Staying Mentally Fit By Being Cognitively Active

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Can being cognitively active slow brain aging?

Goal:
Review what we know on why cognitive activity may help brain fitness; Practical advice for a balanced approach to cognitive health as we age
How does aging affect cognition?

Cognitive abilities often affected by healthy aging, include:

- Executive functions, like shifting between tasks, planning activities, and ignoring irrelevant information
- Memory
- Speed

Model of cognitive decline in healthy and pathological aging

Sperling et al., *Alzheimer’s & Dementia*, 2011
Can a cognitively active lifestyle influence brain aging?

A little background

- Concept of cognitive reserve emerged from research in brain disorders more than 20 years ago
- Lifelong experiences like education and occupational attainment can increase reserve, and may lead to reduced risk for brain aging and Alzheimer’s disease
- More reserve may reflect greater resilience for brain changes in performing cognitive tasks, like memory
- Research on cognitive reserve provided the foundation for current work evaluating the benefits of lifelong learning and keeping your mind active

Model of how differences in reserve can impact cognitive changes as we age

Adapted from Stern, *Lancet Neurol*, 2012
Support for cognitive reserve from brain imaging research

- Brain imaging with positron emission tomography (PET) measured function in patients with Alzheimer’s dementia.

- Among those with similar cognitive impairment, those who had higher scores on a test of prior cognitive ability had lower brain function with PET imaging.

- Having a higher level of reserve required more disease pathology to reach the same level of cognitive impairment as those with lower reserve.

What About Cognitive Training?

Cutting edge research: What we know so far
Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE)

- Focus was to evaluate how training benefits specific cognitive abilities and also daily living activities, like shopping, finances, housework, and using the telephone.

- Study with 2,832 older adults randomized to participate into three training groups: memory, reasoning, and processing speed; each group had 10 60-70 minute sessions over 5-6 weeks and some were given later booster sessions.

- Training effects on cognition were assessed immediately and at one, two, three, five and 10 years after training.
What have we learned from the ACTIVE trial so far?

- After following over 2800 participants over 10 years, all groups showed declines from baseline.
- Each training intervention produced improvements in the trained cognitive ability that dissipated but persisted years later.
- Cognitive training effects on daily functions were small but sustained benefits were observed even 10 years later.

Willis et al., JAMA, 2006; Rebok et al., J Am Geriatr Soc, 2014
Meta-analysis of recent studies on cognitive training in young to middle aged adults

- Ability of working memory training to improve overall intelligence was examined across 20 recent studies.
- Participants across studies were healthy adults, 18 to 50 years of age.
- Cognitive training over weeks can lead to small improvements in general cognitive functions.

### Study

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Adapted from Au et al., *Psychon Bull Rev*, 2014
Meta-analysis of studies on cognitive training in young and older adults

• Ability of working memory and executive function training to improve cognition in older adults was examined in 49 studies.

• Among older adults, small but significant benefits were observed.

• When compared to young adults, elders did about as well in benefiting from cognitive training, but more studies are needed.

Adapted from Karbach & Verhaeghen, Psychol Sci, 2014
Cognitive training increased brain plasticity in healthy older adults

- Research used MRI to test cognitive training over 12 weeks in 37 healthy older adults randomly assigned to training and control groups.

- Training effects on brain blood flow and connectivity was assessed at baseline (T1), mid (T2), and post-training (T3).

- Cognitive training increased brain blood flow and connectivity, supporting greater neuroplasticity, even though the cognitive benefits were small.

Chapman et al., Cerebral Cortex, 2013
Summary

- Aging can lead to declines in some cognitive abilities, like memory, problem-solving, and processing speed.

- We may all have a cognitive reserve that can potentially help hold off brain aging; cognitive engagement through education and lifelong activities may help.

- Research so far on cognitive exercises show training can have benefits; importantly effects are small but can be sustained; more clinical trial research is needed.

- Being cognitively active with a balanced approach, including activities with friends and family may offer the best opportunity for benefits over the lifespan.
Suggestions for a balanced approach to staying cognitively fit

• Keep your mind active
• Do mentally stimulating activities that you find enjoyable
• Read books and magazines
• Play games with friends and family
• Set a goal to learn something new every day
• Take or teach a class
• Be social through work or volunteering

Adapted from National Institute on Aging
What About Life-Long Learning to Enhance Brain Fitness?

Research and Recommendations
Can Lifelong Learning Help As We Age?

World Health Organization:
“Active Aging” is the process of optimizing opportunities for health and participation in order to enhance quality of life as people age.

“Health” includes physical, cognitive, emotional, and social well-being.
AARP Survey on Lifelong Learning (2000), over 1,000 respondents

• Majority were involved in some type of new learning
• Most often for personal development, personal satisfaction
• Provides opportunities for social interaction
• Participation positively contributes to good quality of life and personal satisfaction

But does it help us maintain cognitive abilities?
Rita Levi-Montalcini, M.D.
(1909 – 2012)

- Nobel Prize in Medicine (1986) for her identification and characterization of nerve growth factor
- At age 103, still worked daily in her research laboratory
- In 2012, published six scientific articles on new research
- Established and worked with her foundation providing education for young African girls.
What about the rest of us?

Epidemiological studies have shown that lifestyle factors including:

- *Educational achievement*
- *Occupational attainment*
- *Social activity*
- *Leisure activities*
- *Mentally challenging activities*

Are related to:

- *Maintaining cognitive abilities*
- *A lower incidence of AD*
- *Increased quality of life*

Daffner 2010; Fratiglioni and Qiu 2009; Gates & Valenzuela 2010; Papp et al. 2009
Does continuing to learn have a positive effect?

**University of the Third Age (U3A):**

- Established in 1980’s in Europe
- University courses in humanities, social sciences, science and technology subjects
- Now throughout Europe, Australia, UK, Canada, USA, and online
Does continuing to learn have a positive effect?

Fernández-Ballesteros et al. (2012) examined the impact of U3A education on students in Madrid, over a three year period:

- 82 adults (ages 60 to 70) taking courses, matched to adults not participating in U3A courses
- Followed them for three years, taking at least two courses per year

Over three years:

- Adults not taking courses showed declines in memory

Over three years, adults taking courses:

- Improved memory functioning
- Increased social and productive activities
- Increased emotional balance and less depression
- Increased information-seeking and general health awareness
- Improved quality of life

Fernández-Ballesteros, Rocío; Molina, María Ángeles; Schettini, Rocío; del Rey, Ángel Luis: Gerontopsychology and Geriatric Psychiatry, Vol 25(3), Sep 2012, 145-154.
Does continuing to learn have a positive effect?

Promising, but preliminary...

Will it last?

Motivation, or cognitive abilities?

Does it actually change the brain?
Rodents increase play and curiosity, exhibiting highly motivated behaviors.

Long-term brain changes:
✓ increased neurons
✓ increased synapses
✓ enhanced blood flow
✓ especially in brain regions susceptible to neurodegenerative diseases, such as the hippocampus.

Environmental enrichment: Social interaction, sensory stimulation, and problem-solving opportunities

What about the human brain?

Music is an inherently challenging activity.

*Physical*: Fine motor sequences

*Auditory*: Subtle discriminations of sound quality, rhythm, and pitch

*Cognitive*: Memorization

*Emotional*: Stimulates the brain’s emotion pathways

*Rewarding*: Stimulates the brain’s and reward pathways
Musicians show enhanced brainstem response to speech sounds.

The difference between musicians and non-musicians builds across the lifespan.

Parbery-Clark et al. (2012, 2009b) and Strait et al. (2012a, 2013b).
Musicians are faster and more accurate in identifying words in noisy environments.

**Important:** In older musicians, it didn’t matter how much hearing loss they had sustained.

Strait et al. (2012a, 2013b).
Does music training in older non-musicians provide a benefit?

- Individual piano lessons to 25 older adults (ages 62-84) for six months.
- Control group engaged in various activities – group excursions, language lessons, philosophy courses, etc.
- Tested on memory, response speed, executive functions, working memory

Piano group got faster, nine months after training, while the controls did not change.

Seinfeld, Figueroa, Ortiz, & Sanchez-Vives (2013) Frontiers in Psychology
Does music training in older non-musicians provide a benefit?

Piano group:

Depression scores decreased
Fatigue scores decreased

Seinfeld, Figueroa, Ortiz, & Sanchez-Vives (2013) Frontiers in Psychology
Life-long learning... does it benefit cognition?

- The scientific evidence is promising
- Life-long activities may help maintain cognitive abilities
- The benefits of *new* learning is still unclear

But all the studies agree that life-long learning....

- *Increases social and productive activities*
- *Increases emotional balance and decreases depression*
- *Increases general health awareness*
- *Improves quality of life*
Life-long learning... It's all about balance....

Learning activities give us opportunities for cognitive engagement, social interaction, and physical exercise.

We are energized, we enjoy, we share with friends, we feel a sense of accomplishment.

Quality of life...

World Health Org: “Health” includes physical, cognitive, emotional, and social well-being.
Osher Lifelong Learning Institute at University of Arizona
https://ce.arizona.edu/olli

Pima Council on Aging activities and events calendar
https://www.pcoa.org/events

Tucson Medical Center Healthy Living Connections
https://www.tmcaz.com/Community/SeniorServices

Pima Community College noncredit courses
https://www.pima.edu/community

University of Arizona Calendar of Events
http://uanews.org/calendar
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Let our family care for yours.