The Healthy Aging Brain

David Mansoor, MD
Clinical Associate Professor of Psychiatry
May 2017
Objectives

• What does it mean to age?
  – Perceptions of old age

• Aging effect on the body
  – Physical marks of old age

• Aging effect on the brain
  – Mental marks of old age
    • Normal aging and pathological states

• Can we change the way our brain ages?
Activity

• What does it mean to be old?

Think of 5 adjectives that can be used to describe aging and getting older.
Aging

• Sources of stereotyping
  – Television/Movies
    • Often inaccurate representation as incapable, helpless, grumpy
Elderly San Francisco woman scammed out of her life savings!
Aging

• Sources of stereotyping
  – Television/Movies
    • Often inaccurate representation as incapable, helpless, grumpy
  – Language
    • “aged,” “elderly,” “senior citizen,” “gramps,” “granny,” “older timer,” “old folk”
Aging

• **Sources of stereotyping**
  
  – Television/Movies
    
    • Often inaccurate representation as incapable, helpless, grumpy
  
  – Language
    
    • “aged,” “elderly,” “senior citizen,” “gramps,” “granny,” “older timer,” “old folk”

  – Advertising
    
    • Emphasis placed on youth and looking young
A Man's Guide To Anti-Aging Creams
Aging

• Sources of stereotyping
  – Television/Movies
    • Often inaccurate representation as incapable, helpless, grumpy
  – Language
    • “aged,” “elderly,” “senior citizen,” “gramps,” “granny,” “older timer,” “old folk”
  – Advertising
    • Emphasis placed on youth and looking young

• Older people with positive age stereotypes recover faster from disability

Aging

• There is no universal definition
  – Chronologic age
    • Young old (65 to 74)
    • Middle old (75-84)
    • Oldest old (85+)
  – Biological factors
    • Body and brain
  – Social factors
    • Developmental milestones
Aging Effects on Body

- External changes
  - Wrinkles
  - Loss of hair pigment
  - Thinning of hair
  - Changes in mobility
    - Reduced muscle mass
    - Osteoporosis
Aging Effects on the Body

• Internal changes
  – Cardiovascular system
  – Respiratory system
  – Renal system
  – Reproductive system
  – Sensory systems
  – Accumulation of chronic illness

“Slowness of behavior” – slowness of reaction and physical performance

Sensitivity to medications and illness
Where are you going now?

I'll remember in a minute....
Aging Effects on Brain

- Structural changes

Grey matter: cell bodies
White matter: fat covered tracts
Aging Effects on Brain
Aging Effects on Brain

• From birth to age 3, the brain increases 4 times in weight!
• Slower growth through age 19
• Stable until about age 40
• Slow decrease thereafter
• By age 86, it will have reduced by 11% of its weight at age 19
Aging Effects on Brain

• Structural changes
  – Grey Matter
    • Reduced length and arborization of dendrites
    • Reduction in spine density (decrease in dendritic synapses)
    • Neuronal cell death
    • Changes are greatest in the frontal lobes
  – White matter
    • Deterioration of myelin sheath and oligodendrocyte
    • Susceptible to age related vascular changes
    • Frontal-striatal circuits

Signal transmission from axon to axon is decreased
Aging Effects on Brain

• Pathological States
  – Alzheimer’s disease
    • Extracellular deposition of beta amyloid
    • Intracellular deposition of neurofibrillary tangles
    • Medial temporal lobe: memory
    • Greater rate of global atrophy

Neurology 2003; 61: 487–92
Aging Effects on Brain

• Pathological States
  – Age related white matter changes
    • WM changes are prevalent (50-98%)
    • Related to age and vascular risk factors
    • Due to small vessel arteriosclerosis

• A substrate for cognitive impairment, depression, and functional loss
  – Disrupt subcortical-cortical connections
Aging Effects on Brain

• Other factors
  – Medications
    • Drowsiness and mental dulling
  – Sensory changes
    • Interfere with processing of information
  – Health related changes
    • Concentration and processing speed
  – Changes in mood
Aging Effects on Cognition

• Cognition: how we absorb stimuli and information, and how we make sense of it
  – Memory, language, processing speed, visual motor function, attention, executive function

• “With age comes wisdom”

• “You can’t teach an old dog new tricks”

• “Use it or lose it”
Aging Effects on Cognition

Memory and Aging Publications by Year

Number of Publications

Year

Journals of Gerontology: PSYCHOLOGICAL SCIENCES, 2017, Vol. 72, No. 1
Aging Effects on Cognition

Crystallized vs Fluid Intelligence

- **Crystallized**: vocabulary, general knowledge, social judgment, how to do things
  - An accumulation of information based on life experience
  - Skills, abilities, and knowledge that are over-learned, well-practiced, and familiar

- **Fluid**: problem solving and reasoning about unfamiliar things that are independent of what you’ve learned
  - Learn and process new information, solve problems, and attend to your environment
Aging Effects on Cognition

Memory

Declarative Memory
- knowing what

Implicit Memory
- knowing how

Episodic Memory
- events

Semantic Memory
- facts
Activity

• Semantic Memory vs Episodic Memory vs Procedural Memory
Aging Effects on Cognition - Stable

- **Procedural memory**
- **Semantic memory**

- Stable or gradually improves through the sixth and seventh decades of life

Overlearned skills and knowledge

- Accumulation of information based on life experiences
Aging Effects on Cognition - Decline

- **Processing speed**
  - The rate that we can take a bit of new information, reach some judgment, and formulate a response
    - Eg, solve problems and make decisions
  - Motor speed: slows with lengthened reaction time
Aging Effects on Cognition - Decline

• Attention
  – *Sustained* – simple auditory attention span, stable
  – *Selective* – focus on specific information while ignoring irrelevant information, decline
  • Stroop task
Stroop Task

BLUE  RED  YELLOW
RED  GREEN  GREEN
YELLOW  BLUE  RED
Aging Effects on Cognition - Decline

• **Attention**
  – *Sustained* – simple auditory attention span, stable
  – *Selective* – focus on specific information while ignoring irrelevant information, mixed
  – *Divided*  – focus on multiple tasks simultaneously, declines (particularly for challenging tasks)

• **Working memory** – hold information in memory while simultaneously manipulating it
  – Mental manipulation and reorganization
Aging Effects on Cognition - Decline

- **Episodic memory**: tend not to do as well on tests of new learning
  - Peaks early and declines linearly after age 40
  - “Tip of the tongue” / “senior moment”
  - By age 70, the amount of information recalled 30 minutes after hearing a story is 75% of the amount remembered by an 18 year old
    - perform better if given cues
Aging Effects on Cognition

stimulus

sensory memory

attention

rehearsal

STM

storage

retrieval

LTM

forgotten

forgotten

forgotten

OHSU
Aging Effects on Cognition - Decline

• Memory continued
  – Changes in attention
  – Slow processing speed - rate of acquisition declines
  – A more shallow depth of processing
    • To make something memorable, you have to make it meaningful
  – Retrieval
    • Free recall < cued recall < recognition memory
    • Limited strategic search processes

Aging Effects on Cognition

stimulus

sensory memory

attention

STM

rehearsal

storage

retrieval

LTM

forgotten

forgotten

forgotten
Aging Effects on Cognition

• Executive function
  – Cognitive processes that have to do with managing yourself and your resources in order to achieve a goal
    • Helps us to get stuff done efficiently
    • Sequence, organize, abstract, plan
    • Monitor and regulate behavior
  – Mediated by frontal lobes
Aging Effects on Cognition

• Normal cognitive aging
  – Changes are small and should not result in an impairment in function!
  – Older adults are proficient when it comes to situations that require past experience or knowledge

  – When function is impaired, or changes are happening rapidly, we need to determine the cause
“We turn not older with years, but newer every day” – Emily Dickinson
Healthy Brain Aging

• Lifestyle
  – Diet
  – Exercise
  – Socializing
• Cognitive exercises
• Medications
  – Supplements
Lifestyle

• Mediterranean Diet
  – May protect against cognitive decline (along with other age related disorders)
  – Atherosclerosis, mitochondrial dysfunction (oxidative stress), inflammation
    • Reduce LDL and raise HDL
    • Rich source of anti-oxidents (vit E, vit C, folate, polyphenols)
    • Lower inflammatory biomarkers
  – Reduced burden of WM hyperintensities

Arch Neurol. 2012;69(2):251-256
Lifestyle

- Mediterranean Diet
  - Plant based foods
    - fruits, nuts, legumes, complex carbohydrates (eg, whole grains)
  - Low consumption of meat and meat products (eg dairy), with the exception of fish
  - Olive oil
  - Red wine (5 to 10 oz / day)
Lifestyle

- Mediterranean diet

Randomized clinical trial

447 patients mean age 66.7 with cardiovascular risk factors

Control: Low fat
Mixed nuts: 30g/day
Olive oil: 1L/week

~4 years, neuropsychological testing

Cognitive change over time

Results: MD supplemented with nuts or olive oil improved cognitive function

*JAMA Intern Med.* 2015;175(7):1094-1103
Lifestyle

• Mediterranean diet plus exercise

Prospective cohort study

1880 older adults followed over 12 years

The association between physical activity and diet and AD risk

High PA and high diet adherence associated with 35-44% relative risk reduction compared to the low PA and diet group

Lifestyle

• Exercise
  – Tai-chi: mind/body exercise that incorporates physical, cognitive, social and meditative components
    • Improves age-related decline in cardiovascular health, balance, and mood
  – RCT, 120 older adults, 40 weeks
    – Tai chi, 50 minutes, 3x/week
    – Socialization, 1 hour, 3x/week
    – Walking 30 minute, 3x/week
    – No intervention
  • Whole brain volume and cognitive function

Lifestyle

• Exercise
  – Like the Mediterranean diet, reduces risk of heart disease, diabetes, and stroke
  – Helps improve muscle mass, strength, and aerobic capacity
  – Also helps to improve mood and reduce anxiety
  – Regular exercise is good!
    • 30 minutes of moderate intensity, 5x per week; tai chi, aerobic, or resistance
  – It’s never too late to exercise!
    • Starting at age 85 can improve survival benefits at 3 years

Lifestyle

• Socialization
  – “blue zones”: 5 geographic areas where people live statistically longest
    • Okinawa, Sardinia, Nicoya, Icaria, Loma Linda
    • Social engagement: socially active and integrated into their community
      – Engagement in family life
      – Life purpose
      – Engaged in spirituality or religion
  • Constant physical activity, non-smoking, plant based diet, red wine, legumes, limited meat

Cognitive Exercises

• Learning and mental activity positively cognitive functioning
  – Occupational complexity
  – Level of education
  – Cognitively complex leisure activities (reading, hobbies)
  – An engaged lifestyle (learning a new language or game)

• Cognitive training benefits the trained skill

• ACTIVE Study
  – 5-year follow up
  – 2800 community dwelling persons
    • Mean age 73.6
  – Cognitive training: memory, problem solving, processing speed, no-contact control
  – Effect maintained on the targeted cognitive ability
  – Problem solving resulted in less functional decline in IADLs

Am J Geriatr Psychiatry, March 17, 2009
JAMA, December 20, 2006, Vol 296
Medications

• Prescription Medications
  – Cholinesterase inhibitors
    • Trials have not supported the use of cholinesterase in preventing the conversion from mild cognitive impairment to dementia
      – Increased treatment-associated adverse events
  – Memantine
    • Lack of efficacy in mild Alzheimer’s disease


Medications

• Prescription medications
  – Hormone therapy
    • Estrogen has not shown to be helpful in preserving cognitive function in non-demented postmenopausal women
      – May have adverse effect on cognition
  – NSAIDs
    • Not recommended, may increase risk of cerebrovascular and cardiovascular events
  – Statins
    • Not recommended, case reports of cognitive dysfunction

Medications

• Supplements
  – Gingko biloba
    • RDPCT no evidence of slowing cognitive decline over 6 years, >3000 community dwelling older adults
  – Vitamin E
    • May slow progression in patients with established AD
    • No evidence of benefit in patients who are cognitively intact
    • May increase all-cause mortality
  – Omega 3 Fatty Acids
    • Reduced risk of cognitive decline, dementia, and WM hyperintensities
      – Framingham study showed 47% reduced risk of dementia in group that had highest plasma DHA levels, 9 year follow up

JAMA. 2009;302(24):2663
JAMA. 2014 Jan;311(1):33-44.
Arch Neurol. 2006;63(11):1545
Summary

• The brain changes with age
• Thinking and memory changes as well
• There are ways to promote healthy brain aging
  – Exercise
  – Stay social
  – Mediterranean diet
  – Cognitive exercises
The End

- mansoord@ohsu.edu