The Aging Brain: What can we do about it?

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Disclosures

- No Conflicts of Interest to Disclose

99.6% Fail Rate of Investigational Drugs for Alzheimer's Disease and Other Dementia Disorders


http://www.who.int/ageing/en/

Objectives
1. Explain the aging brain and the cognitive functions most susceptible to decline
2. Identify factors related to increased risk or resilience for cognitive decline
3. Discuss types of activities that might promote brain health and increase quality of life
4. Understand the relationship between mental health and physical health, and how integrative treatment approaches can help

True or False?
• If you live long enough, you will eventually develop dementia?
• Older adults cannot learn new things, like a language or new instrument?
• Memory loss is a normal part of aging?
• Once you start having memory & thinking problems, there is nothing you can do about it?

Changes in Brain Structure and Function with Age
• Decreased brain volume & white matter
• White matter > gray matter
• Shrinkage vs. loss of neurons
• Changes in brain neurochemistry
• Changes in functional connectivity
• Changes in blood flow, plasticity & neurogenesis

Last in, First out?

- Gray matter varies with age
- Areas last to myelinate most vulnerable
  - Frontal & Temporal Association areas
- These changes correlate highly with cognitive test performance
- But... Brain pathology does not always correlate with cognitive dysfunction


484 healthy participants (aged 8-85 years)

Figures: Douaud et al. (2014).

Brain Plasticity

Brain plasticity

- Neurological process by which learning occurs
- Represents several different processes
  - e.g., Stimulation of dendritic branching and/or synaptogenesis

In older adults, research suggests:

- Learning is intact but may happen in different areas
- Learning is slower and requires greater repetition
- Adaptive mechanism to compensate for lost function or brain injury


Compensatory Brain Activity & Plasticity

Functional Compensation

- Increases and decreases in brain activity observed in older adults†
  - Better performance linked to
    - Compensatory bilateral activations in PFC*
    - Shifts in activations from posterior to more anterior brain regions**
    - Increased functional activity in older adults is due to the process of compensatory scaffolding***

Brain Compensation Theories:

- Dedifferentiation†
- HAROLD*
- PASA**
- STAC***
Cognitive Functions with Age

- "Crystallized" Intelligence
  - Knowledge does not decline, and may even improve
- "Fluid" abilities show decrease over time
  - Visual Memory
  - Working Memory
  - Executive Attention/Processing Speed

The aging mind: neuroplasticity in response to cognitive training (Park & Bischof, 2013).

What does normal cognitive aging “look” like?

- Mild changes in attention/processing speed common
- More difficulty multitasking or changing strategies
- Cognitive slowing
  - Can you repeat that?
  - May take longer to learn new things but learning is possible
- Memory Changes
  - “Tip of the tongue”
  - Problem is in accessing memory (recall) and not storage

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Genetic Risk Factors & Dementia

- Early Onset Familial Alzheimer's disease (AD)
  - < 5-10% of population
  - Associated with 3 genetic mutations, autosomal dominant pattern
  - The apolipoprotein E (APOE) ε-4 allele best known genetic risk for late onset AD
  - Not a determinant gene
  - Interactions with sex, race & age but also covaries with behavioral risk factors that are modifiable
    - e.g., Depression, vascular risk factors, & education

MacIntyre et al. (Submitted). Predictors of Heterogeneity in Cognitive Function: APOE-e4, sex, education, depression, and vascular risk.


Which identical twin smoked?


Seven Potentially Modifiable Risk Factors for Alzheimer’s Disease

1. Diabetes
2. Midlife hypertension
3. Midlife obesity
4. Smoking
5. Depression
6. Cognitive inactivity or low educational attainment
7. Physical inactivity


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Promising Novel “Cognitive” Interventions

- Musicians vs. non-musicians
- Piano playing
- Choir
- Dance outperforms aerobic exercise!

Maine Understanding Sensory Integration & Cognition (MUSIC) Project
- Learning to play a music recorder
- 12-music lessons once a week in 26 older adults
- Preliminary findings suggest improvements in neuropsychological tests associated with global cognition & frontal lobe function
- Limitations - no control group – yet!

Brain Atrophy & Meditation

Link between age and cerebral gray matter in mediators vs. controls. Results suggest:
- Everyone’s brain ages but...
- Less age-related gray matter atrophy in long-term meditation practitioners
Mindfulness Training

- Mindfulness is associated with improving attention in adults
- Informal and formal practices to increase awareness
- Types of Activities
  - Mindful Eating
  - Mindful Walking
  - Gratitude
  - Brushing teeth, showering, washing dishes...

2014; 1307(1), 89-103.

2016; 1373, 56-64.

Take-home message

More
- Meditation
- Laughter
- Gratitude
- "Real food"
- Music
- Dance
- Gratitude
- Activities
- Time with people we care about

Less
- "Worrying about the weather"
- Sugary & fast food
- Smoking

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Cognitive Model of Aging

It's not just in our head:
What we think and feel matters

Thoughts

Emotions

Behaviors

What do I have to lose?
I'll be free
Proud
Self-determined
Excited
Learning new skills
Acceptance

Fear
Shame
Embarrassment

Stay home
Smoke, overeat, and drink

"Never too old"
"What do I have to lose?"
"It will be fun!"

Proud
Self-determined
Excited
Learning new skills
Acceptance

Fear
Shame
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Stay home
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Self Determination Theory (SDT) & Behavior Change

1. Foster Autonomy
   • Provide relevant information with personally meaningful reasons for change
   • Enable a sense of agency or choice.
2. Competence
   • Increase skills and confidence to manage health problems
   • Coping strategies to adapt to changes (e.g., how to remain active with loss of mobility or vision)
3. Relatedness
   • Goal Setting - Problem solving that includes instrumental as well as social support to address motivation factors that may maintain maladaptive health behaviors.

Integrative Practice and Precision Medicine

• Concept of disease
• Beyond one system & across the life span
• Holistic approaches to treatment
  • Exercise
  • Diet
  • Quality of Life

Image Credits: Manchester Precision Medicine Institute
Yeah, but... Time to change our approach

Future Directions & Research Needed
- Environment & Successful Aging
- Interdisciplinary work on aging
- Help Me, Help YOU
- More community-based participatory research programs

So What Can We Do as Providers?
- Psychoeducation
  - Understand the psychology behind aging
  - Lifespan approach to behavior
  - Use of positive replacement behaviors
- Patient centered approaches
  - Self-Determination Theory
- Integrative treatment approaches
  - Precision medicine

Thank you for your attention!
- Questions? Comments? Want to get involved?
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