Brain Fitness for Positive Aging

Ray Ownby, MD, PhD
Overview

Cognitive aging and what we can do about it.

Positive Aging
Optimal Cognitive Function
Optimal Physical Function
Absence of Disease

Brain Fitness
Brain structure
Brain function
Overview

Cognitive aging and what we can do about it.
Cognitive Aging
What changes with age
What causes the changes?

The science of memory and cognition
Structural and functional changes
Risk factors

Cognitive aging and what we can do about it.

Plaques and tangles
CONCLUSIONS AND RELEVANCE  Exploratory analyses of a cognitively normal cohort followed up for a median of 3.1 years suggest that elevation in baseline brain amyloid level, compared with normal brain amyloid level, was associated with higher likelihood of cognitive decline, although the findings are of uncertain clinical significance. Further research is needed to assess the clinical importance of these differences and measure longer-term associations.

Michael C. Donohue, PhD; Reisa A. Sperling, MD, MMSc; Ronald Petersen, MD, PhD; Chung-Kai Sun, MS; Michael W. Weiner, MD; Paul S. Aisen, MD; for the Alzheimer’s Disease Neuroimaging Initiative

Nun Study

Cognitive aging and what we can do about it.
Nun Study

Cognitive aging and what we can do about it.

Correlation = 0.57
Correlation squared = 0.32
About a third overlap

What about the other 2/3?
So what else causes cognitive aging?
Neuroinflammation
Depression and Risk for Alzheimer Disease

Systematic Review, Meta-analysis, and Metaregression Analysis

**Conclusions:** A history of depression may confer an increased risk for later developing AD. This relation may reflect an independent risk factor for the disease.

*Arch Gen Psychiatry. 2006;63:530-538*
Long-term cortisol measures predict Alzheimer disease risk.
Ennis, Gilda; An, Yang; Resnick, Susan; Ferrucci, Luigi; MD, PhD; OBrien, Richard; MD, PhD; Moffat, Scott Neurology. 88(4):371-378, January 24, 2017.

Differences in UFC/Cr level control and future participants with AD controlling for baseline age. *p < 0.05; UFC/Cr = urinary free cortisol/creatinine.
What can be done?
Overview

Cognitive aging and what we can do about it.

What we can do about it

- Exercise
- Diet
- Stress management
- Mood
- Sleep
- Purpose in life
- Social engagement
- Cognitive training
- tDCS
Risk factors

Cognitive aging and what we can do about it.

Preventing Cognitive Decline and Dementia: A Way Forward

Committee on Preventing Dementia and Cognitive Impairment
Alan I. Leshner, Story Landis, Clare Stroud, and Autumn Downey, Editors
Board on Health Sciences Policy
Health and Medicine Division

National Academy of Sciences, June, 2017

Also see: Interventions to prevent age-related cognitive decline, mild cognitive impairment, and clinical Alzheimer-type dementia. Agency for Health Research and Quality, Comparative Effectiveness Report Number 188, March 2017.
Treatment

Cognitive aging and what we can do about it.

NBC Nightly News with Lester Holt, June 22, 2017

National Academy of Sciences, June, 2017

Also see: Interventions to prevent age-related cognitive decline, mild cognitive impairment, and clinical Alzheimer-type dementia. Agency for Health Research and Quality, Comparative Effectiveness Report Number 188, March 2017.
Treatment?
Cognitive aging and what we can do about it.

Highest priority areas:
Cognitive training
Blood pressure management
Physical activity

National Academy of Sciences, June, 2017

Also see: Interventions to prevent age-related cognitive decline, mild cognitive impairment, and clinical Alzheimer-type dementia. Agency for Health Research and Quality, Comparative Effectiveness Report Number 188, March 2017.
Exercise
Meta-analysis of effects

Promoting brain health

Exercise training increases size of hippocampus and improves memory


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Edited* by Fred Gage, Salk Institute, San Diego, CA, and approved December 30, 2010 (received for review October 23, 2010)

Diet
Mediterranean diet

- The Mediterranean diet emphasizes olive oil, fish, cheese and yogurt, as well as fresh fruits and vegetables.
- Beans, legumes, and nuts are important.
- Whole grain breads and pastas.
What about exercise *and* diet?
Alzheimer Disease (AD) Incidence in Individuals by No, Some, or Much Physical Activity and Low, Middle, and High Mediterranean-Type Diet Adherence Scores

Cognitive training

Life moves pretty fast. If you don’t stop and look around once in awhile, you could miss it.

--Ferris Bueller
Cognitive Training

Treatment

Cognitive training

- Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) study
- Six sites
- 2,832 participants
- National Institute on Aging
- Key intervention:
  - Speed of processing
    - Useful Field of View
Effects of Cognitive Training Interventions With Older Adults
A Randomized Controlled Trial

Karlene Ball, PhD
Daniel B. Berech, PhD
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Jared B. Jobe, PhD
Mary D. Leveck, PhD
Michael Marsiske, PhD
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George W. Rebok, PhD
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Sharon L. Tennstedt, PhD
Frederick W. Unverzaigt, PhD
Sherry L. Willis, PhD
for the ACTIVE Study Group

Nearly half of community-dwelling persons aged 60 years and older express concern about declining mental abilities. Although there is substantial evidence that many cognitive abilities and processes are related to measures of functional status, need for care, and quality of life, few studies have addressed whether improving cognitive functions might have short- or long-term effects on activities related to living independently. Interventions designed to delay or prevent the need for nursing homes, home care, and hospital stays can save health care costs.

Context Cognitive function in older adults is related to independent living and need for care. However, few studies have addressed whether improving cognitive functions might have short- or long-term effects on activities related to living independently.

Objective To evaluate whether 3 cognitive training interventions improve mental abilities and daily functioning in older, independent-living adults.

Design Randomized, controlled, single-blind trial with recruitment conducted from March 1998 to October 1999 and 2-year follow-up through December 2001.

Setting and Participants Volunteer sample of 2832 persons aged 65 to 94 years recruited from senior housing, community centers, and hospital/clinics in 6 metropolitan areas in the United States.

Interventions Participants were randomly assigned to 1 of 4 groups: 10-session group training for memory (verbal episodic memory, n=711), or reasoning (ability to solve problems that follow a serial pattern, n=705), or speed of processing (visual search and identification, n=712); or a no-contact control group (n=704). For the 3 treatment groups, 4-session booster training was offered to a 60% random sample 11 months later.

Main Outcome Measures Cognitive function and cognitively demanding everyday functioning.

Results Thirty participants were incorrectly randomized and were excluded from the analysis. Each intervention improved the targeted cognitive ability compared with baseline, durable to 2 years (P<.001 for all). Eighty-seven percent of speed-, 74% of reasoning-, and 26% of memory-trained participants demonstrated reliable cognitive improvement immediately after the intervention period. Booster training enhanced training gains in speed (P<.001) and reasoning (P<.001) interventions (speed booster, 92%; no booster, 68%; reasoning booster, 72%; no booster, 49%), which were maintained at 2-year follow-up (P<.001 for both). No training effects on everyday functioning were detected at 2 years.

Conclusions Results support the effectiveness and durability of the cognitive training interventions in improving targeted cognitive abilities. Training effects were of a magnitude equivalent to the amount of decline expected in elderly persons without dementia over 7- to 14-year intervals. Because of minimal functional decline across all groups, longer follow-up is likely required to observe training effects on everyday function.

JAMA. 2002;288:2271-2281
www.jama.com
ACTIVE trial: 5 years later

ACTIVE trial: 10 years later

Ten-Year Effects of the Advanced Cognitive Training for Independent and Vital Elderly Cognitive Training Trial on Cognition and Everyday Functioning in Older Adults

George W. Rebok, PhD, a,b Karlene Ball, PhD, c Lin T. Guey, PhD, d Richard N. Jones, ScD, e Hae-Young Kim, DrPH, d Jonathan W. King, PhD, f Michael Marsiske, PhD, g,h John N. Morris, PhD, e Sharon L. Tennstedt, PhD, d Frederick W. Unverzagt, PhD, i and Sherry L. Willis, PhD, f for the ACTIVE Study Group

Effect Size = 0.36
Cognitive training in ACTIVE trial

Risk for dementia:

- 331 participants developed dementia:
  - Control: 14% in the control
  - 10 or fewer sessions: 12.1%
  - 11 to 14 sessions: 8.2%
- Speed training reduced risk for dementia by 8% per session
- HR, 0.52; CI 0.33 - 0.82; $P = .005$

Cognitive Training

Treatment


Edwards JD, Xu H, Clark DJ, Ross LA, Unverzagt FW. The ACTIVE study: What have we learned and what is next? Cognitive training reduces incident dementia across ten years. ten years (2016). Presented at the meeting of the American Psychological Association. July, Denver, CO.
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NeuroRacer experimental conditions and training design.

(a) Drive only, Sign only, Sign and drive

Single task, Multitask

(b) No-contact control or Single task or Multitasking

Training intervention

1 hour \times 3 \text{ times per week} \times 1 \text{ month}

Initial visit, 1 month, 6+ months

NeuroRacer, EEG and cognitive testing
Can we enhance cognitive training?
Transcranial direct current stimulation

- Application of a small current across the scalp while doing a mental activity
- Multiple studies suggest enhancement of learning and memory
- Potential for treating depression
tDCS
Treatment
tDCS
Treatment
tDCS for cognition in older persons with HIV

- Pilot study
- Combined with speed of processing cognitive training
- Results suggest enhancement of learning and memory
- Pending funding from the National Institute on Aging
GT Racing 2 – Gameloft, Paris

tDCS
Treatment
tDCS for cognition in older persons with HIV

Will tDCS work in normal elderly?

Augmenting cognitive training older adults: The ACT trial

- Funded by National Institute on Aging for 5 years
- Sites at University of Florida, University of Miami, and University of Arizona
- $5.7 million dollars
- Adam Woods, PhD, Principal Investigator
- Status: Recruiting
Bottom line
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What we can do about it

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- tDCS
No pill fixes cognitive aging, and it doesn’t look like one is going to come along soon.
Specific types of diet, exercise and cognitive training *may* slow cognitive aging.
Cognitive Aging

Treatment

More research is needed.
Contact:

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