Exercise Your Brain: The Impact of Physical Activity on Brain Health

Dr. Kelly Schroeder, PT, DPT, MBA
Director of Rehabilitation Services, Community Care Inc.
Learning Objectives

• Distinguish normal aging vs dementia
• Understand current theories of neural plasticity
• Describe the impact of exercise on the brain
• Generate ideas for treatment
Anatomy: Lobes

**FRONTAL:**
Motor Control
Personality, emotional traits
Problem solving
Speaking

**PARIETAL:**
Sensory Information
Reading
Orientation

**TEMPORAL:**
Understanding Language
Hearing
Memory
Behavior

**OCCIPITAL:**
Vision
Anatomy: Midbrain/Limbic System

- Limbic System
  - Hypothalamus
  - Hippocampus
  - Amygdala
  - Anterior Cingulate
Anatomy: Neurons
Anatomy

• To function and survive neurons need to:
  o Be able to Communicate
  o Metabolize
  o Repair, regenerate and remodel
Neural Plasticity

By Jack Corbett
Neural Plasticity

New Hampshire Outdoors
Neuroplasticity

- Depends on:
  - Ability to communicate across synapses
  - Neurogenesis
  - Inflammation
  - Stress responses
- Cognitive Reserve
Normal Aging

- Depends on:
  - Genes
  - Environment and Lifestyle
  - Medicine, exercise, diet, smoking, alcohol, sleep, social isolation, TBI, vascular insult, high blood pressure
Normal Aging

- Decrease in size
- Slowed communication between neurons
- Reduced blood flow
- Possible increased inflammation
Normal Aging

- Difficult to “word find” and recall names
- More problems multitasking
- Mild decrease in holding attention

**BUT….**

- Can still learn new skills
- Can make new memories
- Improve language and vocabulary
Dementia

• Rule out medical conditions that may present as a cognitive impairment
• Mild Cognitive impairment
• Vascular Dementia
• Frontotemporal Disorders
• Lewy Body Dementia
Types of Dementia - Alzheimer’s

- Increased plaques and tangles
- Decrease in functioning synapses
- Impaired metabolism
- Inflammation
Plaques
Tangles

www.alz.org
Exercise and the Brain

Exercise…the happy pill!
“Regular participation in physical activity is associated with a reduced risk of developing Alzheimer’s disease. Among older adults with Alzheimer’s disease and other dementias, regular physical activity can improve performance of ADLS and mobility, and may improve general cognition and balance.”

Exercise

• Highly Fit Women in Mid-life
  o 90% less likely to have dementia later in life
  o If they did develop dementia, it was 11 years later

• Delays early onset Alzheimer’s (avg 38 y.o.)
  o 2.5 hours walking a week

• Slows/stabilizes executive function decline
Exercise-Vascularization

• The Brain is a vascular organ

• Receives 20% of blood supply

• Good vascular supply=happy neurons

• Can exercise improve vascularization, oxygenation, and metabolism thus improving brain health???
Exercise- Glucose

• Hypometabolism correlated to Alzheimer's

• Exercise (type and amount) impacts glucose metabolism in the brain

• Moderate activity increases glucose metabolism in all areas

• Vigorous activity only in hippocampus

• Light activity no change
Exercise - Plaque Production

• Forced treadmill training of mice showed decrease plaque deposits

• Physical Activity in humans showed decrease in plaque deposits
Exercise- Tangle Production

- Exercise may reduce level of Tangles (Tau)
Exercise- Synapses

- Exercise may protect against loss of synapse connections

Credit: Billion Photos
Exercise- Neurogenesis

- Exercise may induce neurogenesis in the hippocampus.
Exercise may decrease inflammation in the brain associated with Alzheimer’s
Exercise-Stress

• Stress increases risk of dementia
• Chronic stress affects plaque formation, especially in hippocampus
• Exercise was shown to prevent formation of extra protein that causes plaque build ups
• Exercise may provide some resistance to stress induced causes of Alzheimer’s
• Controls Hypertension
• Arterial Stiffness linked to increased risk of dementia

• Hypertension:
  o Shrinks grey and white matter
  o Causes tiny traumas, possibly plaques and tangles
Exercise - Hypertension

• Evidence shows potential link between HTN and risk of cognitive decline, memory loss, decreased processing speed
• Systolic BP<120
• Important to control in mid life
• All drug classes reduce risk of dementia (Brooks, 2018)
Exercise- Balance

- All aspects of balance decline as severity of cognitive decline increases
- Postural stability decreases as visual inputs and multitask ability decreases
Exercise - Social Engagement

• Maintain functional ability to be socially engaged
• Super Agers: Social Engagement slows decline of anterior cingulate (Maher et al, 2017)
• Decrease social engagement leads to increase risk for dementia
Hulk was Right???

Exercise, Take Your Vitamins, and Say Your Prayers, Brother!
Exercise Intervention

- Moderate Activity, 60+ min/day
- The earlier the better
- More likely to participate if music  \(\text{(Johnson et. al.)}\)
- Remove any triggers in the environment
- Include balance components
- Simultaneous cognitive/physical training
- Speak slow
Sit to Stand
PACE Team

• Primary Care
• Rehab
• Social Work and Rec
• Dietary
  o Leafy Greens
  o Mediterranean Diet
What I’m Reading…

- Senior Gems/Teepa Snow
- National Institute on Aging
- *The Brain that Changes Itself* by Norman Doidge, M.D.
- *The End of Alzheimer’s* by Dale Bredesen, M.D.
  - MEND approach
Future Research

Alzheimer's Association Study - US POINTER
Care Planning

• What would be on your care plan to promote brain (an overall) health?
• How the Aging Brain Affects Thinking, August 2018 www.nia.nih.gov/health/how-aging-brain-affects-thinking
• Risks to Cognitive Health, August 2018 www.nia.nih.gov/health/risks-cognitive-health
• Moderate Physical Activity Linked to Increases in Metabolism Across Brain Region, April 2018, www.nia.nih.gov/news/moderate-physical-activity-linked-increased-metabolism-across-brain-regions
• High Cardiovascular Fitness May Fend Off Dementia, April 2018, www.medpagetoday.com/neurology/dementia/71787
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• Van der Wardt et. al. (2017). Adherence support strategies for exercise intervention in people with mild cognitive impairment ad dementia: A systemic review. Preventative Medicine Reports


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- What you can do to prevent Alzheimer's, Ted Talk by Lisa Genova. Retrieved from YouTube at [www.youtube.com/watch?v=twG$mr6lov0](http://www.youtube.com/watch?v=twG$mr6lov0)
- Normala, M. et.al. (2017). *Postural Stability in Older Adults With Alzheimer’s Disease*; Physical Therapy, 97:3.