THE AGING PROCESS

INTRODUCTION

As we grow older we begin to go through the aging process, a progressive and inevitable series of changes in our bodies. The aging process is characterized by a decline in physical and mental abilities. It also involves a decreased resistance to disease, diminished powers of recuperation, and a greater risk of developing acute and/or chronic diseases. The aging process can happen slowly or quickly and for each of us it begins at a different point in our lives. But it moves in one direction only and growing old, unfortunately, means that health and strength will slowly fade.

The population in the United States and many other countries is getting older and life expectancy is greater than ever before. The aging process is different for each of us, it affects everyone. Certified nursing assistants (CNAs) and other health care professionals will more and more be caring for people who are elderly. As a CNA, understanding the aging process will be a vital part of your knowledge base.

OBJECTIVES

After completing this module the learner will be able to:

1. Identify the definition of aging.
2. Identify body system changes caused by the aging process.
3. Identify acute and chronic diseases that are common in older adults.
4. Identify health issues that affect the elderly
5. Identify medication issues that are common to the elderly.
THE AGING POPULATION

The American population is getting older. Everyone has read stories about “the graying of America” and the statistics confirm what the mainstream media is reporting. The number of people in the United States who are 65 or older has been slowly and steadily increasing. The population that is 65 years of age and older has grown by over 20% in the last decade and this increase is expected to continue. With each passing year more and more of the population will be elderly and there will be many more people who fit the traditional description of old age - 65 years or older.

There are many reasons why this is happening and why it will continue. Better health care and better access to healthcare are partially responsible. Many diseases and illnesses that could not be treated or that could greatly decrease life span can now be cured. Life expectancy has increased, the number of people who smoke has decreased significantly, and fitness and nutrition have become relatively popular.

And the population will also keep getting older because there are simply more people who are likely to become old. The birth rate of the Baby Boomer generation was relatively high, they make up a large part of the population, and many of these people will be turning 65 in the next decade or so. Given that fact and the increase in life expectancy it is easy to see why America is getting grayer.

HOW DO WE DEFINE THE OLD AND THE ELDERLY?
The words old, old age, elderly, and older adult are frequently used but they do not have universally accepted definitions. Gerontologists (professionals who study aging) have developed categories such as the young-old (60-69) and the middle-old (70-79) and others to describe the elderly. But despite these efforts there are no universally accepted definitions for the terms old, old age, elderly and other words used to describe this population. This is for three reasons.

First, old age or being elderly can only be defined in context. In a society where many people die in infancy or before reaching age 35, someone who is 50 may be considered old. The context can also depend on who asked for the definition of old. If you asked a teenager if a 67-year-old woman is old, the answer would surely be yes. But what would that “old” person say?

Second, the aging process has four dimensions, biological, chronological, psychological, and social, and being old can be defined using any one of these or a combination of them. Many people would consider someone who is 66 to be old and in the chronological sense that is true - that person is older than most of the population. But that 66-year-old woman or man may be in perfect health, exercise every day, be very happy and well-adjusted, and have an active professional and social life. Considering that this 66-year-old is biologically, psychologically, and socially “young,” would you call that person old?

And finally, although the aging process is usually associated with being old but the biological process of aging actually begins very early in life (more about this later). Aging is experienced differently for each person and each aspect of aging, the biological, chronological, psychological, and social develops at its own rate.
So clearly, old age, older adult, or being elderly cannot be easily defined and in many ways a clear outline of what these terms mean is not very useful. However, the terms do persist and are widely used. For the purposes of this module, old age will be considered 65 years or more and the terms old age, elderly, and older adult will be used interchangeably.

**THE AGING PROCESS: INTRODUCTION**

The aging process is defined in this module as follows:

*The aging process is the gradual, decreased ability of the body to function and to heal itself.*

This definition is simple. But aging is *not* simple and to understand what aging is and what it means to people experiencing it requires consideration of these points.

- Aging is not the same as being old: We think of aging as equivalent to being old. But aging actually begins in the late teens. That is the time when our physical capabilities are at their maximum.

- Aging is a process of decline: As we move past the late teens our bodies begin to decline. We gradually lose strength, eyesight and hearing become weaker, and all of the organs systems slowly become less able to function. The heart and lungs are not as strong, the immune system is less able to fight infections, and other parts of the body do not function as well as they previously did.
The process of aging takes time: The aging process, the gradual decline in our health and physical abilities, is very slow. For many years, for most of life, actually, *aging is not noticeable and doesn’t interfere with daily life.*

Stress and repair: Each minute of each day our bodies must deal with internal and external stress, are stressed but fortunately we are also given the ability to handle stress, to fight off infections, and repair damage. But as we get older our bodies lose the capability for self-healing and this has two results: damage that cannot be repaired and susceptibility to disease. In simpler terms, this means that the body wears out, we cannot do what we once did, and acute and chronic illnesses will occur.

Progression: Throughout most our lives the aging process is slow and gradual but at certain point it begins to speed up. When that happens several things occur: 1) the effects of aging begin to be noticeable to the individual; 2) the effects of aging can be measured by a physical examination or testing; 3) the older person becomes more susceptible to disease; 4) the older person is less able to recover from illness, and; 5) the older person develops an acute or chronic disease.

The weak link: Eventually the balance of stress and repair is tipped in favor of damage and an acute or chronic disease happens. The older persons may develop heart failure, chronic kidney disease, or suffer an acute illness such as a stroke or infection from which they cannot recover. In more basic terms, one or more of the organ systems will be the “weak link” that leads to illness.
So aging begins early and it progresses slowly. It represents a gradual decline in the functional ability of the body and a decrease in the ability of the body to handle stress. All of this makes us vulnerable to illness and infection and eventually acute and/or chronic diseases develop and we cannot recover. To put it more simply, our bodies wear out.

**WHY DO WE AGE?**

The question of why we age is a source of constant investigation and there are many theories. Scientists have speculated that aging represents an imbalance between stress and repair. There is also evidence that aging itself seems cause to an increase in internal stress that is separate from the normal external stress, tissue, and organ damage that all human bodies must cope with.

Another theory of aging is that the process of homeostasis is disrupted as we get older. Homeostasis is defined as the ability of the body to maintain an internal environment that allows for optimal functioning. For example, the brain, the heart, and our muscles all work best within a certain range of body temperature and if the body temperature becomes too high or too low, heat can be produced or lost as needed. Homeostatic mechanisms may simply stop working after a certain point.

It could also be that our DNA is programmed to age, that the waste products of metabolism are eliminated less effectively during old age and the accumulation of these may cause aging. In addition, everyone ages differently and some people live to be quite old and have very few health problems and only insignificant decreases in functional ability. Longevity and
freedom from illness is another part of the aging process, but it is not clear why some people live longer and healthier lives.

**SPECIFICS OF THE AGING PROCESS: SYSTEM CHANGES**

The aging process affects each of us differently so descriptions of what happens to our bodies as we become elderly can only be general in nature. When and how our health is affected depends on the individual, but aging happens to us all.

Age-related changes in the body systems will be discussed in this section. The implications and consequences of these changes will be discussed in the next section of the module.

**Body and Bone Composition and the Skin**

People gain weight as they get older. The percentage of body weight that is fat is increased and we gradually lose muscle mass. The loss of muscle mass begins slowly but increases more quickly as we age. The number of fast twitch muscle fibers - the ones that give us power - decrease so strength is gradually lost. Joints become less flexible because the tendons and ligaments deteriorate, and the bones lose calcium and become thinner and more brittle. The bones and joints in particular are constantly in a balance between breakdown and re-building and as we get older this balance is irreversibly tipped towards breakdown.

The skin gets thinner and dryer as we age and it gets noticeably more fragile. Receptors for touch and pain in the skin do not function as well. In addition,
thinning of the skin plus loss of the fat layer immediately below the skin means that body heat is more easily lost.

Cardiovascular System

The cardiovascular system is comprised of the blood vessels, the blood, and the heart. The purpose of the cardiovascular system is to deliver oxygen and nutrients to the organs and tissues and to help eliminate metabolic waste products. These functions are done by the heart pumping the blood throughout the body by way of the arteries, capillaries, and veins.

Several important age-related changes occur to the cardiovascular system. The heart muscle becomes thicker and stiffer and much less compliant, as do the arteries and the other blood vessels. In most people the heart muscle does not become weaker with age but it does lose some capacity for response to stress. In addition, the process of atherosclerosis, typically known as hardening of the arteries, increases with age and many elderly people - the majority of them - have atherosclerostic plaques in the arteries of the brain, the heart, and major blood vessels. Blood volume is unaffected by age, but the ability of the bone marrow to produce more blood cells during times of stress is definitely decreased. Finally, the blood must be able to form clots to prevent bleeding, but in many older persons blood clotting is sub-optimal.

Gastrointestinal Tract

The gastrointestinal (GI) tract breaks down food, absorbs nutrients and fluids, and eliminates wastes. Each part of the GI tract, from the mouth to the lower GI tract, can be affected by the aging process.
In the mouth, the gums recede as we get older and the teeth become more prone to decay. The esophagus, the muscular tube that connects the oral cavity to the stomach, is less sensitive to pain and the valve (technically called a sphincter) that separates the esophagus from the stomach begins to leak. This allows acidic stomach contents to splash back into the esophagus but because pain sensation in the esophagus is diminished, this may go unnoticed.

Other parts of the GI tract experience age-related changes as well. The stomach becomes more sensitive to the irritating effect of certain drugs such as aspirin and ibuprofen; the small intestine of an older adult does not absorb calcium as efficiently as the small intestine of someone younger; the lower bowel loses muscle tone and is less able to expel feces, and; the strength and tone of the anal sphincter are decreased.

**Genito-Urinary System**

The urinary bladder of an elderly person has a smaller maximum capacity. The bladder is not emptied completely during urination and the ability to voluntarily delay urination is decreased. The female urethra become shorter and may not close completely after every act of urination. Sexual function for men and women is adversely affected by age and obviously the ability to reproduce is compromised. For men, the prostate gland gradually becomes enlarged with age.

**Hepato-biliary System**

The hepato-biliary system is comprised of the gallbladder and the liver. The gallbladder stores bile and releases it into the GI tract; bile is a compound made by the liver that is needed to absorb fat. The liver has a wide range of important
functions, including but not limited to production of blood clotting factors, cholesterol production, metabolism of drugs, regulation of blood sugar, and assisting with the immune response to infection and stress.

The liver is a very active organ and is constantly faced with the twin demands of stress and repair. The size and functioning ability of the liver both decline with age. Examples of this are the decreased production of clotting factors and perhaps most importantly, the ability to break down and metabolize drugs.

**Immune System**

The immune system defends us against disease and infection. We are constantly exposed to bacteria, viruses, and other harmful pathogens but the immune system recognizes and neutralizes them. The immune system ages along with the rest of the body and as we get old the immune system becomes less strong and less effective. This is one of the primary reasons that older people are more susceptible to autoimmune diseases, cancers, and infections. Diminished immune system also limits the ability to recover from illnesses.

**Nervous System and the Brain**

Age-related changes in the nervous system and the brain are very complex and not well understood. Coordination between different areas of the brain decreases with age and the ability to quickly process information is decreased. The brain atrophies (shrinks) as we get older. Nerve cells and nerve fibers are lost and nervous system does not transmit impulses from the brain to the body as quickly or efficiently. Abnormal tissues deposits called plaques and tangles begin
to form in the brain and for some people these will eventually cause Alzheimer’s disease.

**Renal System**

The renal system is profoundly affected by age. The kidneys grow smaller and quite a bit of the functional kidney tissue is lost and replaced with fat or fiber: By the age of 75 approximately one-third of each kidney is no longer viable.

The kidneys also suffer from changes to their blood supply. The kidney is a very active organ and it needs a lot of blood to function properly; slightly more than 20% of the blood pumped by the heart with each beat goes to the kidneys. But aging causes the blood vessels in the kidney to become very narrow. This deprives the kidneys of oxygen and nutrients and this in turn decreases the ability of the kidneys to eliminate toxins, drug metabolites, and waste products.

**Respiratory System**

The primary function of the lungs and the respiratory system is gas exchange. Oxygen is delivered to the blood during inhalation and carbon dioxide is eliminated from the blood and out through the lungs during exhalation. Aging affects the lungs and the respiratory system and gas exchange in many ways. These age-related changes include:

- Decreased elasticity: Lung tissue is very elastic. When the lungs are stretched during inhalation, the elastic property of lung tissue creates a powerful impulse for them to recoil and return to their original size. This elasticity and recoil is the primary way that exhalation occurs. But as we
age the elasticity of the lungs is significantly diminished and exhalation is less efficient and less complete.

- Decreased functional lung tissue: As we get older the amount of functional lung tissue we have is decreased and less oxygen moves through the lungs into the blood. Carbon dioxide elimination however is not affected by aging.

- Chest, diaphragm, and rib muscles: The chest, diaphragm, and rib muscles get weaker and stiffer with age. This limits the ability to inhale and fully expand the lungs.

- Resistance to disease: There are several age-related changes in the respiratory system that decrease resistance to disease. For example, the cough reflex is weakened so mucous and inhaled bacteria and viruses are not effectively cleared from the lungs.

**Sensory Changes**

Changes in sensory ability are some of the most noticeable effects of aging. Many older adults will report that they cannot hear or see as well as they once could. They also note that their senses of taste and smell are diminished.

- Vision: The eyes experience significant changes from aging. The ability to distinguish between colors decreases; the eyes cannot adapt to low light conditions or darkness, and; presbyopia, which is commonly called near sightedness, develops. Presbyopia limits the ability of the eyes to focus on objects that are close at hand. Someone who has presbyopia must use
corrective lenses or she/he will have to hold a book or an object at arm’s length in order to see it clearly.

- Hearing: Hearing is seriously affected by age. Two examples of this are changes in pitch discrimination and sound location. Older people have difficulty in hearing high-pitched sounds, especially high pitched consonants such as t or k. Words that contain those letters may not be well understood or heard clearly. Older adults are also less able to distinguish speech from background noise and because of that, the volume of speech and decreased hearing acuity may not be the issues that can interfere with a older person’s comprehension of speech; it may be the interference of the surrounding noise that makes it difficult for the elderly to understand what you are saying.

- Taste and smell: The ability to discriminate between tastes gets worse as we get older, but much of this is caused by a very sharp decrease in the sense of smell. By the age of 80 most people have lost 50%-80% of their sense of smell.

Aging, and the consequences of aging, are inevitable and there are other age-associated changes aside from the one discussed above. As we grow older, our bodies lose strength and health, they cannot adapt to stress, and they cannot recover from stress. These changes related to aging may be an inconvenience, but they are also the cause of many acute and chronic illnesses.
This section of the module outlined how the body systems are affected by aging. The next section will discuss the acute and chronic illnesses that can result from these changes.

**Table 1: Body System Changes and Aging**

<table>
<thead>
<tr>
<th>Condition</th>
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<tbody>
<tr>
<td>Arterial stiffness</td>
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<td>Blood clotting dysfunction</td>
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<tr>
<td>Bone marrow dysfunction</td>
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<tr>
<td>Bone weakness and fragility</td>
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<tr>
<td>Brain and nervous system tissue loss and dysfunction</td>
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<tr>
<td>Decreased immune system function</td>
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<tr>
<td>Dry, thin skin</td>
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<tr>
<td>Gastrointestinal dysfunction</td>
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<tr>
<td>Joint breakdown and stiffness</td>
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<tr>
<td>Loss of blood supply to organs</td>
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<tr>
<td>Loss of kidney function</td>
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<tr>
<td>Loss of liver function</td>
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<tr>
<td>Loss of muscle mass and strength</td>
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<tr>
<td>Loss of functional lung tissue, decreased lung elasticity</td>
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<tr>
<td>Prostate gland enlargement</td>
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<tr>
<td>Vision, hearing, smell, and taste disorders</td>
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</table>

**AGING AND DISEASE**

Older people are not, as a group, as healthy as people who are young. The U.S. Department of Health and Human Services (HHS) makes periodic assessments of the health and living conditions of older adults. The 2013 HHS report noted that the majority of older Americans have at least one chronic medical condition and many of them have several.

Diseases of virtually every organ system disproportionately affect the elderly population. Arthritis, cancers, cardiac arrhythmias, heart disease, hypertension, diabetes, kidney failure, liver disease, stroke, and other acute and chronic diseases are far more common in older people than in the younger population. It is not uncommon for someone over the age of 65 to have multiple chronic
diseases and for many diseases and medical emergencies such as arthritis, hypertension, myocardial infarction (commonly known as a heart attack) stroke, etc., being over age 65 by itself is considered to be a risk factor for the development of these problems.

Elderly people are also more susceptible to certain conditions that are not diseases but contribute to poor health. The older population responds less predictably to medications and they suffer more medication side effects. Poor nutrition, certain types of injuries, poor dental health, social isolation, and bowel and bladder problems are all more common in the elderly population.

**Acute and Chronic Diseases and the Elderly**

Some of the more common acute and chronic diseases that affect the elderly, and especially ones that CNAs should be familiar with, will be discussed. See Table 2 for a summary.

- Bone, joint, and skin diseases: **Osteoarthritis**, often simply called arthritis, is very common in older adults. Approximately 50% of all people 65 and older have osteoarthritis to a degree that affects their lives and approximately 80%-90% of that population has osteoarthritis that can be seen on x-ray. Osteoarthritis causes joint pain and swelling and can several affect walking and activities of daily living. **Osteoporosis** is a disease that causes the bones to become thin, brittle, and likely to fracture. Osteoporosis and low bone mass affect millions of older Americans and women are particularly at risk: one in two women over the age of 50 will eventually suffer a fracture that is caused by osteoporosis.
Skin cancers such as basal cell carcinoma and squamous cell carcinoma typically have their onset in the later stages of life.

- Cardiovascular system: The incidence of atherosclerosis, cardiac arrhythmias, congestive heart failure (CHF) coronary artery disease, hypertension, myocardial infarction, stroke, and transient ischemic attack (typically called a TIA, and known by the public as a mini stroke or minor stroke) increases significantly with age and old age is considered to be a major risk factor for the development of cardiovascular disease. Stroke is defined as irreversible brain damage caused by a blood clot or bleeding in the brain, and 75% of all strokes happen to people who are 64 years of age or older. Hypertension increases the risk of atherosclerosis, chronic kidney disease (CKD), myocardial infarction, and stroke and hypertension becomes more common as we age. Atherosclerosis and coronary artery disease are diseases that typically affect older adults, causing chest pain, decreased exercise tolerance, and myocardial infarction. Congestive heart failure is also a common disease of the elderly, causing shortness of breath and exercise intolerance.

- Endocrine system: The incidence of non-insulin dependent diabetes increases with age. Much of this increase is related to modifiable risk factors such as diet, obesity, and a sedentary life style.

- Gastrointestinal tract: The GI tract suffers from aging and this is reflected in the increased incidence in older adults of GI tract diseases such as colon cancer and diverticulosis. The incidence of colon cancer is
increases dramatically after age 65 and approximately 90% of all cases occur in people over the age of 50. Diverticulosis is caused by weaknesses in the intestinal wall. This results in areas of the gut that bulge out and can cause abdominal pain.

- Genito-urinary system: Prostate cancer is the most common cancer affecting older men. Approximately 99% of all cases of prostate cancer occur in men aged 50 or older and by age 70 the majority of men will have prostate cancer. Urinary tract infections are relatively common in elderly men and women. These infections have many age-related causes including, but not limited to: changes in the anatomy of the urinary tract; diabetes; enlarged prostate gland; diminished immune system functioning; decreased levels of estrogen in women, and; the use of medications that can cause urinary retention.

- Hepato-biliary system: Perhaps the most important effect that aging has on the liver is the change in drug metabolism. Most medications are metabolized by the liver and many are excreted by the liver, as well. These processes can be significantly changed by the effects of aging on the liver. Dosages need to be adjusted based on age and older adults may respond badly to what is considered a normal amount of medication. In addition, the duration of effects of a medication is likely to be much longer in an older adult because someone who is 65 or older does not metabolize and eliminate drugs as quickly as a younger adult.
• Immune system: The decrease in immune system functioning that occurs as we age has profound effects. The older adult is more susceptible to infections. They are less able to recover from infections and the recovery period is often prolonged.

• Nervous system and brain: Many older adults maintain a normal level of intelligence and cognition well into their old age. Although diminished brain function is not an inevitable consequence of getting older, aging is associated with an increased risk for serious neurological diseases such as Alzheimer’s disease, dementia, and Parkinson’s disease. Depression and suicide are also associated with growing older.

• Renal system: Chronic kidney disease is a progressive disease that causes anemia, fatigue, weight loss, and loss of kidney function. It is also associated with the development of hypertension and other cardiovascular diseases. Chronic kidney disease can also affect the elimination of many drugs. As with many chronic medical conditions, CKD is more common in older adults and age is considered to be a risk factor for CKD.

• Respiratory system: Chronic obstructive pulmonary disease (COPD) is a common respiratory disease that is primarily caused by cigarette smoking. Chronic obstructive pulmonary disease severely decreases gas exchange and people who have COPD have chronic cough, difficulty breathing, and decreased exercise tolerance. These symptoms often progress to the point where simple activities of daily living can seem impossible. The disease begins at an early age but the clinical signs and symptoms begin
in late adulthood and early old age. Pneumonias are also more likely to happen in the older population and older adults are more likely to die from pneumonia than children or younger adults.

- Diseases of the sensory organs: Cataracts and glaucoma are diseases of the eyes that become very common as we age. A cataract is a thickening of the lens of the eye that causes difficulty focusing and myopia (commonly known as near sightedness) and cataracts are one of the leading causes of blindness. Glaucoma is characterized by increased in the eyeball. The increased pressure can irreversibly damage the ocular blood vessels and nerves and glaucoma, as with cataracts, is one of the leading causes of blindness.

**Table 2: Acute and Chronic Diseases that Affect the Elderly**

<table>
<thead>
<tr>
<th>Disease</th>
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<tbody>
<tr>
<td>Alzheimer’s disease</td>
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<tr>
<td>Anemia</td>
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<td>Angina pectoris</td>
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<td>Arthritis</td>
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<td>Atherosclerosis</td>
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<td>Cancers</td>
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<td>Cardiac arrhythmias</td>
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<td>Cataracts</td>
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<td>CKD</td>
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<tr>
<td>Congestive heart failure</td>
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<tr>
<td>COPD</td>
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<tr>
<td>Coronary artery disease</td>
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<tr>
<td>Dementia</td>
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<tr>
<td>Depression</td>
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<td>Diabetes</td>
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<td>Diverticulosis</td>
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<td>Glaucoma</td>
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<td>Hypertension</td>
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<td>Myocardial infarction</td>
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<td>Osteoporosis</td>
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<td>Parkinson’s disease</td>
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<td>Pneumonia</td>
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</table>
Health Issues of the Elderly

Some of the health issues that confront the elderly are not specific diseases. They are conditions that occur as a result of the age-related changes in body or they are caused by an acute or chronic disease. Examples include:

- Ambulatory difficulty: Older people often have muscle and joint pain, stiffness, and weakness. Balance and vision disorders and peripheral neuropathy also become more prevalent with advancing age. All of these problems combine to make ambulating difficult for older adults.

- Falls: Falls are relatively frequent in older adults. Approximately one out three adults 65 years or older has a fall, or several falls, each year. Falls are the leading cause of non-serious and serious injury in this age group, and lacerations, hip fractures, and traumatic brain injury after a fall are not uncommon. Another consequence of falls is the fear of falling. After one or two falls many older adults begin to become less active and they are hesitant to ambulate. While this may in one sense limit the risk of falling, it can also increase the risk of falling as muscles and joints that are not exercised become weak and stiff.

- Incontinence: Age is one the biggest risk factors for bladder and bowel incontinence. The age-related changes in the genito-urinary and GI systems certainly contribute to these problems, but constipation, diabetes,
infections, medications, mobility disorders, and stroke can all be causes of bladder or bowel incontinence.

• Malnutrition: Food intake decreases as we age and there are multiple reasons why this happens. The appetite declines and poor dentition makes chewing and eating difficult. The sense of taste and the sense of smell that are so important to the enjoyment of food are not as acute as they once were, and social isolation and depression tend to make people less likely to eat. The end result can be malnutrition and increased susceptibility to disease.

• Medication problems: Many older adults are taking multiple medications. This increases the risk for drug interactions and increases the risk for medication errors. Medical insurance pays for some of the cost of medications, but the cost of co-payments may induce an older adult to skip doses or stop taking a medication for a while in order to save money.

SUMMARY

The aging process is a profound and life-changing experience. The body slowly begins to weaken, resistance to disease is decreased, and recovery time is prolonged. Acute and chronic medical conditions become more common and life-disrupting conditions such as incontinence and falls can severely affect independence and quality of life. Many people age 65 or older self-report some sort of disability. These may be minor or they may be significant, requiring the older person to need skilled assistance. The aging process is experienced differently by each of us. But age-related changes are inevitable.