact their risk of violence. Creating safe physical and social environments may reduce violence in the community.
- Societal
  - A focus on society asks us to understand and look at how our society either encourages or inhibits violence, for example how social or cultural norms use violence to resolve conflicts or how wealth and health inequalities impact violence risk.

If you are someone you know is experiencing domestic violence, the National Domestic Violence Hotline has confidential support 24 hours a day, 7 days a week, 365 days a year. If you are concerned about your internet being monitored, you can call 800-799-SAFE (7233). If you are in immediate danger, you should call 911.

11.6: Completing Physical Activity Safely in Your Neighborhood

Figure 11.6.1: Photo by Anders Krøgh Jørgensen on Unsplash

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 midday 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 the 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.

Air Pollution

Figure 11.6.2: Photo by Kristen Morith on Unsplash

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).

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.

Follow the Advice of Your Health-Care Provider

Figure 11.6.3: Photo by Online Marketing on Unsplash

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 those 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.

11.7: Aging

Figure 11.7.1: Photo by Centre for Ageing Better on Unsplash

More than 10,000 people turn 65 every day in the United States, and people are living longer, healthier lives. Healthy lifestyles, planning for retirement, and knowing your options for health care and long-term care are more important than ever before.

Across the world, the number and proportion of people aged 60 years and older in the population is increasing. In 2019, the number of people aged 60 years and older was 1 billion. This number will increase to 1.4 billion by 2030 and 2.1 billion by 2050. This increase is occurring at an unprecedented pace and will accelerate in coming decades, particularly in developing countries. This historically significant change in the global population requires adaptations to the way societies are structured across all sectors. For example, health and social care, transportation, housing and urban planning. Working to make the world more age-friendly is an essential and urgent part of our changing demographics.

Adopting healthy habits and behaviors, staying involved in your community, using preventive services, managing health conditions, and understanding all your medications can contribute to a productive and meaningful life.

Many factors influence healthy aging. Some of these, such as genetics, are not in our control. Others — like exercise, a healthy diet, going to the doctor regularly, and taking care of our mental health — are within our reach. Research supported by National Institute on Aging (NIA) and others has identified actions you can take to help manage your health, live as independently as possible, and maintain your quality of life as you age, these include both physical and mental health strategies.

It is important that as we age to get moving through exercise and physical activity. Physical activity is a cornerstone of healthy aging. As people age, muscle function often declines. Older adults may not have the energy to do everyday activities and can lose their independence; however, exercise can help older adults maintain their muscle mass as they age. A study of adults 40 and older found that taking 8,000 steps or more per day, compared to only taking 4,000 steps, was associated with a 51% lower risk of death from all causes.

It is also important that we make smart food choices throughout our lifetime, including when aging. As we have learned in previous chapters, smart food choices can help reduce our chances of developing a chronic disease.

We need to make additional positive lifestyle choices in making sure that we get a good night's sleep every night, not smoke, and avoid or limit alcohol consumption. It is also important to see your doctor regularly. This is essential for healthy aging. People who went to the doctor regularly in a 2021 study, found to have improved quality of life and feelings of wellness.

It is also important to be aware of your mental health as you age. Throughout our life, we need to be aware of how to reduce stress and engage in activities. Older adults are more likely to be isolated as they age. Research shows that people who participate in

hobbies and social leisure activities may be at lower risk for some health problems.

Functional Ability and Fall Prevention

Figure 11.7.2: Photo by Jon Tyson on Unsplash

Functional ability is the capacity of a person to perform tasks or behaviors that enable him or her to carry out everyday activities, such as climbing stairs or walking on a sidewalk. Functional ability is key to a person's ability to fulfill basic life roles, such as personal care, grocery shopping, or playing with the grandchildren. Loss of functional ability is referred to as functional limitation.

Middle-aged and older adults who are physically active have lower risk of functional limitations than do inactive adults. It appears that greater physical activity levels can further reduce risk of functional limitations.

Older adults who already have functional limitations also benefit from regular physical activity. Typically, studies of physical activity in adults with functional limitations tested a combination of aerobic and muscle-strengthening activities, making it difficult to assess the relative importance of each type of activity. However, both types of activity appear to provide benefits.

In older adults at risk of falls, strong evidence shows that regular physical activity is safe and reduces this risk. Reduction in falls is seen for participants in programs that include balance and moderate-intensity muscle-strengthening activities for 90 minutes a week plus moderate-intensity walking for about an hour a week. It's not known whether different combinations of type, amount, or frequency of activity can reduce falls to a greater degree. Tai chi exercises also may help prevent falls.

12: DEVELOPING UNDERSTANDING OF THE HEALTHCARE SYSTEM AND DISCERNING HEALTH INFORMATION

12.1: Introduction

Healthcare can feel overwhelming and hard to navigate at times. Healthcare differs between the United States and other places in the world. It has also evolved across different cultures and over time. We will look at the distinctions between Western and Eastern medicine and alternative medicine options. We will also look at developing an understanding of how healthcare works in the United States and what options you have compared to the Universal medicine options in other places of the world. Lastly, we will explore how to interpret the ever constant health news and review methods for evaluating health information.

Healthcare

Healing people has been done differently throughout the world and throughout history. Many Americans use medical treatments that are not part of mainstream (conventional or western) medicine. When you are using these types of care, it may be called complementary, integrative, or alternative medicine.

In the U.S., how you pay for your healthcare is dependent on whether you have insurance and the type of insurance you have. In many other countries healthcare is covered through universal health coverage.

Western Medicine: Conventional Medicine

Conventional medicine, also called allopathic medicine, biomedicine, mainstream medicine, orthodox medicine, and Western medicine, is the medical system most Americans are used to. It is a system in which medical doctors and other healthcare professionals (such as nurses, pharmacists, and therapists) treat symptoms and diseases using drugs, radiation, or surgery. Western medicine is the basis of most of the modern healthcare in the world utilizing a systemic approach, incorporating: 1.) physically examining the body and the associated symptoms, 2.) diagnosing diseases and conditions using scientific evidence, and 3.) using treatments that are clinically proven to be effective.

Eastern Medicine: Complementary and Alternative Medicine (CAM)

The words “complementary,” “alternative,” and “integrative,” are often used interchangeably to represent practices that are not included in conventional medicine. These are typically supported by tradition and seldom taught in a Western medical setting.

If a non-mainstream practice is used together with conventional medicine, it’s considered “complementary.” However, If a non-mainstream practice is used in place of conventional medicine, it’s considered “alternative.” There are many definitions of “integrative” health care, but all involve bringing conventional and complementary approaches together in a coordinated way. True alternative medicine is uncommon. Most people who use non-mainstream approaches use them along with conventional treatments.

The National Center for Complementary and Integrative Health (NCCIH) is responsible for conducting and supporting research and providing information about complementary health products and practices.

Complementary approaches can be classified by their primary therapeutic input (how the therapy is taken in or delivered), which may be nutritional or psychological/physical. These include:

- Mind–body therapies: These combine mental focus, breathing, and body movements to help relax the body and mind.
  - meditation: focused breathing or repetition of words or phrases to quiet the mind and lessen stressful thoughts and feelings.
  - biofeedback: using special machines, the patient learns how to control certain body functions that are normally out of one’s awareness (such as heart rate and blood pressure).
  - hypnosis: a trance-like state in which a person becomes more aware and focused on certain feelings, thoughts, images, sensations or behaviors. A person may feel more calm and open to suggestions in order to aid in healing.
  - yoga: ancient system of practices used to balance the mind and body through stretches and poses, meditation, and controlled breathing
  - tai chi: a form of gentle exercise and meditation that uses slow sets of body movements and controlled breathing
  - imagery: focusing on positive images in the mind, such as imagining scenes, pictures, or experiences to help the body

heal
    - creative outlets: interests such as art, music, or dance
- Biologically based practices: This type of CAM uses things found in nature.
    - vitamins: nutrients the body needs in small amounts to function and stay healthy
    - dietary supplements: products added to the diet that may contain ingredients such as vitamins, minerals, and herbs, to name a few
    - botanicals: plants or parts of plants. One type is cannabis.
    - herbs and spices such as turmeric or cinnamon
    - special foods or diets: always be in consultation with your doctor
- Manipulative and body-based practices: These are based on working with one or more parts of the body.
    - massage therapy: a therapy where the soft tissues of the body are kneaded, rubbed, tapped, and stroked
    - chiropractic therapy: a type of manipulation of the spine, joints, and skeletal system
    - reflexology: a type of massage in which pressure is applied to specific points on the feet or hands, which are believed to match up with certain parts of the body
- Energy healing: Energy healing is based on the belief that a vital energy flows through the body. The goal is to balance the energy flow in the patient. There's not enough evidence to support the existence of energy fields. However, there are no harmful effects in using these approaches.
    - reiki: placing hands lightly on or just above the person with the goal of guiding energy to help a person's own healing response
    - therapeutic touch: moving hands over energy fields of the body or gently touching a person's body

Health Insurance in the United States

No one plans to get sick or hurt, but most people need medical care at some point. Health insurance covers essential health benefits critical to maintaining your health and treating illness and accidents, for example getting free preventive care, like vaccines, screenings, and some check-ups, even before you meet your deductible. Health insurance protects you from unexpected, high medical costs by paying less for covered in-network health care, even before you meet your deductible. People without health coverage are exposed to these costs, which can sometimes lead into extreme debt or even into bankruptcy.

The U.S. does not have universal health coverage, meaning the government does not provide health insurance for every person, rather the U.S. health system is a mix of public and private, for-profit and nonprofit insurers and health care providers. The federal government provides Medicare, Medicaid and the Children's Health Insurance Program (CHIP). Private insurance is provided primarily by employers and people can also purchase their own health insurance coverage. Although there are options for health insurance, there are still about 8.5% of Americans who are uninsured, which is a reduction from 16% in 2010 before the passing of the Patient Protection and Affordable Care Act.

Medicare is health insurance for:

- People 65 or older (eligible to sign up for Medicare 3 months before turning 65)
- Those with a disability, End-Stage Renal Disease (ESRD), or ALS (also called Lou Gehrig's disease) may be able to sign up before 65.

Medicaid is a joint federal and state program that:

- Helps with medical costs for some people with limited income and resources.
- Offers benefits not normally covered by Medicare, like nursing home care and personal care services.

The Children's Health Insurance Program (CHIP) is a joint federal and state program that:

- provides health coverage to eligible children, through both Medicaid and separate CHIP programs.

Managed Care Plans

- Managed care plans are a type of health insurance. They have contracts with health care providers and medical facilities to provide care for members at reduced costs. These providers make up the plan's network. How much of your care the plan will pay for depends on the network's rules.
    - With a Health Maintenance Organizations (HMO) you choose a primary care doctor who coordinates most of your care. HMO's usually only pay for care within their specified network of doctors/providers. HMO plans typically have lower monthly premiums. You can also expect to pay less out of pocket.

- With a Preferred Provider Organizations (PPO) you tend to have higher monthly premiums in exchange for the flexibility to use○ providers both in and out of network without a referral. Out-of-pocket medical costs can also run higher with a PPO plan.
- Point of Service (POS) plans let you choose between an HMO or a PPO each time you need care.

If you're unemployed, or your employer does not provide health insurance, you may be able to get an affordable health insurance plan through the Health Insurance Marketplace. The Health Insurance Marketplace was developed in response to the Patient Protection and Affordable Care Act passed in 2010. Its primary goal is to achieve universal health insurance coverage by facilitating cooperation among employers, citizens, and the government. Its other objectives are to make healthcare more affordable while simultaneously increasing healthcare quality and reducing unnecessary spending.

The Affordable Care Act (ACA) created a dramatically different marketplace for individual health insurance through three key reforms: prohibiting insurers from considering subscribers' health status or risk; providing substantial subsidies for millions of people to purchase individual coverage, many for the first time in their lives; and creating an "exchange" structure that facilitates comparison shopping. Due to the ACA the uninsured rate has dropped from 16 percent in 2010 to 8.5%.

Health Insurance Key Terms

Part of health literacy is understanding key health insurance terms. This will allow for educated decisions when choosing a health insurance plan. Below are some basic key terms that are helpful to understand when researching health insurance plans:

In-Network Providers: health care providers who are contracted with your health insurance plan to provide services at a contracted or discounted rate.

Out-of-Network Providers: health care providers who are not contracted with your health insurance plan. Out-of-network coinsurance usually costs you more than in-network coinsurance because there is no contracted or discounted rate.

Exclusive Provider Organization (EPO): A managed care plan where services are covered only if you use doctors, specialists, or hospitals in the plan's network (except in an emergency).

Health Maintenance Organization (HMO): A type of health insurance plan that usually limits coverage to care from doctors who work for or contract with the HMO. It generally won't cover out-of-network care except in an emergency. An HMO may require you to live or work in its service area to be eligible for coverage. HMOs often provide integrated care and focus on prevention and wellness.

Point of Service (POS): A type of plan where you pay less if you use doctors, hospitals, and other health care providers that belong to the plan's network. POS plans require you to get a referral from your primary care doctor in order to see a specialist.

Preferred Provider Organization (PPO): A type of health plan where you pay less if you use providers in the plan's network. You can use doctors, hospitals, and providers outside of the network without a referral for an additional cost.

Premium: The amount paid for your health insurance every month. In addition to your premium, you usually have to pay other costs for your health care, including a deductible, copayments, and coinsurance.

Deductible: The amount you pay for covered health care services before your insurance plan starts to pay. With a $2,000 deductible, for example, you pay the first $2,000 of covered services yourself.

Many health insurance plans cover certain services such as check-ups, disease management, and preventive services before the deductible has been met. Family plans often have both an individual deductible, which applies to each person, and a family deductible, which applies to all family members.

Generally, plans with lower monthly premiums have higher deductibles. Plans with high monthly premiums usually have lower deductibles. Those who use their health insurance often would probably be wise to choose a plan with a slightly higher premium but a lower deductible, which may save money in the long-term.

After paying the deductible, you will usually pay only a copayment or coinsurance for covered services. Your insurance company pays the rest.

Copayment: A fixed amount ($20, for example) you pay for a covered health care service after you've paid your deductible. Let's

say your health insurance plan's allowable cost for a doctor's office visit is $100. Your copayment for a doctor visit is $20. If you've paid your deductible: You pay $20, usually at the time of the visit. If you haven't met your deductible: You pay $100, the full allowable amount for the visit. Copayments (sometimes called "copays") can vary for different services within the same plan, like drugs, lab tests, and visits to specialists.

Coinsurance: The percentage of costs of a covered health care service you pay (20%, for example) after you've paid your deductible. Let's say your health insurance plan's allowed amount for an office visit is $100 and your coinsurance is 20%. If you've paid your deductible: You pay 20% of $100, or $20. The insurance company pays the rest. If you haven't met your deductible: You pay the full allowed amount, $100.

Out-of-Pocket Maximum: The most you have to pay for covered services in a plan year. After you spend this amount on deductibles, copayments, and coinsurance, your health plan pays 100% of the costs of covered benefits.

Although this is not an all-encompassing list of key terms for health insurance, these are some of the terms you are likely to encounter when shopping for health insurance.

Choices in Medical Care

Choosing the right medical professional can be difficult and will vary depending on your day-to-day health status. Below is a brief list of medical professionals you can visit for a variety of health issues:

Primary Care Practitioner (PCP) is a medical professional whom you can go to for routine ailments, preventive care, general medical advice, and appropriate referrals. The primary care provider for most people is a medically trained family practitioner, an internist, or a pediatrician.

Other PCP include:

Osteopath: general practitioner who receives medical training similar to a Doctor of Medicine (MD), but is more involved in musculoskeletal focus than internal focus.

Nurse Practitioners are professional nurses with advanced training obtained through either a master's degree program or specialized nurse practitioner program. They have the authority and training to conduct diagnostic tests and prescribe medications (in some states). Nurses may also earn the clinical doctor of nursing degree (ND), a doctorate of nursing science (DNS or DNSc), or a research-based doctorate (PhD) in nursing.

Physician Assistants must work under the supervision of a physician and are legally permitted to prescribe drugs in all states.

Other practitioners include:

Nurses are highly trained and strictly regulated practitioners who provide a wide range of services including patient education, counseling, community health and disease prevention information, and administration of medications.

Licensed Registered Nurses (RN) have completed either a 4-year program leading to a Bachelor of Science degree (BSN) or a 2-year associate degree program.

Licensed practical or vocational nurses (LPN or LVN) have completed a one- to two-year training program.

Ophthalmologists hold a medical degree and can perform surgery. An optometrist evaluates visual problems but is not a trained physician.

Podiatrists: specialize in care of the foot; extensive training similar to MD; can prescribe and perform surgery.

Dentists are specialists who diagnose and treat diseases of the teeth, gums, and oral cavity. Orthodontists are specialists in the alignment of teeth. Oral surgeons perform surgical procedures to correct problems of the mouth, face, and jaw.

Ask Good Questions

Whichever health care professional you choose to visit, your health depends on good communication. Asking questions and providing information to your doctor and other care providers can improve your care. Quality health care is a team effort. You play

an important role. One of the best ways to communicate with your doctor and health care team is by asking questions. Because time is limited during medical appointments, you will feel less rushed if you prepare your questions before your appointment.

- Your doctor wants your questions.
- Doctors know a lot about a lot of things, but they don't always know everything about you or what is best for you.
- Your questions give your doctor and health care team important information about you, such as your most important health care concerns.
- That is why they need you to speak up.

12.2: Health Facilities

Health facilities are places that provide health care. They include hospitals, clinics, outpatient care centers and specialized care centers, such as birthing centers and psychiatric care centers. When you choose a health facility, you might want to consider:

- How close it is
- Whether your health insurance will pay for services there
- Whether your health care provider can treat you there
- The quality of the facility

Quality is important. Some facilities do a better job than others. One way to learn about the quality of a facility is to look at report cards developed by state and consumer groups.

Look for a hospital that:

- Is accredited by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO).
- Is rated highly by the State and by consumer groups or other organizations.
- Has a lot of experience and success in treating your condition.
- Monitors quality of care and works to improve quality.

In choosing a nursing home or other long-term care facility, look for one that:

- Has been found by State agencies and other groups to provide quality care.
- Provides a level of care, including staff and services, that will meet your needs.

Universal Healthcare

The World Health Organization states that:

- Half of the world's population do not have access to the health care they need.
- 100 million people are driven into poverty each year through out-of-pocket health spending.
- 75% of national health policies strategies and plans are aimed at moving towards universal health coverage.
- Over 930 million people spend at least 10% of their household income on health care.

In an effort to bring healthcare to all people across the world, The World Health Organization (WHO) is encouraging all countries of the world to adopt Universal Health Coverage (UHC). The WHO is providing support and technical expertise to advance universal health coverage in 115 countries, representing a population of at least 3 billion people. The goal is to bridge global commitments with country action to achieve universal health coverage.

The WHO defines universal healthcare as "ensuring that all people have access to needed health services (including prevention, promotion, treatment, rehabilitation and palliation) of sufficient quality to be effective while also ensuring that the use of these services does not expose the user the financial hardship. It includes the full range of essential health services, from health promotion to prevention, treatment, rehabilitation, and palliative care."

Many countries offer universal healthcare, these include:

- Australia (Healthcare System in Australia)
- Canada (Canadian Health Care System)
- France (French Healthcare System)
- Germany (German Healthcare System – GKV)
- Ireland (Healthcare System in Ireland)
- Italy (Healthcare System in Italy)
- Japan (Japanese Healthcare System)
- New Zealand (New Zealand's Healthcare System)
- Portugal (Healthcare System in Portugal)
- Spain (Healthcare System in Spain)

- Sweden (Sweden's Healthcare System)
- United Kingdom (Healthcare System in the UK)

12.3: Prescription Medicine

You may need to take medicines every day, or only once in a while. Either way, you want to make sure that the medicines are safe and will help you get better. In the United States, the Food and Drug Administration (FDA) is in charge of assuring the safety and effectiveness of both prescription and over-the-counter medicines.

Even safe drugs can cause unwanted side effects or interactions with food or other medicines you may be taking. They may not be safe during pregnancy. To reduce the risk of reactions and make sure that you get better, it is important for you to take your medicines correctly.

Understanding Generic Drugs

Generic drugs are important options that allow greater access to health care for all Americans. They are copies of brand-name drugs and are the same as those brand name drugs in dosage form, safety, strength, route of administration, quality, performance characteristics and intended use.

Health care professionals and consumers can be assured that FDA approved generic drug products have met the same rigid standards as the innovator drug. All generic drugs approved by FDA have the same high quality, strength, purity and stability as brand-name drugs. And, the generic manufacturing, packaging, and testing sites must pass the same quality standards as those of brand name drugs.

A generic drug is identical -- or bioequivalent -- to a brand name drug in dosage form, safety, strength, route of administration, quality, performance characteristics and intended use. Although generic drugs are chemically identical to their branded counterparts, they are typically sold at substantial discounts from the branded price. According to the Congressional Budget Office, generic drugs save consumers an estimated $8 to $10 billion a year at retail pharmacies. Even more billions are saved when hospitals use generics.

Prescription Drug Abuse

Medications can be effective when they are used properly, but some can be addictive and dangerous when abused. Some prescribed medications that - when used in ways or by people other than prescribed - have the potential for adverse medical consequences, including addiction.

Experts don't know exactly why this type of drug abuse is increasing. The availability of drugs is probably one reason. Doctors are prescribing more drugs for more health problems than ever before. Online pharmacies make it easy to get prescription drugs without a prescription, even for younger people.

In 2010, approximately 16 million Americans reported using a prescription drug for nonmedical reasons in the past year; 7 million in the past month. After marijuana, prescription and over-the-counter medications account for most of the commonly abused drugs.

Three types of drugs are abused most often:

- Opioids—prescribed for pain relief
- Central Nervous System (CNS) depressants—barbiturates and benzodiazepines prescribed for anxiety or sleep problems (often referred to as sedatives or tranquilizers)
- Stimulants—prescribed for attention-deficit hyperactivity disorder (ADHD), the sleep disorder narcolepsy, or obesity.

How can you help prevent prescription drug abuse?

- Ask your doctor or pharmacist about your medication, especially if you are unsure about its effects.
- Keep your doctor informed about all medications you are taking, including over-the counter medications.
- Read the information your pharmacist provides before starting to take medications.
- Take your medication(s) as prescribed.
- Keep all prescription medications secured at all times and properly dispose of any unused medications.

12.4: Health Fraud

When you see statements like “miracle cure,” “revolutionary scientific breakthrough,” or “alternative to drugs or surgery,” what you should be thinking is, “bogus product,” “Danger,” or “Health fraud alert!”

Health fraud scams have been around for hundreds of years. The snake oil salesmen of old have morphed into the deceptive, high-tech marketers of today. They prey on people’s desires for easy solutions to difficult health problems, from losing weight to curing serious diseases like cancer. According to the Food and Drug Administration (FDA), a health product is fraudulent if it is deceptively promoted as being effective against a disease or health condition but has not been scientifically proven safe and effective for that purpose. Health fraud scams can do more than waste your money, they can cause serious injury or even death.

Scammers promote their products through newspapers, magazines, TV infomercials and cyberspace. You can find health fraud scams in retail stores and on countless websites, in popup ads and spam, and on social media sites like Facebook and Twitter. It is important to understand the signs of fraudulent health products.

The FDA provides the following list of 6 Tip-offs to Rip-offs:

1. One product does it all. Be suspicious of products that claim to cure a wide range of diseases. The agency continues to send warning letters and take enforcement action as appropriate against companies marketing fake cure-all products. These miracle cures don’t exist – they’re bogus – and the only thing these companies are selling is false hope.
2. Personal “success” testimonials. Success stories, such as, “It cured my diabetes” or “It immediately stopped my COVID-19 infection,” are easy to make up and are not a substitute for scientific evidence. Reviews found on popular online marketplaces and social media can be fake.
3. Quick fixes. Few diseases or conditions can be treated quickly, even with legitimate products. Beware of language such as, “Lose 30 pounds in 30 days,” “protects from viral infections,” or “eliminates skin cancer in days.”
4. “All natural” cure or treatment. Don’t be fooled by descriptions like “all-natural cure.” Such phrases are often used in health fraud as an attention-grabber to suggest that a product is safer than conventional treatments. These terms don’t necessarily equate to safety. Some plants found in nature (such as poisonous mushrooms) can be harmful or even kill when consumed. Moreover, the FDA has found numerous products promoted as “all-natural” cures or treatments that contain hidden and dangerously high doses of prescription drug ingredients or other active pharmaceutical ingredients.
5. “Miracle cure.” Alarms should go off when you see this claim or others like it such as, “new discovery,” “guaranteed results,” or “secret ingredient.” If a real cure for a serious disease were FDA-approved, it would be widely reported through the media and prescribed by licensed health professionals—not plastered on advertisements in social media and messaging apps, or buried in websites, print ads, and TV infomercials.
6. Conspiracy theories. Claims like “This is the cure our government or Big Pharma doesn’t want you to know about” are used to distract consumers from the obvious, common-sense questions about the so-called miracle cure.

12.5: How to Read Health News

If you've just read a health-related headline that has caused you to spit out your morning coffee ("Coffee causes cancer" usually does the trick), it's always best to follow the Blitz slogan: "Keep Calm and Carry On". On reading further, you'll often find the headline has left out something important, such as, "Injecting five rats with really highly concentrated coffee solution caused some changes in cells that might lead to tumors eventually. (Study funded by The Association of Tea Marketing)".

The most important rule to remember is: don't automatically believe the headline. It is there to draw you into buying the paper and reading the story. Would you read an article called, "Coffee pretty unlikely to cause cancer, but you never know"? Probably not. To avoid spraying your newspaper with coffee in the future, you need to analyze the article to see what it says about the research it is reporting on. Consider the following questions to help you figure out which articles you're going to believe and which you're not.

Does the article support its claims with scientific research? Your first concern should be the research behind the news article. If an article touts a treatment or some aspect of your lifestyle that is supposed to prevent or cause a disease, but doesn't give any information about the scientific research behind it, then treat it with a lot of caution. The same applies to research that has yet to be published.

Is this article based on a conference abstract? Another area for caution is if the news article is based on a conference abstract. Research presented at conferences is often at a preliminary stage and usually hasn't been scrutinized by experts in the field. Also, conference abstracts rarely provide full details about methods, making it difficult to judge how well the research was conducted. For these reasons, articles based on conference abstracts should be no cause for alarm. Don't panic or rush off to your doctor.

Was the research in humans? Quite often, the "miracle cure" in the headline turns out to have only been tested on cells in the laboratory or on animals. These stories are regularly accompanied by pictures of humans, which creates the illusion that the miracle cure came from human studies. Studies in cells and animals are crucial first steps and should not be undervalued. However, many drugs that show promising results in cells in laboratories don't work in animals, and many drugs that show promising results in animals don't work in humans. If you read a headline about a drug or food "curing" rats, there is a chance it might cure humans in the future, but unfortunately there is a larger chance that it won't. So there is no need to start eating large amounts of the "wonder food" featured in the article.

How many people did the research study include? In general, the larger a study the more you can trust its results. Small studies may miss important differences because they lack statistical "power", and are also more susceptible to finding things (including things that are wrong) purely by chance.

You can visualize this by thinking about tossing a coin. We know that if we toss a coin the chance of getting a head is the same as that of getting a tail – 50/50. However, if we didn't know this and we tossed a coin four times and got three heads and one tail, we might conclude that getting heads was more likely than tails. But this chance finding would be wrong. If we tossed the coin 500 times - i.e. gave the experiment more "power" - we'd be more likely to get a heads/tails ratio close to 50/50, giving us a better idea of the true odds. When it comes to sample sizes, bigger is usually better. So when you see a study conducted in a handful of people, treat it with caution.

Did the study have a control group? There are many different types of studies appropriate for answering different types of questions. If the question being asked is about whether a treatment or exposure has an effect or not, then the study needs to have a control group. A control group allows the researchers to compare what happens to people who have the treatment/exposure with what happens to people who don't. If the study doesn't have a control group, then it's difficult to attribute results to the treatment or exposure with any level of certainty. Also, it's important that the control group is as similar to the treated/exposed group as possible. The best way to achieve this is to randomly assign some people to be in the treated/exposed group and some people to be in the control group. This is what happens in a randomized controlled trial (RCT) and is why RCTs are considered the "gold standard" for testing the effects of treatments and exposures. So when reading about a drug, food or treatment that is supposed to have an effect, you want to look for evidence of a control group, and ideally, evidence that the study was an RCT. Without either, retain some healthy skepticism.

Did the study actually assess what's in the headline? This one is a bit tricky to explain without going into a lot of detail about things called proxy outcomes. Instead, bear in mind this key point: the research needs to have examined what is being talked about in the headline and article. Somewhat alarmingly, this isn't always the case.

For example, you might read a headline that claims, “Tomatoes reduce the risk of heart attacks”. What you need to look for is evidence that the study actually looked at heart attacks. You might instead see that the study found that tomatoes reduce blood pressure.

This means that someone has extrapolated that tomatoes must also have some impact on heart attacks, as high blood pressure is a risk factor for heart attacks. Sometimes these extrapolations will prove to be true, but other times they won’t. Therefore if a news story is focusing on a health outcome that was not examined by the research, treat it with a pinch of salt.

Who paid for and conducted the study? This is a somewhat cynical point, but one that’s worth making. The majority of trials today are funded by manufacturers of the product being tested – be it a drug, vitamin cream or foodstuff. This means they have a vested interest in the results of the trial, which can potentially affect what the researchers find and report in all sorts of conscious and unconscious ways. This is not to say that all manufacturer-sponsored trials are unreliable. Many are very good. However, it’s worth seeing who funded the study to sniff out a potential conflict of interest.

Should you “shoot the messenger”? Overblown claims might not necessarily be due to the news reporting itself. Although journalists can sometimes misinterpret a piece of research, at other times the researchers (or other interested parties) over-extrapolate, making claims their research doesn’t support. These claims are then repeated by the journalists.Given that erroneous claims can come from a variety of places, don’t automatically assume they come from journalists. Instead, use the questions above to figure out for yourself what you’re going to believe and what you’re not.

Evaluating and Finding Health Information

In Chapter 1, we discussed the CRAAP method to use as a strategy for assessing websites. CRAAP is an acronym that stands for Currency, Relevance, Authority, and Purpose.

Currency: The timeliness of the information.

Relevance: The importance of the information for your needs.

Authority: The source of the information.

Accuracy: The reliability, truthfulness, and correctness of the content

Purpose: The reason the information exists.

We also learned how the following examples will most likely pass the CRAAP test for health information:

- The Center for Disease Control and Prevention
- World Health Organization
- PubMed Central
- MyHealthFinder
- U.S. Department of Health and Human Services

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GLOSSARY

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Sample Word 1 | Sample Definition 1

DETAILED LICENSING

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Webpages: 102

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About Chronic Diseases| CDC

Preventing Chronic Diseases: What You Can Do Now| CDC

Diabetes Basics | CDC

United States Cancer Statistics (USCS)

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What happens during a stroke? - Vaibhav Goswami

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