



AGING-RELATED CHANGES

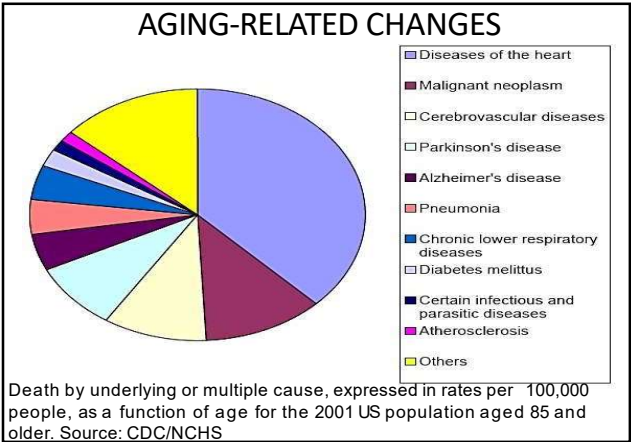
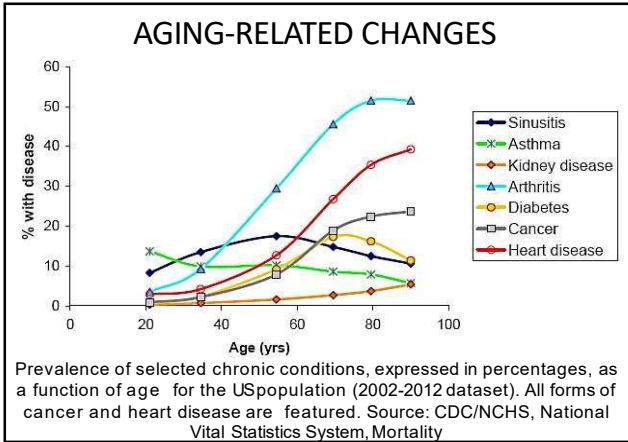
- Physical changes related to "Normal" aging are not diseases.
- We all change physically, as we grow older.
- Some systems slow down, while others lose their "fine tuning."
- People who live an active lifestyle lose less muscle mass and flexibility as they age.
- As a general rule, slight, gradual changes are common, and most of these are not problems to the person who experiences them.
- Steps can be taken to help prevent illness and injury, and which help maximize the older person's independence, if problems do occur.

AGING-RELATED CHANGES

- Aging is characterized by changes in appearance, such as a gradual reduction in height and weight loss due to loss of muscle and bone mass, a lower metabolic rate, longer reaction times, declines in certain memory functions, declines in sexual activity--and menopause in women--, a functional decline in audition, olfaction, and vision, declines in kidney, pulmonary, and immune functions, declines in exercise performance, and multiple endocrine changes.

CONT....

- Although the immune system deteriorates with age, called immune-senescence, a major hallmark of aging is an increase in Inflammation levels, reflected in higher levels of circulating pro-inflammatory cytokines and that may contribute to several age-related disorders such as Alzheimer's disease, atherosclerosis and arthritis.



AGING-RELATED CHANGES

Death by underlying or multiple cause, expressed in rates per 100,000 people or in percentage of the total deaths, for the 2001 US population in two age groups: 45-54 years and 85 years of age and older.	Cause of death	45-54 years		Over 85 years	
		Incidence	% of deaths	Incidence	% of deaths
	Diseases of the heart	92.8	21.66%	5607.5	37.48%
	Malignant neoplasm	126.3	29.48%	1747	11.68%
	Cerebrovascular diseases	15.1	3.52%	1485.2	9.93%
	Parkinson's disease	0.1	0.02%	1312.8	8.77%
	Alzheimer's disease	0.2	0.05%	703.2	4.70%
	Pneumonia	4.6	1.07%	676.5	4.52%
	Chronic lower respiratory diseases	8.5	1.98%	638.2	4.27%
	Diabetes mellitus	13.6	3.17%	318.6	2.13%
	Certain infectious and parasitic diseases	22.9	5.35%	243.8	1.63%
	Atherosclerosis	0.5	0.12%	177.3	1.19%
	Others	143.8	33.57%	2050.9	13.71%

BODY SYSTEMS

SENSORY SYSTEM-HEARING

Hearing

- Loss is usually in ability to hear high frequency sounds.
- Hearing loss can lead to social isolation and should be addressed.
- Hearing aids cannot address all types of hearing loss.

How to help mitigate effects of hearing loss:

- Lower the pitch of voice.
- Speak directly to the person so that they can see your face.
- Eliminate background noise.

SENSORY SYSTEM-VISION

□ Vision

- Not all older people have impaired vision
- Loss of ability to see items that are close up begins in the 40's
- Size of pupil grows smaller with age: focusing becomes less accurate
- Lens of eye yellows making it more difficult to see red and green colors
- Sensitivity to glare increases
- Night vision not as acute

□ How to help mitigate the effects of vision loss:

- Increase lighting
- Use blinds or shades to reduce glare
- Maintain equal levels of lighting

SENSORY SYSTEM-TASTE AND SMELL

Taste and Smell

- Some loss in taste and smell as one ages, but loss is usually minor and not until after age 70
- Many older people often complain of food being tasteless

Possible causes:

- Loneliness at meals
- Unwilling/unable to cook
- Dental problems
- Financial barriers

SENSORY SYSTEM-PAIN AND TOUCH

□ Pain and Touch

- With age, skin is not as sensitive as in youth
- Contributing factors include:
 - Loss of elasticity
 - Loss of pigment
 - Reduced fat layer

□ Safety Implications:

- Lessened ability to recognize dangerous levels of heat
- Lessened ability of body to maintain temperature
- Tendency to develop bruises, skin tears more easily

BRAIN AND CENTRAL NERVOUS SYSTEM

- Without illness, a person can expect high mental Competence well past age 80.
- Physical reactions are slowed due to increased "lag" time of neurons transmitting information: Slowing manifests itself in the learning process.
- Unfamiliar or high stress activities cause an older person to perform more slowly.
- Throughout adulthood, there is a gradual reduction in the weight and volume of the brain. This decline is about 2% per decade. Contrary to previously held beliefs, the decline does not accelerate after the age of 50, but continues at about the same pace from early adulthood on. The accumulative effects of this are generally not noticed until older age.

BRAIN AND CENTRAL NERVOUS SYSTEM

There is neuronal loss in the brain throughout life.

- Slowed neuronal transmission
- Changes in sleep cycle: takes longer to fall asleep, total time spent sleeping is less than their younger years, awakenings throughout the night, increase in frequency of daytime naps
- Sense of smell markedly decreases
- Intellectual functioning defined as "Stored" memory increases with age.
- Problem solving skills increase with age.
- Older people are able to learn very weak.

MUSCLES AND BONES

Muscles and Bones

- Loss of elasticity of connective tissue can cause pain and impair mobility
- No way to prevent these changes
- Maintain bone health through diet, exercise and getting adequate rest
- Always consider medication side effects when assessing mobility concerns

How to help:

- Encourage use of assistive devices if indicated
- Modify environment to reduce fall risk
- Encourage activity- take walks etc.

GI TRACT

- Basal and maximal stomach acid production diminish sharply in old age. At the same time, the mucosa thins.
- Decline in number of gastric cells results in decreased production of HCL (an acidic environment is necessary for the release of vitamin B12 from food sources).
- Decrease in amount of pancreatic enzymes without appreciable changes in fat, CHO, or protein digestion.
- Diminished gastric (eg pepsinogen) & pancreatic enzymes result in a hindrance to the absorption of other nutrients like iron, calcium, & folic acid.
- Hepatic blood flow, size & weight decrease with age.

GI TRACT

- Constipation is more common in older adults due to slowed circulation, reduced sense of thirst, lessened activity level and decreased tone in stomach & intestines which results in slower peristalsis and constipation.
- Emotions play a significant role in appetite and digestion.

How to help:

- Encourage activity
- Encourage socialization and emotional well-being
- Encourage intake of fluids

SKIN-EPIDERMIS

- The number of epidermal cells decreases by 10% per decade and they divide more slowly making the skin less able to repair itself quickly.
- Epidermal cells become thinner making the skin look noticeably thinner.
- Changes in the epidermis allows more fluid to escape the skin.

SKIN-IN BETWEEN

- The rete-ridges of the dermal-epidermal junction flatten out
 - Making the skin more fragile and making it easier for the skin to shear.
 - This process also decreases the amount of nutrients available to the epidermis by decreasing the surface area in contact with the dermis.
 - slower repair/turnover

SKIN-DERMIS

- These changes cause the skin to wrinkle and sag.
- The dermal layer thins.
- Less collagen is produced.
- The elastin fibers that provide elasticity wear out.
- Decrease in the function of sebaceous & sweat glands contributes to dry skin.
- The fat cells get smaller.
 - This leads to more noticeable wrinkles and sagging.

SKIN-TOES & NAILS

- Toes & nails become thicker & more difficult to cut.
- Grow more slowly.
- May have a yellowish color.

SKIN-HAIR

Men:

- Most men lose the hair about their temples during their 20s.
- Hairline recedes or male pattern baldness may occur.
- Increased hair growth in ears, nostrils, & on eyebrows.
- Loss of body hair.

Women

- Usually do not bald, but may experience a receding hairline.
- Hair becomes thinner.
- Increased hair growth about chin & around lips.
- Loss of body hair.

HEART

Heart/Circulatory System

- Deposits of the "aging pigment," lipofuscin, accumulate.
- The valves of the heart thicken and become stiffer.
- The number of pacemaker cells decrease and fatty & fibrous tissues increase about the SA node. These changes may result in a slightly slower heart rate.
- A slight increase in the size of the heart, especially the left ventricle, is common.
- Age changes make the heart less able to pump efficiently.
- Less blood pumped results in lowered blood oxygen levels.
- The limits of the heart to exert itself are reduced with age.
- Medications processed and eliminated differently than in young adults.

BLOOD VESSELS

Blood vessels

- Arteries lose elasticity with age making heart have to pump harder to circulate blood, this is mainly due to:
 - thickening & stiffening in the media of large arteries is thought to be caused by collagen cross-linking.
 - smaller arteries may thicken/stiffen minimally; their ability to dilate & constrict diminishes significantly.
- In veins age-related changes are minimal and do not impede normal functioning.

KIDNEY

- Renal blood vessels become smaller & thicker reducing renal blood flow.
- Decreased renal blood flow from about 600ml/min (age 40) to about 300ml/min (age 80)
- Kidney size decreases by 20-30% by age 90.
 - This loss occurs primarily in the cortex where the glomeruli (# of gloms decrease by 30-40% by age 80) are located.
- Decreased GFR. Typically begins to decline at about age 40. By age 75 GFR may be about 50% less than young adult. Current research shows that this is not true for all elders, however.

ENDOCRINE SYSTEM

- In most glands of the body there is some atrophy & decreased secretion with age, but the clinical implications of this are not known.
- What may be different is hormonal action. Hormonal alterations are variable & gender-dependent.

Most apparent in:

- Glucose homeostasis
- Reproductive function
- Calcium metabolism

REPRODUCTIVE SYSTEM

Women

- The “climacteric” occurs (defined as the period during which reproductive capacity decreases (ie, ovarian failure) then finally stops = loss of estrogen & progesterone; FSH & LH ↑↑). This is also described as the transition from peri-menopause (~age 40s) to menopause.
- Thinning & graying of pubic hair
- Loss of subQ fat in external genitalia giving them a shrunken appearance.
- Ovaries & uterus decreases in size & weight.

REPRODUCTIVE SYSTEM

- Skin is less elastic + loss of glandular tissue gives breasts a sagging appearance
- Other physical changes may include hot flashes (can cause sleep deprivation if they occur at night), sweats, irritability, depression, headaches, myalgias. Sexual desire is variable. The symptoms are typically present for about 5 years
- Atrophy of vaginal tissues due to low estrogen levels = thinning & dryness occurs; agglutination of labia majora & minora may occur.

REPRODUCTIVE SYSTEM

Men

- Testosterone decreases, testes become softer & smaller
- Erections are less firm & often require direct stimulation to retain rigidity
- Though fewer viable sperm are produced & their motility decreases, men continue to produce enough viable sperm to fertilize ova well into older age.
- Less seminal fluid may be ejaculated
- They may not experience orgasms every time they have sex
- The prostate gland enlarges; this often results in compression of the urethra which may inhibit the flow of urine.

MUSCULOSKELETAL SYSTEM-MUSCLES

- Sarcopenia (↓ muscle mass & contractile force) occurs with age. Some of this muscle-wasting is due to diminished growth hormone production, but exactly how much is due to aging versus disuse is unclear.
- Sarcopenia is associated with increased fatigue & risk of falling (so may compromise ADLs).
- Sarcopenia affects all muscles including, for example, the respiratory muscles (↓ efficiency of breathing) & GI tract (constipation) fulfillment.

MUSCULOSKELETAL SYSTEM-BONES

- Bone/Tendons/Ligaments:
- Gradual loss of bone mass (bone resorption > bone formation) starting around age 30s.
- Decreased water content in cartilage
 - The “wear-&-tear” theory regarding cartilage destruction & activity doesn’t hold up as osteoarthritis is also frequently seen in sedentary elders.
- Decreased water in the cartilage of the intervertebral discs results in a ↓ in compressibility and flexibility. This may be one reason for loss of height.
- There is also some decrease in water content of tendons & ligaments contributing to ↓ mobility.

RESPIRATORY SYSTEM

Respiratory System

- How well the lungs supply the body with oxygen seems to relate directly to age.
- The amount of oxygen delivered to the bloodstream and the rate of blood flow declines with age.
- Even with the lung capacity remaining normal, the lung tissues seem to lose facility for making the oxygen-to-blood transfer to the bloodstream.
- Since older people can not breathe as fast, there is less oxygen entering the blood per minute. Less oxygen in the system cuts down the amount of work that can be done.

RESPIRATORY SYSTEM

- The number of cilia & their level of activity is reduced.
- Glandular cells in large airways are reduced.
- Decreased number of nerve endings in larynx.
- The cough reflex is blunted thus decreasing the effectiveness of cough.
- Decreased levels of secretory IgA in nose & lungs results in decreased ability to neutralize viruses.

RESPIRATORY SYSTEM

- The number of FUNCTIONAL alveoli decreases as the alveolar walls become thin, the alveoli enlarge, are less elastic.
- Decreased elasticity of the lungs may be due to collagen cross-linking.
- The loss of elasticity accounts for "senile hyperinflation"; unlike in smokers, there is little or no destruction of the alveoli.
- The FEV1 drops by 30 mL/year during your adult life
- VC is diminished by about 20%
- RV increases by about 50%

HEMATOLOGIC SYSTEM

- A decrease in total body water is observed with aging. Blood volume therefore decreases.
- The number of red blood cells (and correspondingly, H&H) are reduced, but not significantly.
- Most of the white blood cells stay at the same levels, but lymphocytes decrease in number and effectiveness.
- Overall, cell counts and parameters in the peripheral blood are not significantly different from in young adult life.
- However, the cellularity of the bone marrow decreases moderately. For example, 30% cellularity on an iliac crest biopsy (which would be very low for a young adult) is not unusual in an older person.

IMMUNE SYSTEM

- The efficiency of the immune system declines with age, but this is variable among persons.
- Nonspecific defenses become less effective
- The ability of the body to make antibodies diminishes.
- Autoimmune disorders are increased in older adults. Not everyone believes that the increased incidence of autoimmune disease is an expected part of aging, but all acknowledge the increase in findings of positive rheumatoid factor, anti-nuclear antibody, and false-positive syphilis screens in healthy older adults.

IMMUNE SYSTEM

- The thymus gland (which produces hormones that activate T cells) atrophies throughout life.
- The peripheral T-cells (J. Immunol. 144: 3569, 1990) proliferate much less exuberantly in old age.
- Common infections are often more severe with slower recovery & decreased chances of developing adequate immunity.

