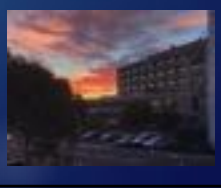
Mens sana in corpore sano

The phrase comes from Satire X of the Roman poet Juvenal



SEEVA SIVAKUMARAN

SATURDAY

11 MAY 2019

Talk overview

- Introduction
- Why do we change with ageing
- Physiological changes in important organs and how we could reduce the rate of degenerative changes
- Take home messages

Health is wealth

நோயற்ற வாழ்வே குறைவற்ற செல்வம்

- Health is wealth or in the more precise term it is the most valuable wealth than any other material things as you cannot enjoy anything, no matter how beautiful, expensive and unique it is in the lack of good health.
- Here we are considering both mental and physical health which are very much dependent on each other.

You should pray for a healthy mind in a healthy body.

Ask for a stout heart that has no fear of death,
and deems length of days the least of Nature's gifts
that can endure any kind of toil,
that knows neither wrath nor desire and thinks
the woes and hard labours of Hercules better than
the loves and banquets and downy cushions of Sardanapalus.
What I commend to you, you can give to yourself;
For assuredly, the only road to a life of peace is virtue.

—Roman poet Juvenal (10.356-64)

- A healthy body exists in the healthy mind and again a healthy mind requires a fit and healthy body to flourish up to full extent.
- So here in lies, the **importance of a healthy body and a healthy mind** which are two important wheels of our life and one cannot exist or sustain without the other one.

"WHAT IS AGEING ?"

PHYSIOLOGY OF AGING

DR. ED SOLTIS
DEPARTMENT OF NEUROSCIENCES
SPRING 2005

What is healthy ageing

- Is it same as successful ageing?

Healthy ageing is about "*optimising opportunities for good health, so that chronologically older people continue to take active part in society and enjoy an independent and high quality of life*"[1].

EuroHealthNet's Healthy Ageing Website

Growing old is mandatory; growing up is optional.

Chili Davis

Do not regret growing older. It is a privilege denied to many. Author Unknown

- **At age 20, we worry about what others think of us.**
- **At age 40, we don't care what they think of us.**
- **At age 60, we discover they haven't been thinking of us at all."**

Ann Landers (1918-2002)

When does ageing start

- Ageing really starts before birth

- *Aging is a largely mysterious process*

At age 75, the average person, compared to age 30

- 92% of brain weight
- 84% of basal metabolism
- 70% kidney filtration rate
- 43% of maximal breathing capacity

- We are not the people we once were!

Why should all learn about healthy ageing

For personal reasons

- To age gracefully and healthily

Professional reasons

- As health professionals to help our patients age gracefully and healthily

Stages of Life

- Chronological age typically used to note life's transitions

TABLE 1.1
Stages of the Life Span

Stage	Duration
Prenatal life	
Ovum	Fertilization through week 1
Embryo	Weeks 2–8
Fetus	Months 3–10
Birth	
Postnatal life	
Neonatal period	Newborn; birth through week 2
Infancy	Three weeks until end of first year
Childhood	
Early	Years 2–6
Middle	Years 7–10
Later	Prepubertal; females 9–15; males 12–16
Adolescence	The 6 years following puberty
Adulthood	Between 20 and 65 years
Senescence	From 65 years on
Death	

Why

- Some people grey early
- Some people develop skin wrinkling early
- Some loose their teeth early
- Some develop cataract early

- why

Is it in the genes ,the environment or both ?

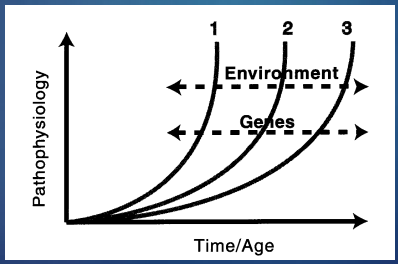
- Mostly in the Genes but influenced heavily by life style

Successful Aging

- Chronological age and physiological age are not the same
- Due to complex interactions of genetics and environment the out come varies
- Individuals "age" at different rates and with significant variability

Significance of Human Aging

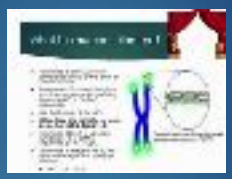
- What is "normal" in the aging process - primary aging
- More susceptibility to disease - secondary aging
- More heterogeneity in the elderly population
- Onset indeterminable and progression varied
- Genetic and environmental factors



The human body is composed, in part, of miniscule structures called chromosomes

- The chromosomes contain all of the genetic information — the predetermined traits that are passed from parents to children — in our bodies.
- The combinations of genes, the carriers of genetic information, determine every person's sex, hair colour, eye colour, and other characteristics. The end of each chromosome is called a telomere.

DNA AND TELOMERES



Telomere

- A telomere (/ˈtɛləmɪər/ or) is a region of repetitive nucleotide sequences at each end of a chromosome, which protects the end of the chromosome from deterioration or from fusion with neighbouring chromosomes.
- **What happens to telomeres as we age?**
- Each time a cell divides, 25-200 bases are lost from the ends of the telomeres on each chromosome.
- Two main factors contribute to telomere shortening during cell division
- When the telomere becomes too short, the chromosome reaches a 'critical length'...
- This 'critical length' triggers the cell to die

What happens to telomeres as we age?

- Each time a cell divides, 25-200 bases are lost from the ends of the telomeres on each chromosome.
- Two main factors contribute to telomere shortening during cell division
- When the telomere becomes too short, the chromosome reaches a 'critical length'...
- This 'critical length' triggers the cell to die by...

Ways to Maximize Telomere Length and Increase Life Expectancy

- Lead a healthful lifestyle.
- Consider calorie restriction.
- Enjoy a glass of non-alcoholic red wine daily.
- Incorporate plenty of fish into your diet.
- Eat dark chocolate.
- **Abstain from smoking and alcohol consumption.**
- **Deal with stress**

Influence of diet and gut on health

Thirukural

இழிவறிந்து உண்பான்கண் இன்பம்போல் நிற்கும்
கழிபேர் இரையான்கண் நோய்.

கலைஞர் மு.கருணாநிதி உரை:

அளவோடு உண்பவர் உடல் நலமுடன் வாழ்வதும்
அதிகம் உண்பவர் நோய்க்கு ஆளாவதும் இயற்கை.

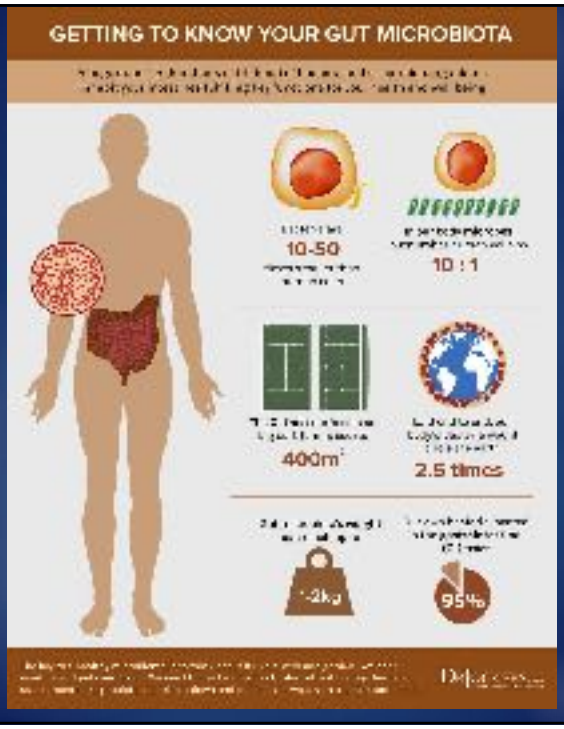
- மருந்தென வேண்டாவாம் யாக்கைக்கு அருந்தியது
  அற்றது போற்றி உணின்.
- ஒருவன் முதலில் உண்டது சீரணமாகிவிட்டதை நன்கு அறிந்து அதன் பிறகு உண்டால், அவன் உடம்புக்க மருந்து என்று ஒன்று வேண்டியது இல்லை)

Gut microbiome and health

DEFINING MICROBIOME: MEET YOUR BACTERIAL BUDDIES

The collective genetic material of the microbiota, our microbiome, is remarkably dynamic.

- your microbiome does a lot.



The human gut microbiome impacts human brain health in numerous ways

Structural bacterial components such as lipopolysaccharides provide low-grade tonic stimulation of the innate immune system.

(1) Excessive stimulation due to bacterial dysbiosis, small intestinal bacterial overgrowth, or increased intestinal permeability may produce systemic and/or central nervous system inflammation.

(2) Bacterial proteins may cross-react with human antigens to stimulate dysfunctional responses of the adaptive immune system.

(3) Bacterial enzymes may produce neurotoxic metabolites such as D-lactic acid and ammonia. Even beneficial metabolites such as short-chain fatty acids may exert neurotoxicity.

(4) Gut microbes can produce hormones and neurotransmitters that are identical to those produced by humans. Bacterial receptors for these hormones influence microbial growth and virulence.

(5) Gut bacteria directly stimulate afferent neurons of the enteric nervous system to send signals to the brain via the vagus nerve.

.

Gut microbes

Through these varied mechanisms, gut microbes shape the architecture of sleep and stress reactivity of the hypothalamic-pituitary-adrenal axis.

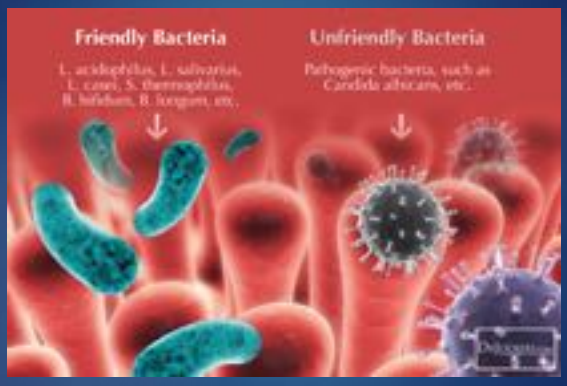
They influence memory, mood, and cognition and are clinically and therapeutically relevant to a range of disorders, including alcoholism, chronic fatigue syndrome, fibromyalgia, and restless legs syndrome.

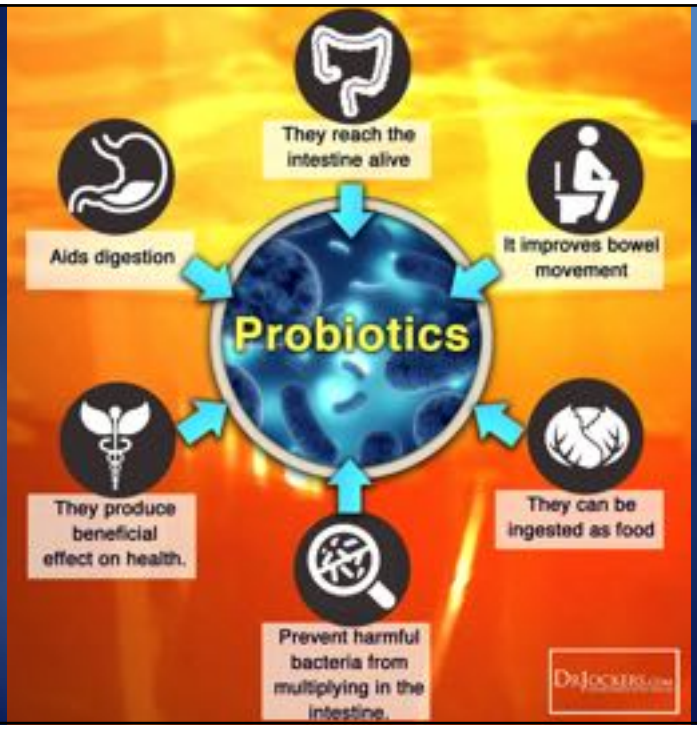
Nutritional tools for altering the gut microbiome therapeutically include changes in diet, probiotics, and prebiotics.

As your microbiome grows, it affects your body in a number of ways

- **Digesting breast milk:** Some of the bacteria that first begin to grow inside babies' intestines are called *Bifidobacteria*. They digest the healthy sugars in breast milk that are important for growth
- **Digesting fiber:** Certain bacteria digest fiber, producing short chain fatty acids, which are important for gut health.
- Fiber may help prevent weight gain, diabetes, heart disease and the risk of cancer
- **Helping control your immune system:** The gut microbiome also controls how your immune system works. By communicating with immune cells, the gut microbiome can control how your body responds to infection
- **Helping control brain health:** New research suggests that the gut microbiome may also affect the central nervous system, which controls brain function


Intestinal Flora Affects Your Health
The microbes that live inside your intestines influence your health in beneficial and harmful ways
Immunity
Vitamins
Metabolism
Obesity
Inflammation
Autism
Bad Gut Microbes
=
Increased Inflammation
=
Poor Quality of Life


Friendly Bacteria
Unfriendly Bacteria



Calorie restriction CR

- **Caloric Restriction with regular resistance exercise is a recipe Longer Healthy Life**

Life style

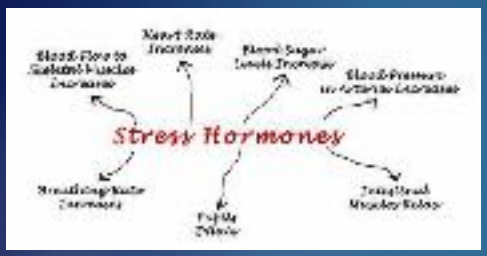
- an inactive lifestyle contributes to chronic miseries such as obesity, diabetes, heart disease, cancer, osteoporosis, and an earlier death.
- Rates of depression and anxiety are at their highest recorded levels in countries as diverse as India, China, the U.S., and the UK.
- Undoubtedly, many aspects of "modern life" — increasing social isolation , poor diets, a focus on money and image — contribute to this state.
- However, inactivity is another key factor.

Sarah Gingell Ph.D

Exercise and Brain

- *Exercise directly affects the brain*. Regular exercise increases the volume of certain brain regions
- Of critical importance for mental health is the hippocampus — an area of the brain involved in memory, emotion regulation and learning.
- Studies in other animals show convincingly that exercise leads to the creation of new hippocampal neurons (neurogenesis), with preliminary evidence suggesting this is also true in humans.

Stress and physiological changes



The following physiological effects of stress occur:

- The brain releases endorphins to relieve pain
- Heart rate increases and heart increases its strength of contraction to pump more blood
- Blood pressure rises
- Digestion slows so the much needed blood may be diverted to muscles
- Salivation and mucous secretion decreases - the result is a "cotton mouth" feeling
- Pupils dilate so that you have a more sensitive vision
- All of your senses - sight, hearing, smell, and taste - become more acute, ready to identify any threats
- Sweating increases to flush waste and to cool down the body
- Blood clotting increases to prevent bleeding to death during physical threat
- Sugars and fats are released into the blood stream to supply fuel
- Adrenaline and other hormones are released into the bloodstream to provide energy
- Muscle tension increases to prepare for action in the shortens time
- Bronchi dilate, allowing for more air into the lungs
- Breathing gets shallow and faster to supply more oxygen to the muscles and body tissue
- This reaction is pure stress and is a result of a cascade of hormones that starts as soon as your brain realizes that a demand is being made on your body.
- These physiological effects of stress are meant to be short term. Once the danger passes, the body should return to its state of homeostasis, the state of internal equilibrium when all the body systems function smoothly and are balanced.

So Far

- What is ageing
- Physiological Vs Chronological ageing
- Why do we age
- Chromosomes and telomeres
- What is healthy ageing
- How age healthily
- Gut Microbes
- Probiotics
- Calorie restriction and fasting
- excercise and body
- Exercise and mind stress and ageing

Secrets to Healthy ageing

Healthy life style when you are young

Resistance exercise

Eat well

Regular exercise

Adequate dairy products

BE HAPPY
BE POSITIVE
SLEEP WELL
SOCIALISE
MEET & GREET

Physiological changes in different organs with ageing and the disabilities

Main disabilities that affect quality of life

- 1.Arthritis/chronic pain
- 2.Sarcopenia- loss muscle bulk
- 3.Loss of balance and falls
- 4.Poor eye sight
- 5.Poor hearing
- 6.Loss of teeth
- 7.Urinary problems
- 8.Loneliness and depression
- 10.Loss of short term memory
- Life style and diet
- NCD Non communicable diseases (BP, IHD, Diabetes)

All together cause frailty of old age

Musculoskeletal

- Sarcopenia:
  - Loss of muscle mass that occurs with aging
  - Cause not completely understood
  - Preventable/reversible with regular physical activity

Effects of ageing on muscles balance and gait

- Increased body sway
- Short steps
- Slow speed
- Narrow stride width
- Variable stepping frequency
- Loss of gait automaticity
- Muscle mass loss and weakness (Sarcopenia)
- Visual impairment / contrast
- Delayed reaction time

Joints

Osteoarthritis

- Cause not known
- Also referred to as degenerative joint disease with inflammatory overlap
- A gradual wearing away of joint cartilage that results in the exposure of rough underlying bone ends
- Can do damage to internal ligaments
- Most commonly associated with weight bearing joints

Bones

- Osteopenia --> Osteoporosis:
  - Gradual loss of bone that reduces skeletal mass without disrupting the proportions of minerals & organic materials
  - For many, it is asymptomatic
  - Bones most critically involved: vertebra, wrist, hip

Osteoporosis is a globally Prevalent Disease

- **Affects 200 million women worldwide[1]**
  - **1/3 of women aged 60 to 70**
  - **2/3 of women aged 80 or older**
- **Approximately 20-25% of women over the age of 50 have one or more vertebral fractures[2]**
  - **United States: 25%[3]**
  - **Australia: 20%[4]**
  - **Western Europe: 19%[5]**
  - **Scandinavia: 26%[5]**
  - **Denmark: 21%[6]**

International Osteoporosis Foundation
2. Melton LJ 3rd et al., Spine 1997, 22:2S
3. Ettinger B et al., J Bone Miner Res 1992,7:449
4. Jones G et al., Osteoporos Int 1996, 6:233
5. O'Neill et al., J Bone Miner Res 1996, 11:1010
6. Jensen GF et al., Clin Orthop 1982,166:75

Why Bother with falls and osteoporosis

- Osteoporosis is common in elderly
- Falls are common in Elderly
- Fractures are common in elderly

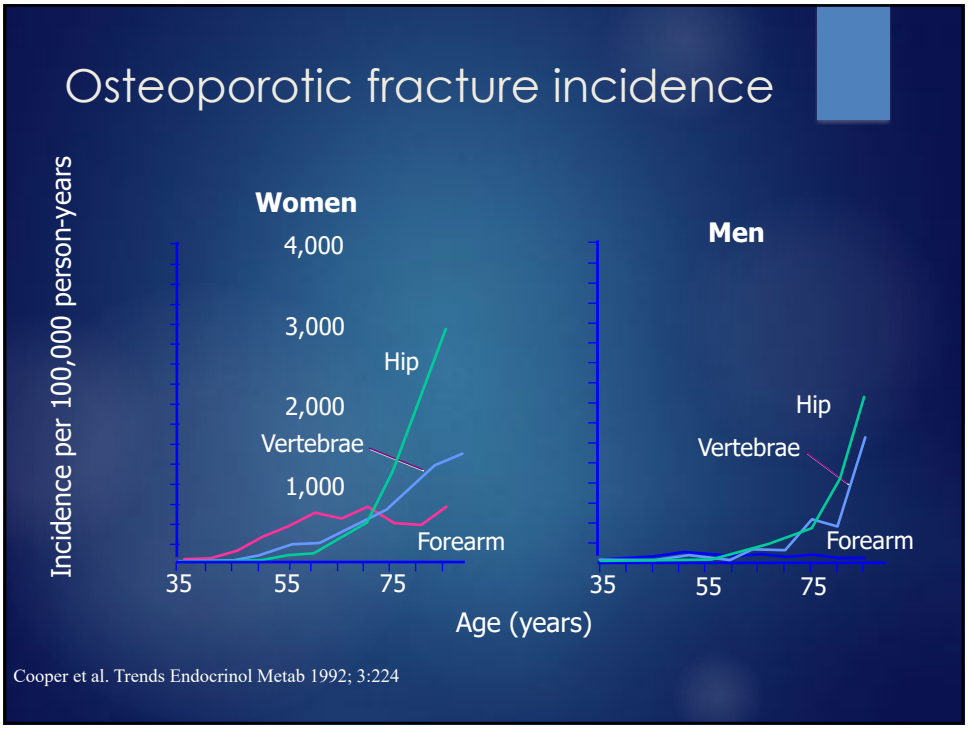
All of the above can cause severe morbidity & mortality

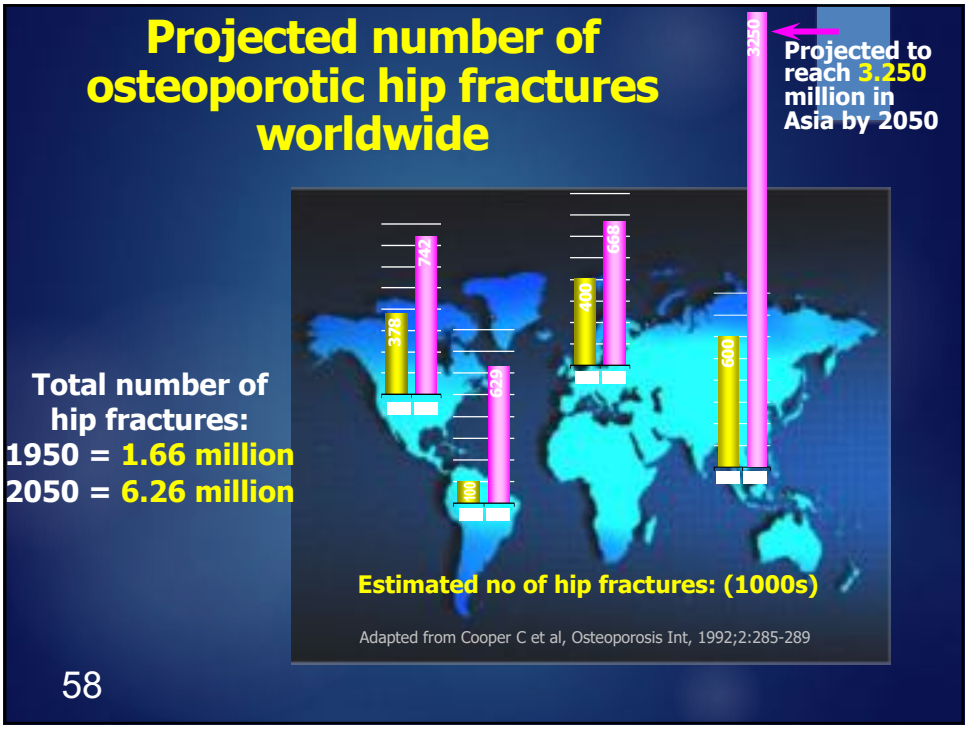
1.Targeted interventions reduce risk of falls

2. Proven specific therapy reduces progress of osteoporosis & reduce risk of further fractures

What is the significance of a fall

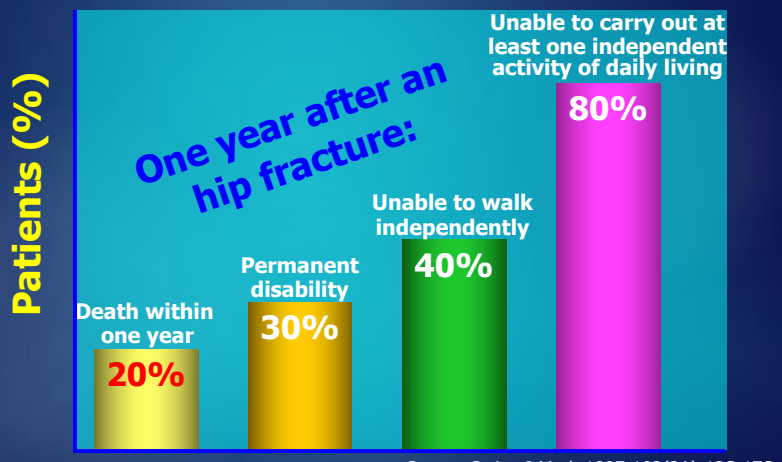
- More than 90 % of factures are due to falls
- A non-specific presentation of illness
- Multiple causes lead to falls
- Not a normal part of healthy ageing
- Falls are PREVENTABLE


Osteoporotic fracture incidence
Incidence per 100,000 person-years
Women
4,000
3,000
2,000
1,000
Hip
Vertebrae
Forearm
35
55
75
Men
Hip
Vertebrae
Forearm
35
55
75
Age (years)
Cooper et al. Trends Endocrinol Metab 1992; 3:224


Projected number of osteoporotic hip fractures worldwide
Projected to reach 3.250 million in Asia by 2050
Total number of hip fractures:
1950 = 1.66 million
2050 = 6.26 million
Estimated no of hip fractures: (1000s)
Adapted from Cooper C et al, Osteoporosis Int, 1992;2:285-289
58

All fractures are associated with morbidity

59



Cooper C, Am J Med, 1997;103(2A):12S-17S

Teeth and gums.

- The tough enamel that protects your teeth from decay can start to wear away over the years, leaving you susceptible to cavities. Gum disease is also a concern for older adults.
- Good dental hygiene can protect your teeth and gums. Dry mouth, which is a common side effect of many medications that seniors take, may also be a problem.
- Bad oral hygiene leads to inflammatory changes that affect the heart

Skin in Old age

- becomes thinner and less elastic
- loses moisture and can become dry and more vulnerable to splitting and cracking
- develops folds and wrinkles
- loses its cushioning layer of subcutaneous fat
- has decreased sensory perception and is less likely to be able to detect temperature changes or pain
- has decreased temperature control and therefore an older person is less able to regulate their body temperature
- is more easily injured (prone to tearing and bruising)
- is slower to heal.

SKIN Wrinkling

- Muscles of the face are capable of tremendous movement.

"Smiles, laughter, frowns, disappointment, ager, rage, and surprise are all recorded.

The hand of time captures these expressions and outlines them on the face….

By the age of 40, most people bear the typical lines of their expressions."

(Kart & Kinney,)

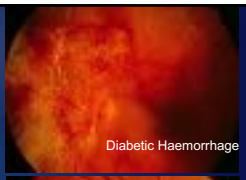
Common Causes of Vision Loss in Elderly

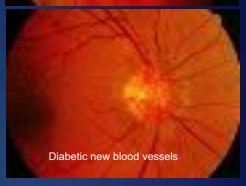
DAVID A. QUILLEN, M.D., Pennsylvania State University College of Medicine, Hershey, Pennsylvania

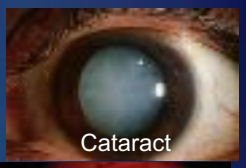
Am Fam Physician. 1999 Jul 1;60(1):99-108.

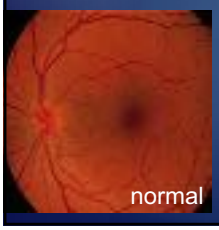
Vision loss among the elderly is a major health care problem.

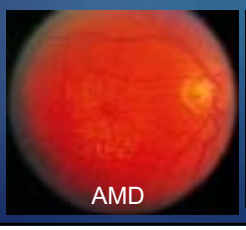
- Approximately one person in three has some form of vision-reducing eye disease by the age of 65.
- The most common causes of vision loss among the elderly are age-related macular degeneration, glaucoma, cataract and diabetic retinopathy.

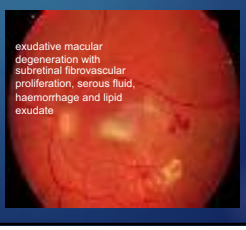


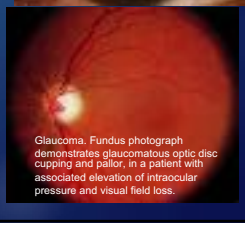












Presbycusis -Age related loss of hearing

- Hearing loss is a sudden or gradual decrease in how well you can hear.
- It is one of the most common conditions affecting older and elderly adults.
- Approximately one in three people between the ages of 65 and 74 has hearing loss and nearly half of those older than 75 have difficulty hearing.
- Having trouble hearing can make it hard to understand and follow a doctor's advice, to respond to warnings, and to hear doorbells and alarms.
- It can also make it hard to enjoy talking with friends and family. All of this can be frustrating, embarrassing, and even dangerous.

GASTROINTESTINAL SYSTEM

- Atrophy of secretion mechanisms
- Decreasing motility of the gut
- Loss of strength/tone of muscular tissue & supporting structures
- Changes in neurosensory feedback
  - Enzyme & hormone release endocrine/exocrine glands
  - Innervation of the tract
  - Diminished response to pain & internal sensations

URINARY SYSTEM

- "The bladder of an elderly person has a capacity of less than half (250ml) that of a young adult (600 ml) and often contains as much as 100 ml of residual urine".
- Micturition reflex is delayed–
- usually activated when bladder is half full
- In older age group not until bladder is nearly at capacity

Good quality sleep

Try these tips:

- Review your medications and supplements with your doctor or pharmacist and consider changes to their use that could be affecting sleep quality.
- Stop drinking fluids within two hours of bedtime to minimize trips to the bathroom.
- If pain keeps you awake at night, talk to your doctor to see if taking an over-the-counter pain medication before bed may help. While this may not stop you from waking up, you may have an easier time falling back to sleep.
- Keep your sleep environment as dark as possible. This includes limiting lights from the television, computer screen and mobile devices. Light disrupts your body's natural sleep rhythm.

Good quality sleep

- Limit caffeine intake, particularly in the eight hours before bedtime.
- Avoid alcohol near bedtime — alcohol may help you fall asleep, but once it wears off, it makes you more likely to wake up in the night.
- To maintain a quality sleep cycle, limit daytime napping to just 10 to 20 minutes. If you find that daytime naps make you less sleepy at bedtime, avoid napping altogether.
- If you have trouble falling asleep, try taking 1 to 2 milligrams of melatonin (look for the sustained-release tablets) about two hours before bed.

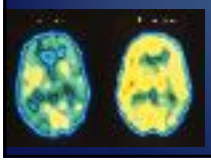
Recognizing mood disorders

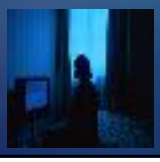
May 14, 2015 | Bipolar Disorder, APA 2015, APA 2015 BPD, Geriatric, James M. Ellison, MD, MPH

Although aging may be accompanied by stresses, losses, and illnesses we should not accept debilitating mood symptoms as a routine concomitant of aging.

Mood disorders and clinically significant mood symptoms disrupt older adults' later years.

They are lonely because they are alone," is the frank response of T. Byram Karasu, M.D.,





Social Isolation May Raise Death Risk for Elderly

- "Social contact is a fundamental aspect of human existence.
- The scientific evidence is that being socially isolated is probably bad for your health, and may lead to the development of serious illness and a reduced life span," said lead researcher Andrew Steptoe, director of the Institute of Epidemiology and Health Care at University College London.

Pulmonary function in aging

Oyarzún G M[1].
[1]Laboratorio de Investigaciones Respiratorias, Instituto de Ciencias Biomédicas, Facultad de Medicina, Universidad de Chile, Santiago, Chile.
moyarzun@med.uchile.cl

Aging generates four important changes in the structure and function of the respiratory system.

There is a reduction in the elastic recoil of the lung causing "senile emphysema", a condition characterized by reduction in the alveolar surface area without alveolar destruction, which is associated with hyperinflation, increased lung compliance and reduction in alveolar-capillary diffusing capacity.

Lung changes

Ageing tends to diminish the reserve of the respiratory system in cases of acute disease.

Decreased sensitivity of respiratory centres to hypoxia or hypercapnia results in a diminished ventilatory response in cases of heart failure, infection or aggravated airway obstruction.

Furthermore, decreased perception bronchoconstriction and diminished physical activity may result in lesser awareness of the disease and delayed diagnosis.

Compliance of the chest wall diminishes, thereby increasing work of breathing when compared with younger subjects.

Respiratory muscle strength also decreases with ageing, and is strongly correlated with nutritional status and cardiac index.

Expiratory flow rates decrease with a characteristic alteration in the flow-volume curve suggesting small airway disease.

Lung changes

Carbon monoxide transfer decreases with age, reflecting mainly a loss of surface area.

In spite of these changes, the respiratory system remains capable of maintaining adequate gas exchange at rest and during exertion during the entire lifespan, with only a slight decrease in arterial oxygen tension, and no significant change in arterial carbon dioxide tension.

Age-related changes in hepatic function. Implications for drug therapy.

Woodhouse K[1], Wynne [1]University Department of Geriatric Medicine, University of Wales College of Medicine, Cardiff.

- An age-related decrease in the hepatic clearance of many drugs has been reported. Several mechanisms have been proposed, but only some are supported by hard evidence.
- Liver volume declines with age, as does hepatic blood flow--changes which may largely account for the reduced clearance of capacity- and flow-limited drugs, respectively.
- Age-related histological changes in the liver are minor and of uncertain significance; standard liver function tests do not change significantly with aging.
- There is, as yet, no direct evidence of a generalised fall in hepatic drug-metabolising enzyme activities in aging humans measured in vitro, but some in vivo studies suggest that certain very specific cytochrome P450 isoenzymes may be affected by aging, especially in men
- . Finally, there may be an age-related decline in the response to environmental influences.

Changes in the heart

Overall cardiovascular function at rest in most healthy elderly individuals is adequate to meet the body's need for pressure and flow.

The resting heart rate is unchanged. Heart size is essentially not different in younger vs older adults, but heart wall thickness increases modestly, due largely to an increase in myocyte size.

While the early diastolic filling rate is reduced, an enhanced atrial contribution to ventricular filling in elderly individuals maintains filling volume at a normal

Renal ageing.

Martin JE[1], Sheaff MT.
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The function of the kidney, as well as its morphology, changes markedly with age.

The glomerular filtration rate falls progressively, independent of overt pathology.

Glomerular, vascular and accompanying parenchymal changes occur and other disorders associated with ageing, such as diabetes and hypertension, have a deleterious effect on both form and function.

Brain changes

In some people, structures called plaques and tangles develop outside of and inside neurons, respectively, although in much smaller amounts than in AD.

Damage by **free radicals** increases

Free radicals are a kind of molecule that reacts easily with other molecules

Inflammation increases

Inflammation is the complex process that occurs when the body responds to an injury, disease, or abnormal situation

Brain changes

Changes in neurons and neurotransmitters affect communication between neurons.

In certain brain regions, communication between neurons can be reduced because white matter (myelin-covered axons) is degraded or lost.

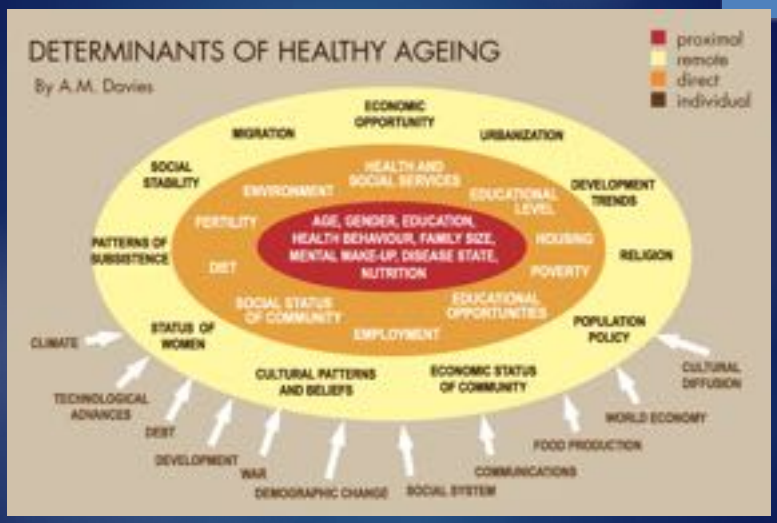
Changes in the brain's blood vessels occur.

Blood flow can be reduced because arteries narrow and less growth of new capillaries occurs.

Brain changes

Certain parts of the brain shrink, especially the prefrontal cortex (an area at the front of the frontal lobe) and the hippocampus.

Both areas are important to learning, memory, planning, and other complex mental activities.



Take home messages

Secrets to Healthy ageing

Healthy life style when you are young

Resistance exercise

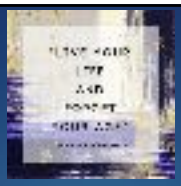
Eat well

Regular exercise

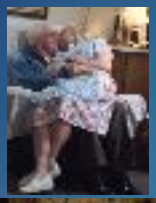
BE HAPPY
BE POSITIVE
SLEEP WELL
SOCIALISE
MEET & GREET

Adequate dairy products

Thank you



Questions ???



Tackling loneliness and social isolation among our ageing population is a challenge we cannot ignore, both at an individual level and at a wider community level.

Compassion, understanding, love , affection AND giving a helping hand to the elderly lead to a happy society

Compassion, understanding, love & affection ,AND giving a helping hand to the elderly lead to a happy society

Befriending schemes offer lonely and isolated older people vital companionship and emotional support.