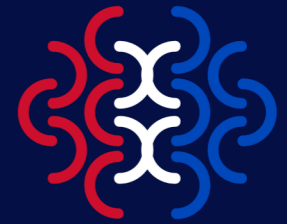


**UsAgainstAlzheimer's**



**BRAIN HEALTH  
ACADEMY™**  
UsAgainstAlzheimer's

Cognitive Training  
and  
Dementia

# Cognitive Training & Dementia

May 9, 2024

# Acknowledgements

This course and continuing education credit is provided free of charge, with support from



# Presenter



## Dr. Henry Mahncke

joined Posit Science at its inception as Vice President of Research & Outcomes, where he led the first large-scale clinical trials of a publicly available cognitive training program. He now serves as CEO of Posit Science, where his focus is ensuring that the breakthrough science of brain plasticity can help every brain on the planet. Previously, he worked as consultant at McKinsey focused on health care and video games, and then as a science and technology advisor to the British government. Dr. Mahncke earned his PhD in Neuroscience at the University of California, San Francisco.

### Disclosure:

Dr. Mahncke serves as the CEO of Posit Science, a company that develops the computerized cognitive training program BrainHQ

# Course Description

There is evidence that cognitive training tools can help older adults who are healthy or have mild cognitive impairment to improve cognitive health and perhaps their everyday functioning. Studies show some forms of cognitive training may help reduce or delay the development of cognitive impairment and dementia.

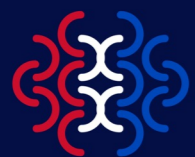
This course provides an overview of effective strategies and provides resources to help health professionals utilize cognitive training to help build cognitive resilience.

# Learning Objectives

- Participants will be able to list 6 or more modifiable risk factors for dementia.
- Participants will be able to summarize the types of cognitive training exercises that may help reduce the risk of dementia or improve functioning.
- Participants will be able to identify effective interventions and strategies to employ cognitive training with a special focus on adults 45+.
- Participants will be able to identify special considerations for high-risk populations.

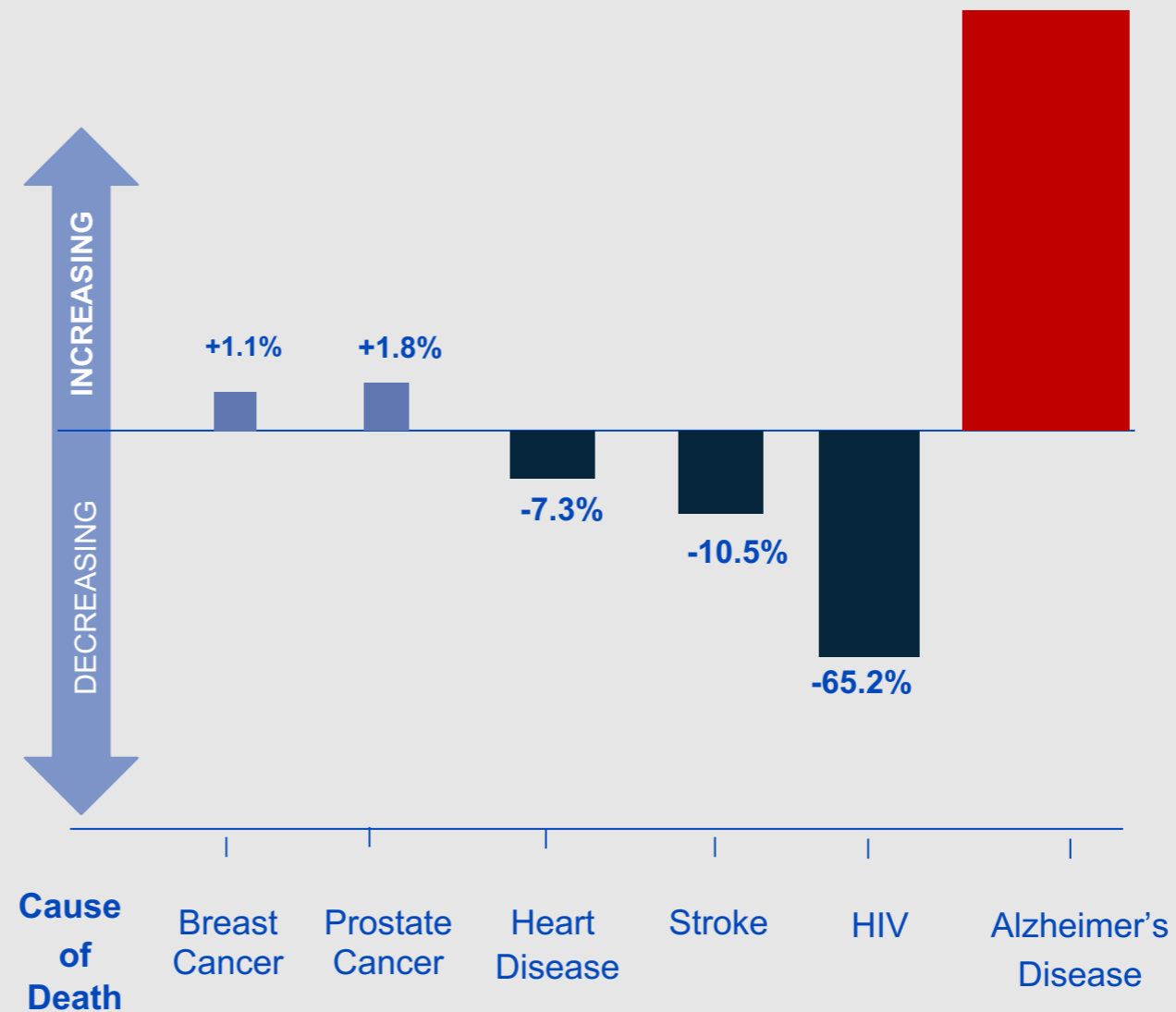
01

# Facts: Alzheimer's and related dementias (ADRD)



# Scope of the Epidemic (U.S.)

6.5 million adults  
1 in 9 adults age  $\geq 65$   
1 in 3 adults age  $\geq 85$   
2/3 are women  
Alzheimer's deaths  
increased 145% from  
2000-2019, while other  
top causes of death  
have declined



(BAR GRAPH NOT TO SCALE)

# Inequities in Brain Health

African American people are  
**2X AS LIKELY**  
to have Alzheimer's

Latino people are  
**1.5X AS LIKELY**  
to have Alzheimer's



**Less likely** than White patients to receive a timely diagnosis;

In a recent study of Medicare beneficiaries, Black Americans (18.2%) and Latinos (15.8%) were less likely to receive a timely diagnosis when compared to Whites (23.3%).<sup>4</sup>



**More likely** to report experiencing racial discrimination along their patient and caregiver journeys;

Half of Black Americans (50%) and one in three Latino Americans (33%) report they have experienced healthcare discrimination.<sup>5</sup>



**Less likely** to be enrolled in cutting-edge Alzheimer's and brain health research.

Latino and Black Americans make up less than 10% of all clinical trial participants in active ADRD research.<sup>6</sup>



# Health Disparities & Comorbidities for Alzheimer's in the African American Community

44% More Likely to have a stroke.

23% More Likely to live with obesity.

25% More Likely to die from heart disease.

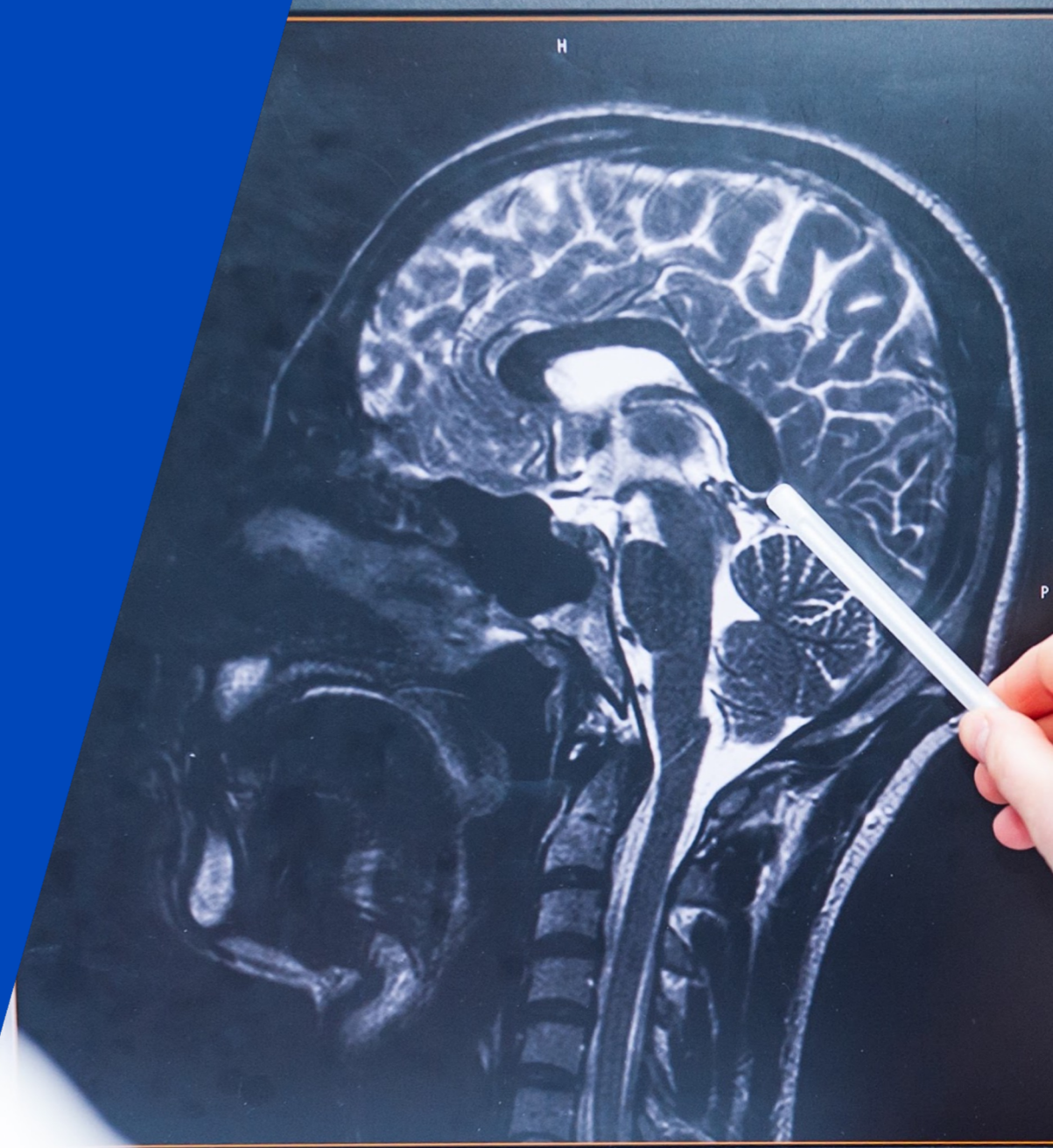
72% More Likely to be diabetic.

**2X AS LIKELY**  
TO HAVE ALZHEIMER'S



02

# Modifiable Risk Factors for Dementia



**BRAIN HEALTH  
ACADEMY™**  
UsAgainstAlzheimer's

# Alzheimer's: Non-Modifiable Risk Factors

## Age

Number one risk factor is advancing age.  
Risk doubles every 5 years after age 65.

## Family History

Genetics vs environmental factors.

## Education

Fewer years of formal education and lower levels of cognitive engagement may be risk factors.

## Sex

2/3 of those with Alzheimer's are women.  
16% of women age  $\geq 71$  (11% of men).  
After age 65, have more than 1 in 5 chance (1 in 11 for men).

# Modifiable Risk Factors

**40%**

of dementia cases  
could be prevented  
by addressing these  
lifestyle factors

## INCREASE

- Healthy Diet
- Physical Activity
- Mental Activity
- Cognitive and social activity

## DECREASE

- Hypertension
- High cholesterol
- Uncontrolled diabetes
- Obesity
- Smoking
- Depression
- Excessive Alcohol Intake
- Head Injury
- Air Pollution
- Hearing Loss

03

# The link between Cognitive Training to Alzheimer's and related dementias



*“Old men retain their intellects well enough, if only they keep their minds active and fully employed.”*

– Cicero (Cato Maior de Senectute)

# Studies of Cognitive Activity Show Protection Against Cognitive Decline and the Dementia Onset

## Example Study: Bronx Aging Study

- 469 people, without dementia, aged 75+, followed for ~5 years
- Participation in cognitively stimulating activities scored – board games, crosswords, reading, writing, playing music, group discussions
- Each point (0-42) associated with 7% lower risk of dementia

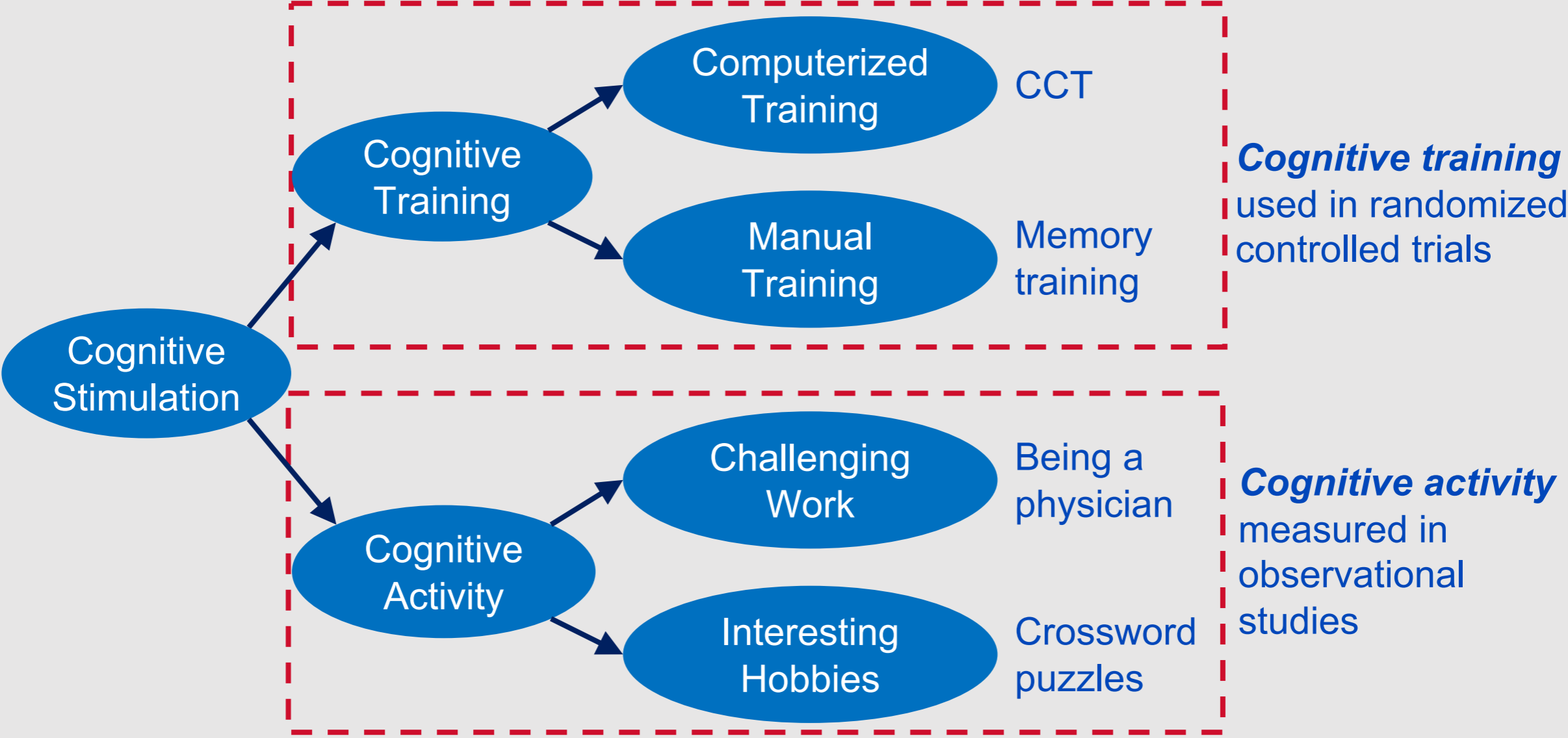
## Current Meta-Analysis: Yates 2016

- 19 observational and case-control trials evaluated with 32,546 participants
- Cognitive activity associated with ~32% reduction in risk of cognitive decline and ~40% reduction in dementia risk

But...

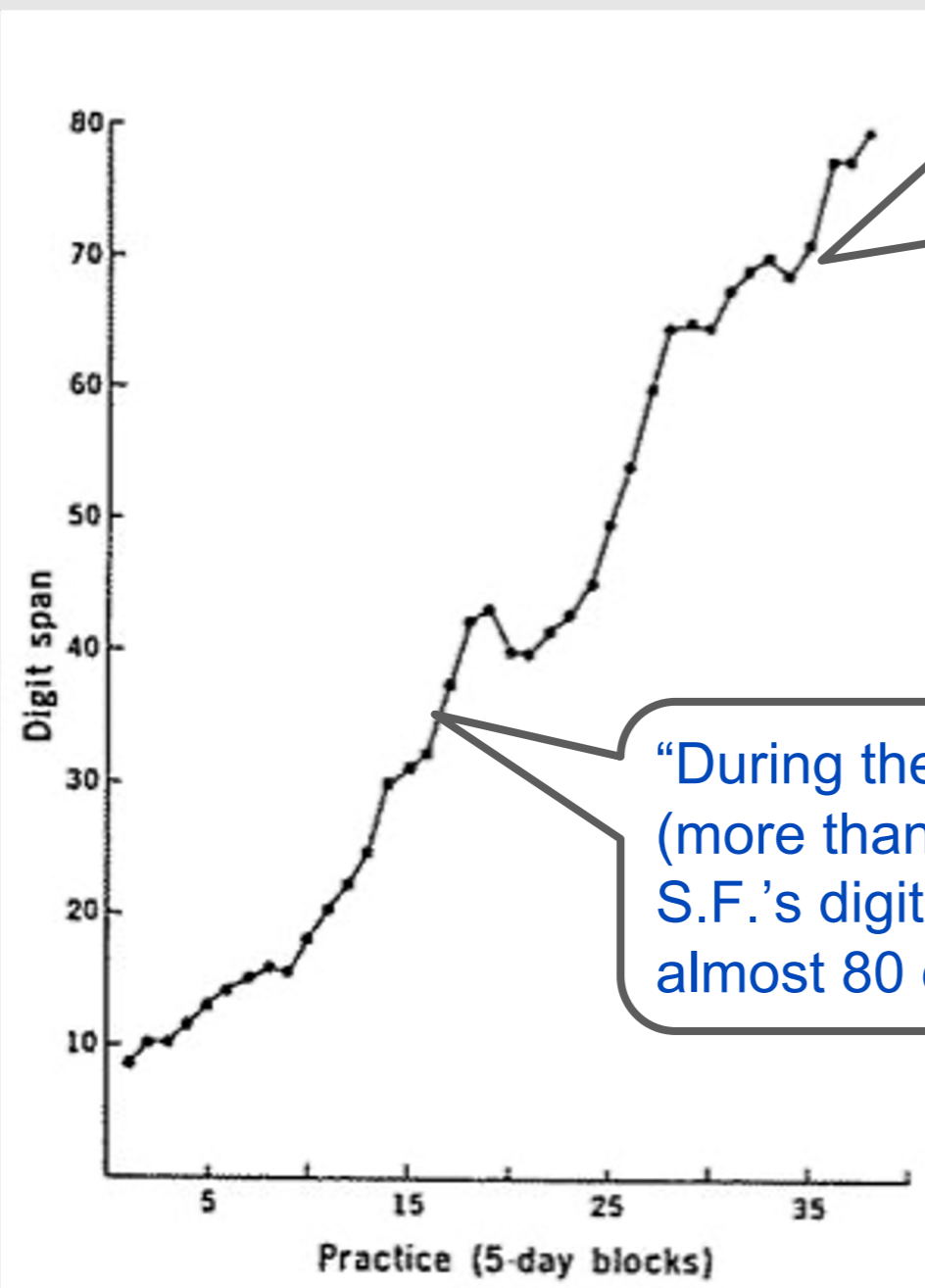
- Observational studies cannot help us understand the direction of causation
- Does cognitive activity slow the onset of dementia, or does lack of dementia allow participation in cognitive activity?

# Randomized Controlled Trials Have Used Cognitive Training Programs





# An Early Approach: People's Memory Gets Worse, So Let's Have Them Practice Remembering Things



“In one experimental session, S.F. was switched from digits to letters of the alphabet after three months of practice and exhibited no transfer: His memory span dropped back to about six.”

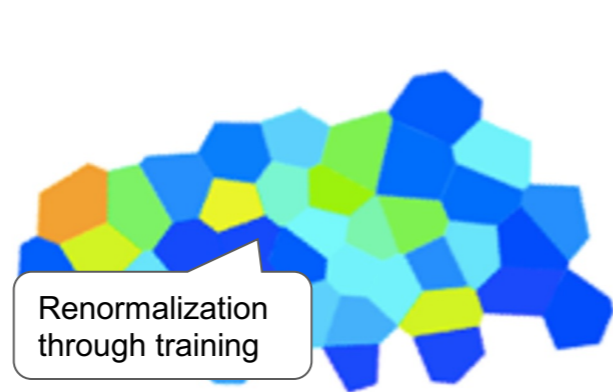
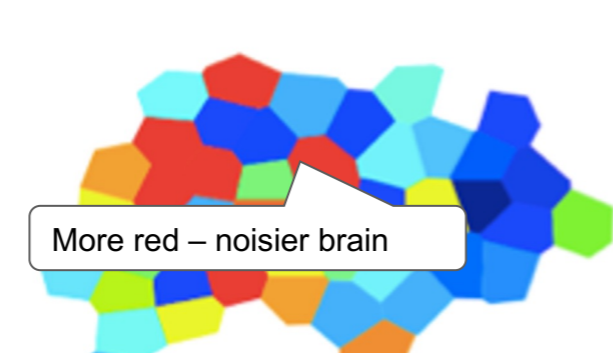
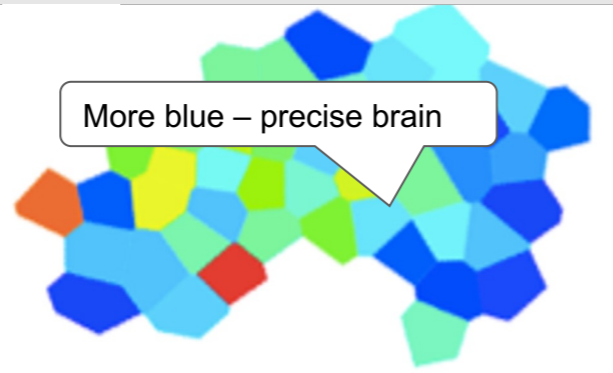
“During the course of 20 months of practice (more than 230 hours of laboratory testing), S.F.’s digit span steadily improved from 7 to almost 80 digits.”

Ericsson 1980 (Science)

# A Modern Approach: The Brain Can Rewire Itself Through Training

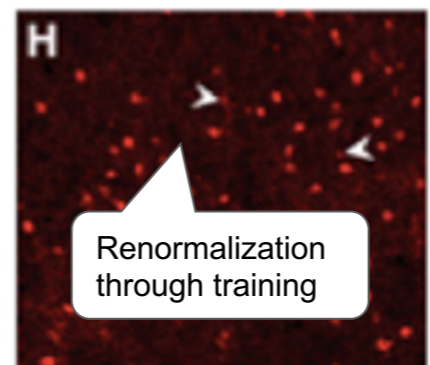
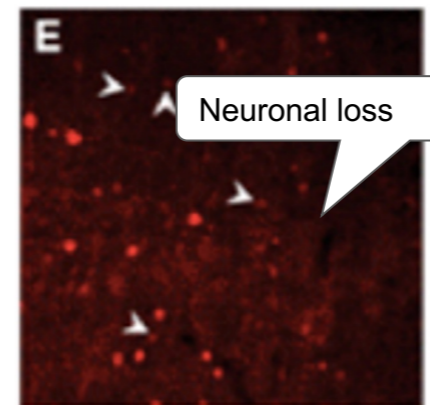
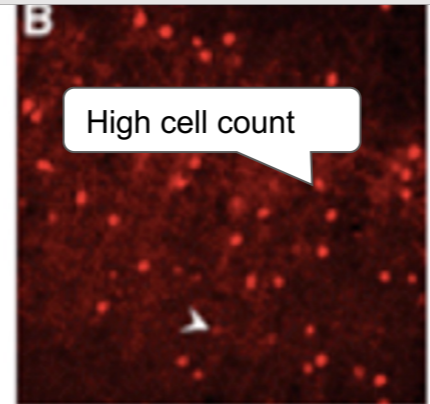
## Neural Precision

Bandwidth maps  
(blue is more precise, red is less)



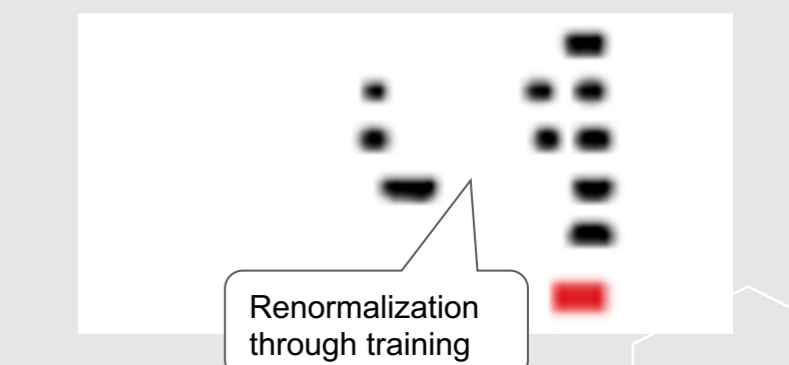
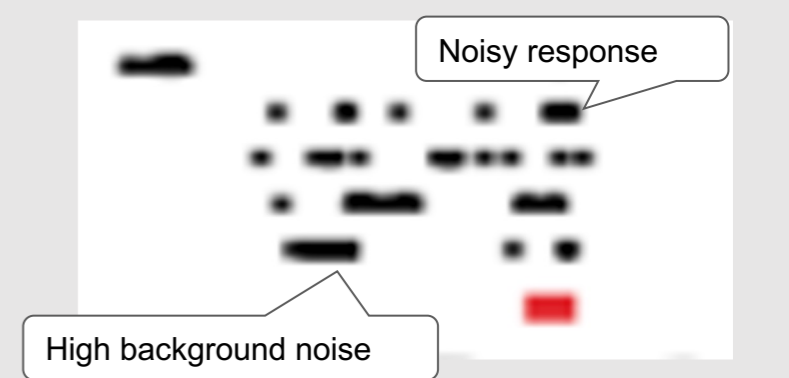
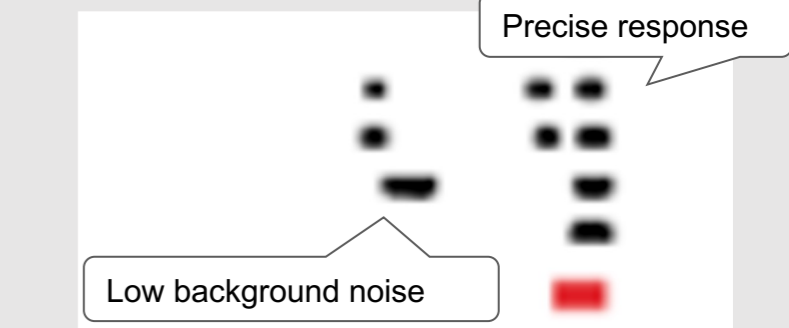
## Neural Coordination

Parvalbumin positive inhibitory interneurons in cortex (shown in red)



## Neural Performance

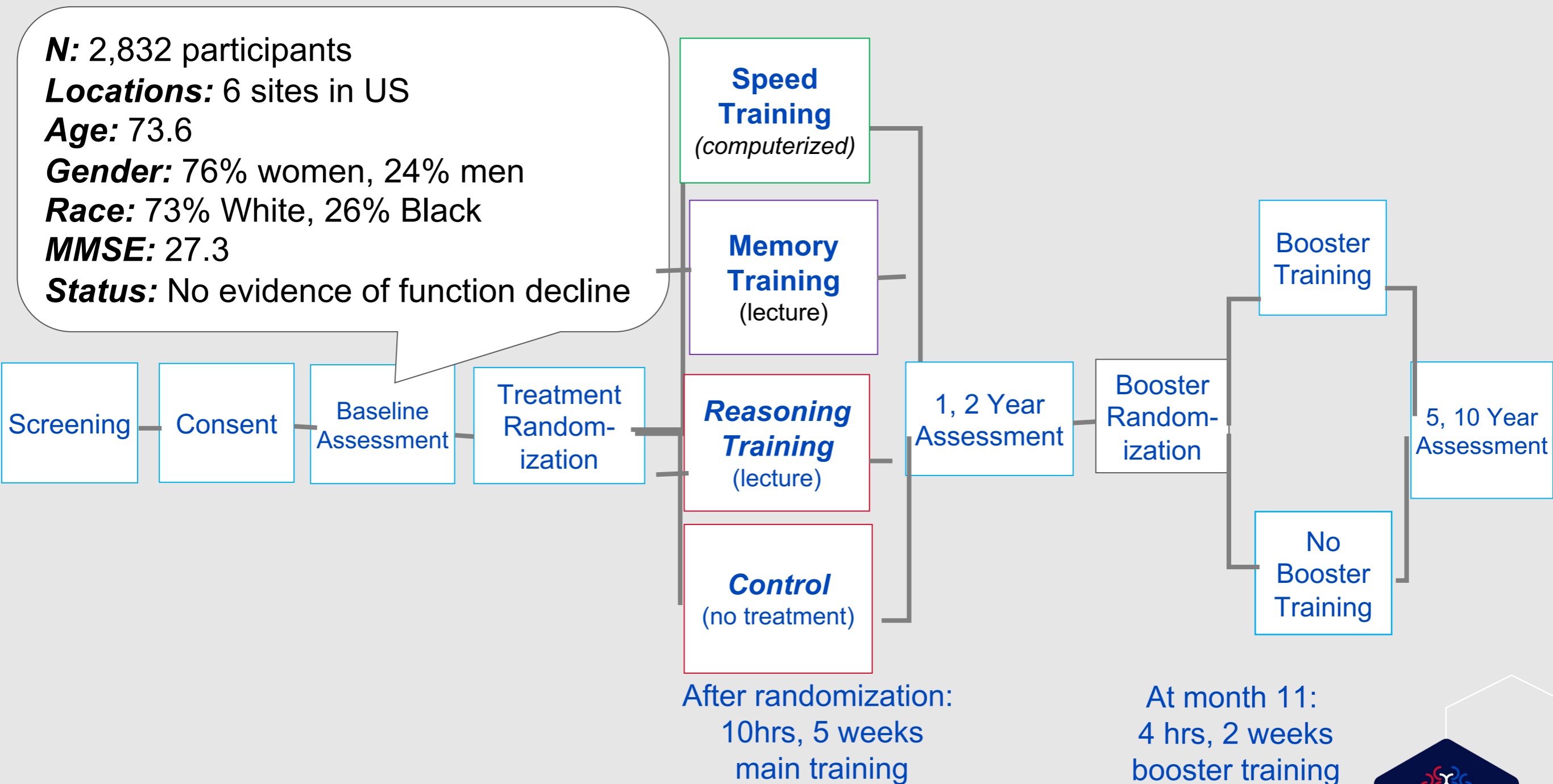
Neural spikes (black, one trial per row) in response to stimulus (red)



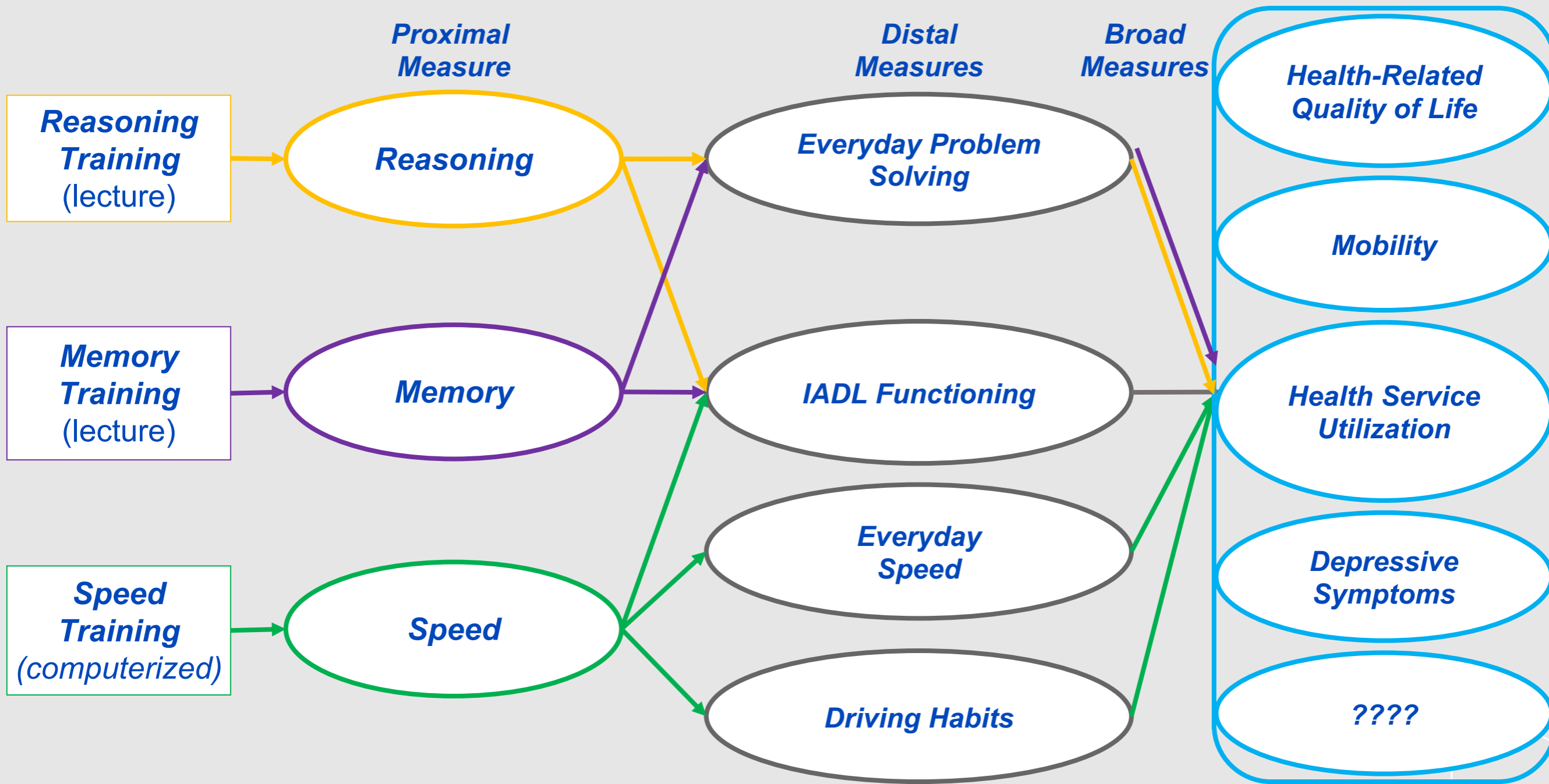
De Villars-Sidani 2010 (PNAS)

# An Example Study of Cognitive Training: The ACTIVE Study

**N:** 2,832 participants  
**Locations:** 6 sites in US  
**Age:** 73.6  
**Gender:** 76% women, 24% men  
**Race:** 73% White, 26% Black  
**MMSE:** 27.3  
**Status:** No evidence of function decline

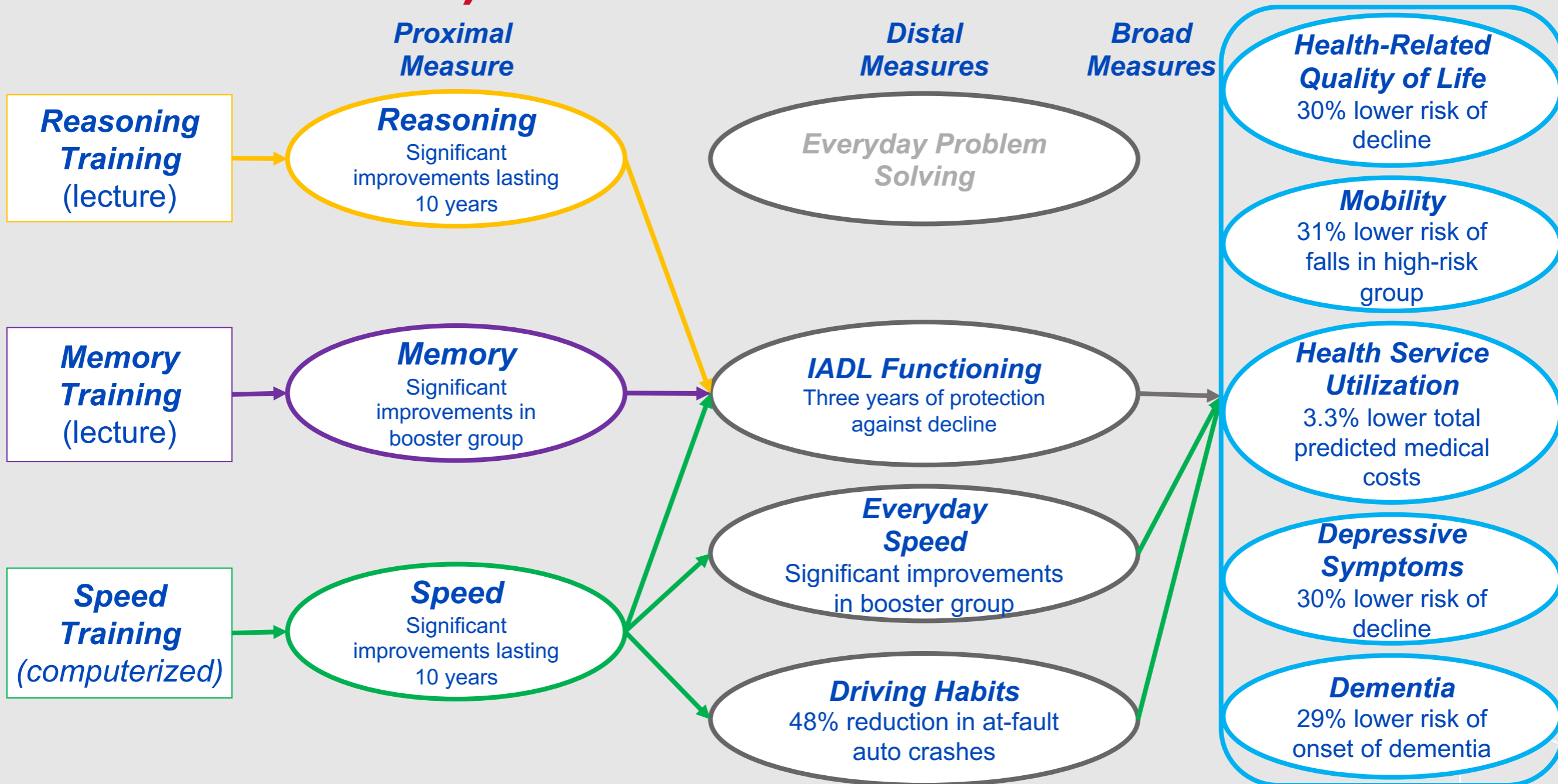


# ACTIVE Assessed Participants on Proximal, Distal, and Broad Measures of Function



Jobe 2001

# ACTIVE Showed That Every Cognitive Training Program Had Benefits (Some More Than Others)

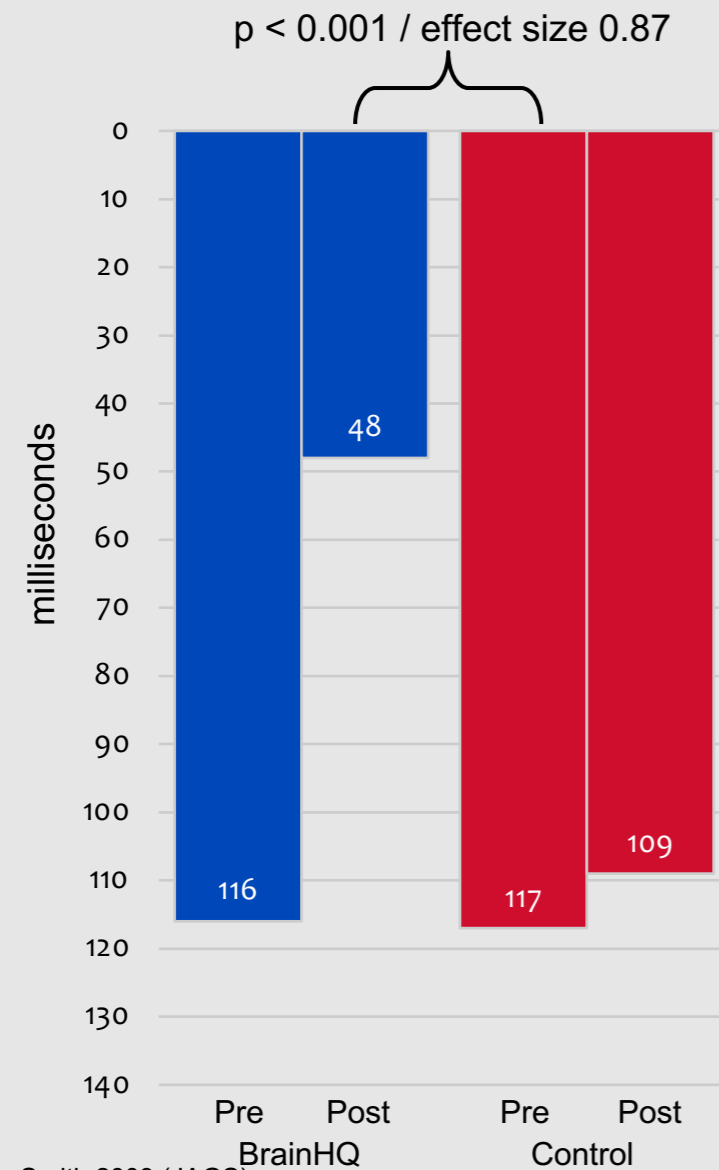


Ball 2002, Willis 2006, Rebok 2014, Wolinsky 2006, Wolinsky 2009, Edwards 2018

# IMPACT Shows That Speed-Based CCT Can Improve Memory

## Processing Speed

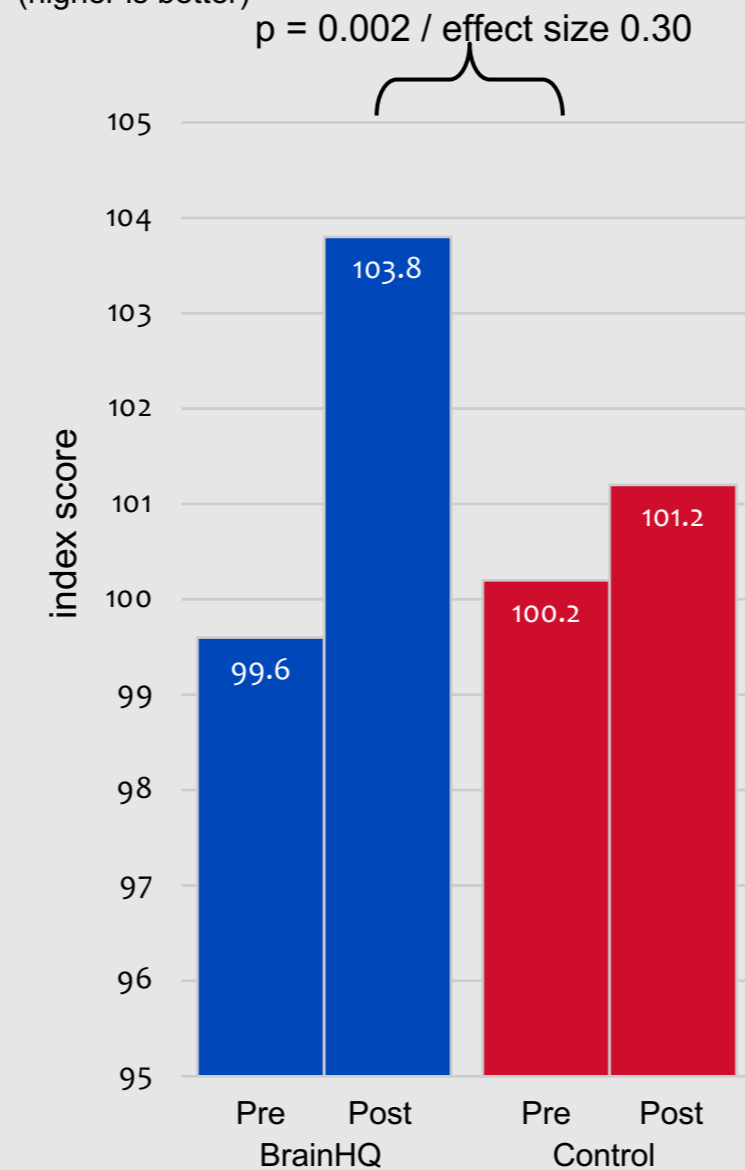
High or Low  
(lower is better)



Smith 2009 (JAGS)

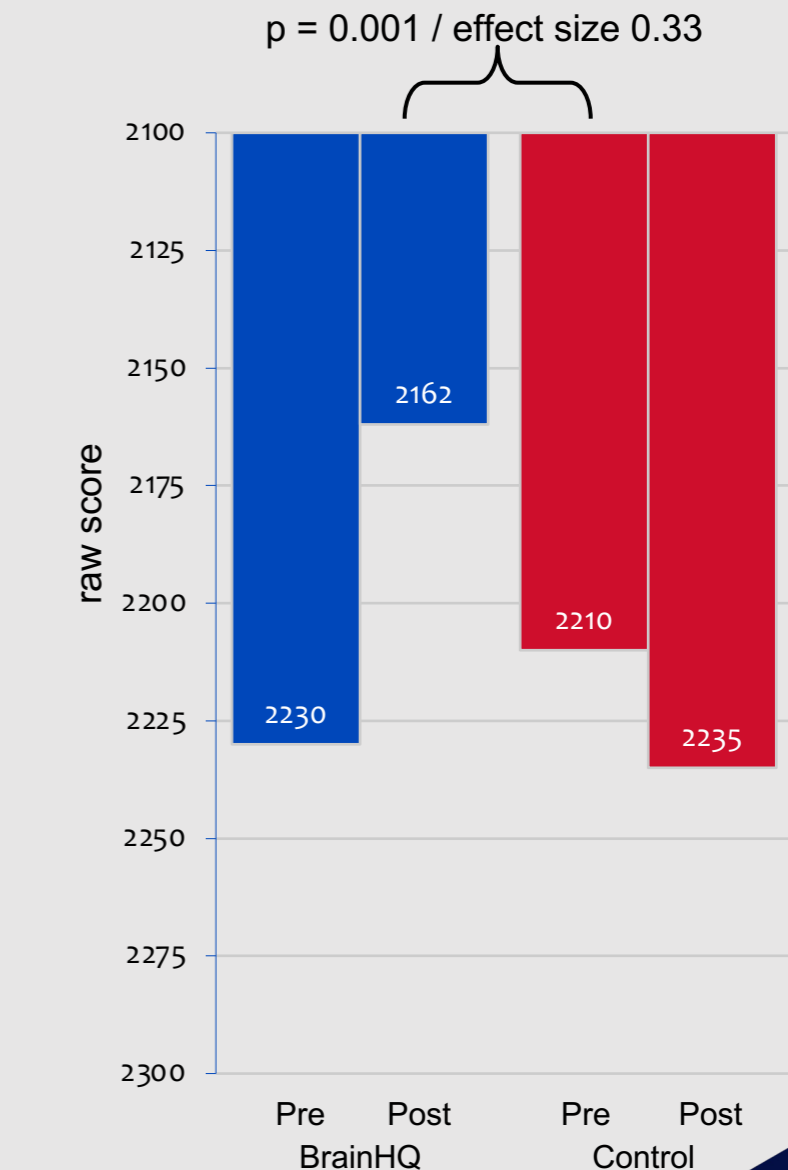
## Overall Memory

RAVLT, RBMT, Digits Backwards, LNS  
(higher is better)



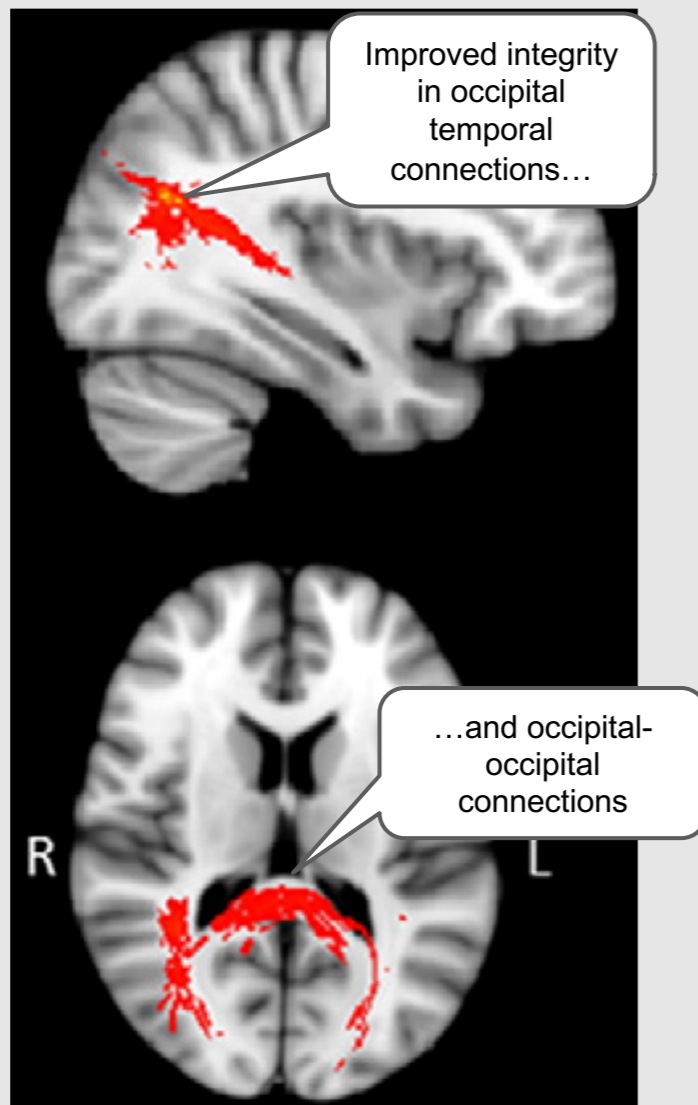
## Everyday Cognition

CSRQ-25 (PRO)  
(lower is better)

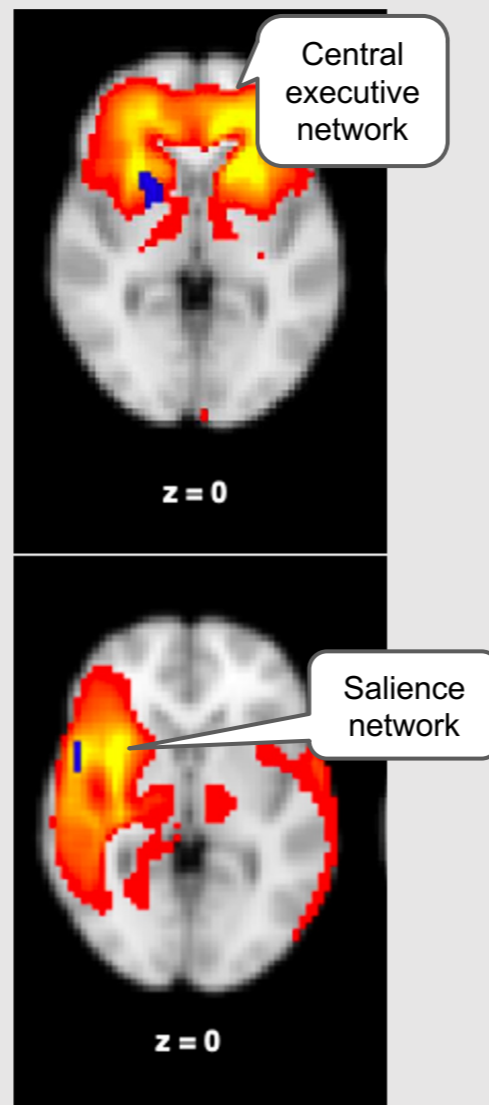


# Cognitive Training Rewires Brains

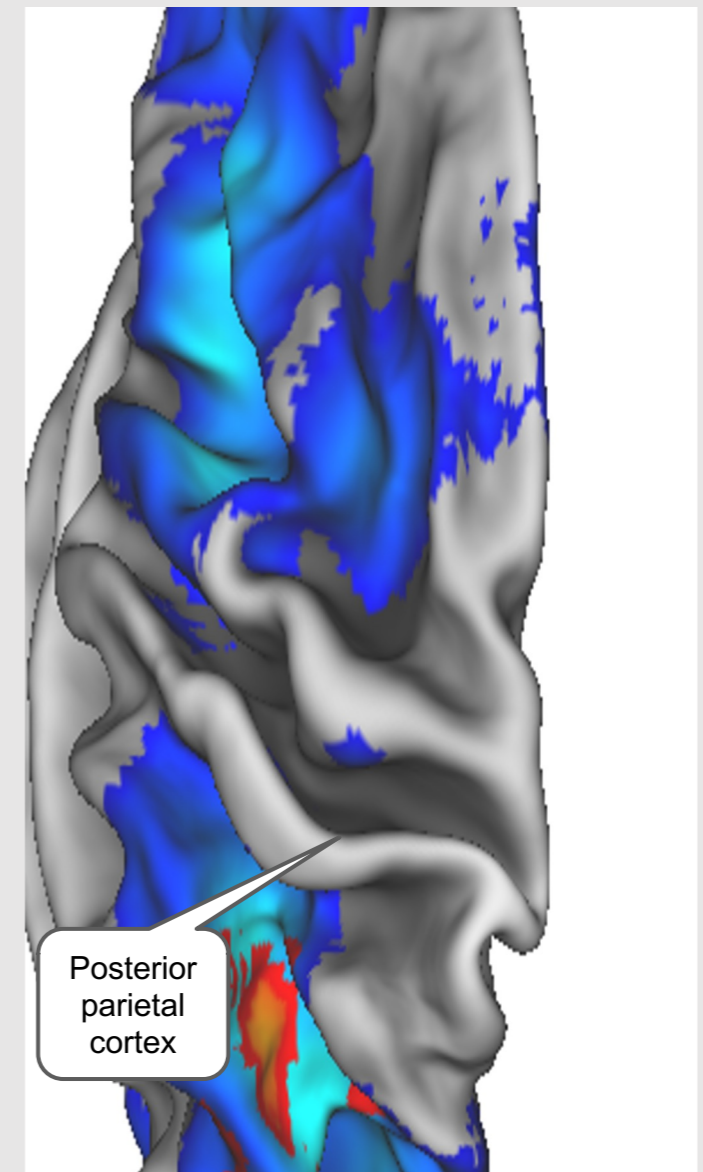
**Diffusion Tensor Imaging (DTI)**  
measures white matter tract integrity



**Functional Connectivity Analysis**  
measures cross-regional connectivity



**Task-related fMRI**  
measures brain activation during executive function task (flanker)



Strenziok 2014 (NeuroImage), Lin 2020 (NeuroImage), Lee 2019 (in submission)

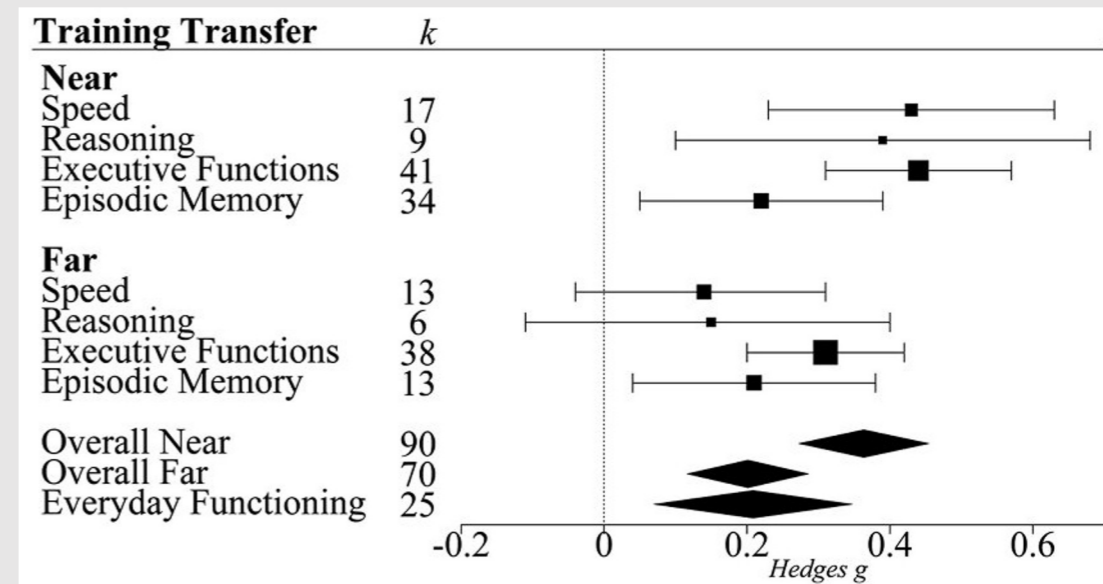
# Let's Look At A Lot of Studies With a Meta-Analysis



215 research studies of cognitive training



12,595 study participants



Significant benefits in both healthy aging and MCI; significant benefits to cognitive function and everyday functioning

Basak 2020



# Speed Training Was Remarkably Effective in the ACTIVE Study

The Processing-Speed Theory of Adult Age Differences in Cognition

Timothy A. Salthouse  
Georgia Institute of Technology



*Speed may be the central contributor to age-related cognitive decline*

Brain plasticity and functional losses in the aged: scientific bases for a novel intervention

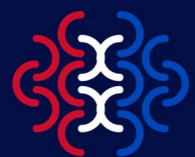
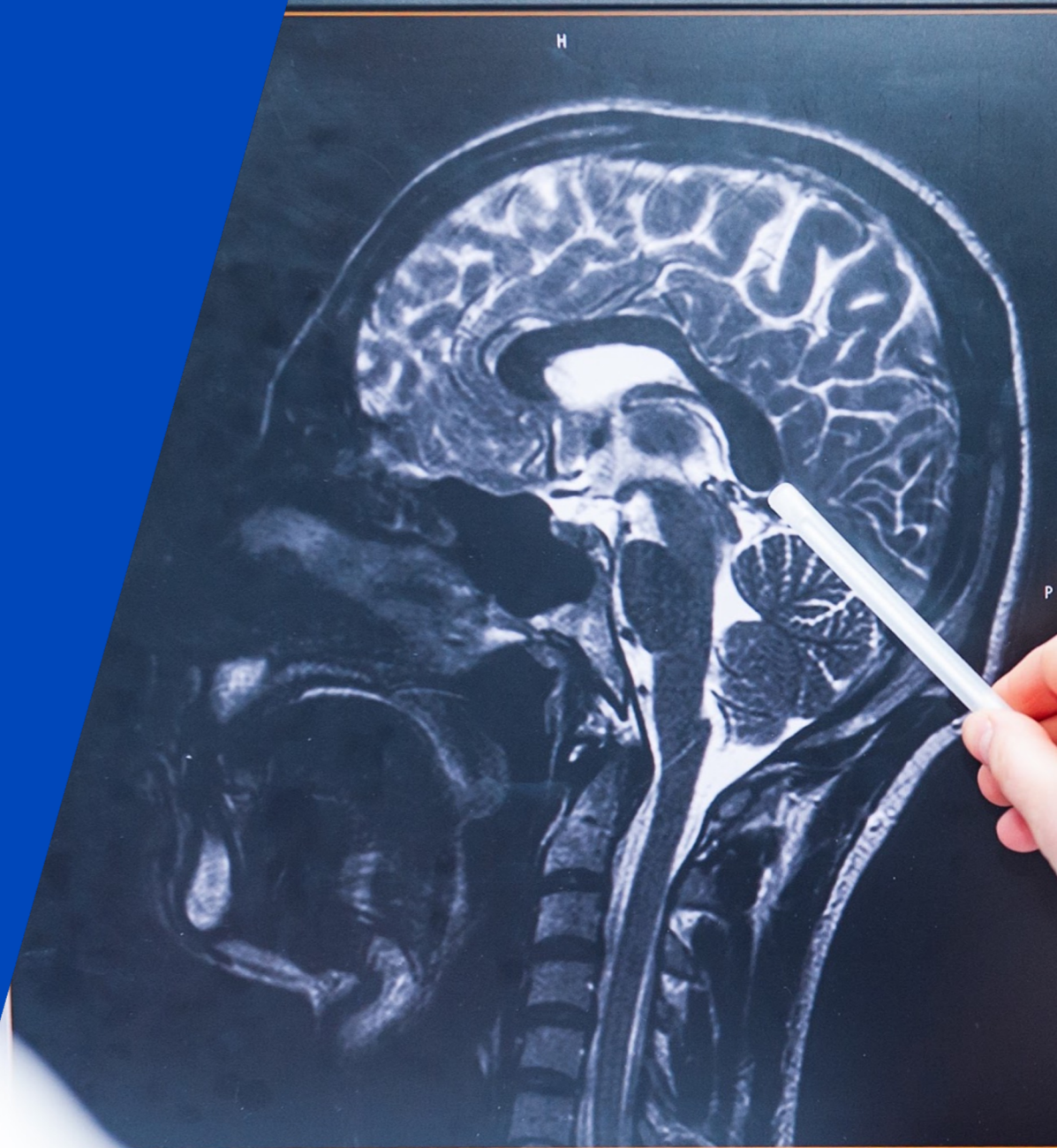
Henry W. Mahncke<sup>2</sup>, Amy Bronstone<sup>2</sup> and Michael M. Merzenich<sup>1,\*</sup>



*Speed training may be uniquely effective at driving brain plasticity*

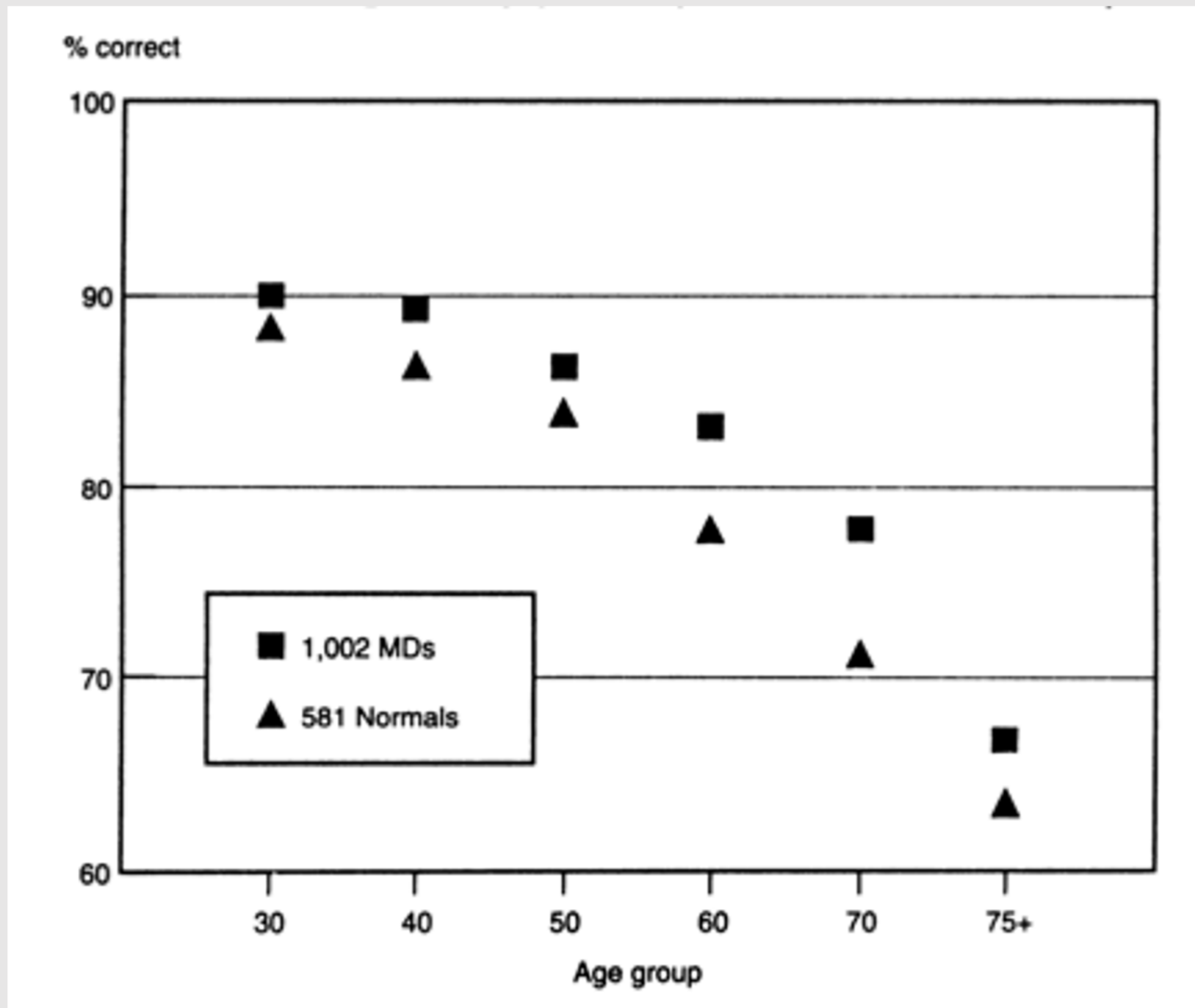
04

# Other benefits of addressing Cognitive Training



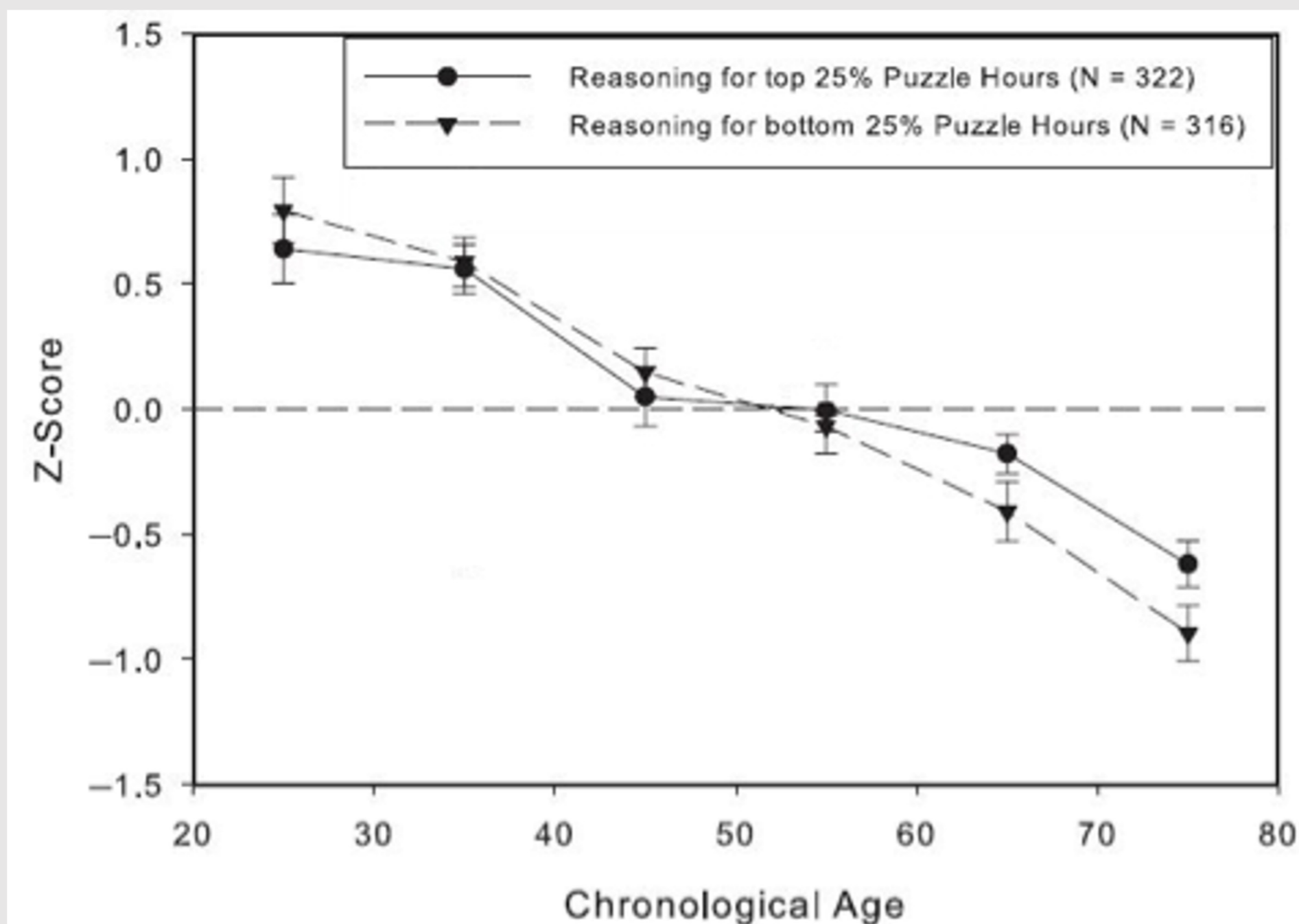
**BRAIN HEALTH  
ACADEMY™**  
UsAgainstAlzheimer's

# But Doctor, I'm a Doctor



- Cognitive decline occurs at the same rate in medical doctors and “normals”
- MDs seem to get dementia at about the same rate as “normals”
- Education lowers the risk of dementia – but perhaps this benefit has a ceiling affect by the end of college

# I've Heard Crossword Puzzles Are Good for the Brain



- Engaging in crossword puzzles does not seem to affect the rate of cognitive decline over time
- No notable randomized controlled trials
- Commonly used as control activities in studies of CCT

# Some Common Questions about Cognitive Training

## Questions

## Answer

### Benefits

- Don't people only get better at the task they practice on?

- ACTIVE show benefits in IADLs, everyday speed, driving safety, HRQoL, fall risk, depressive symptoms, and dementia risk, meta-analysis confirms real-world benefits

### Studies

- Are the studies good enough to rely on?

- The largest studies of brain health interventions are cognitive training studies

### Advertising

- Are commercial brain training programs scams?

- Review brain training programs claims carefully – ensure that strong scientific studies support claims

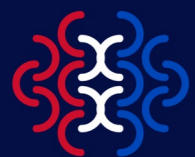
### Exercise

- Isn't physical exercise better than cognitive training?

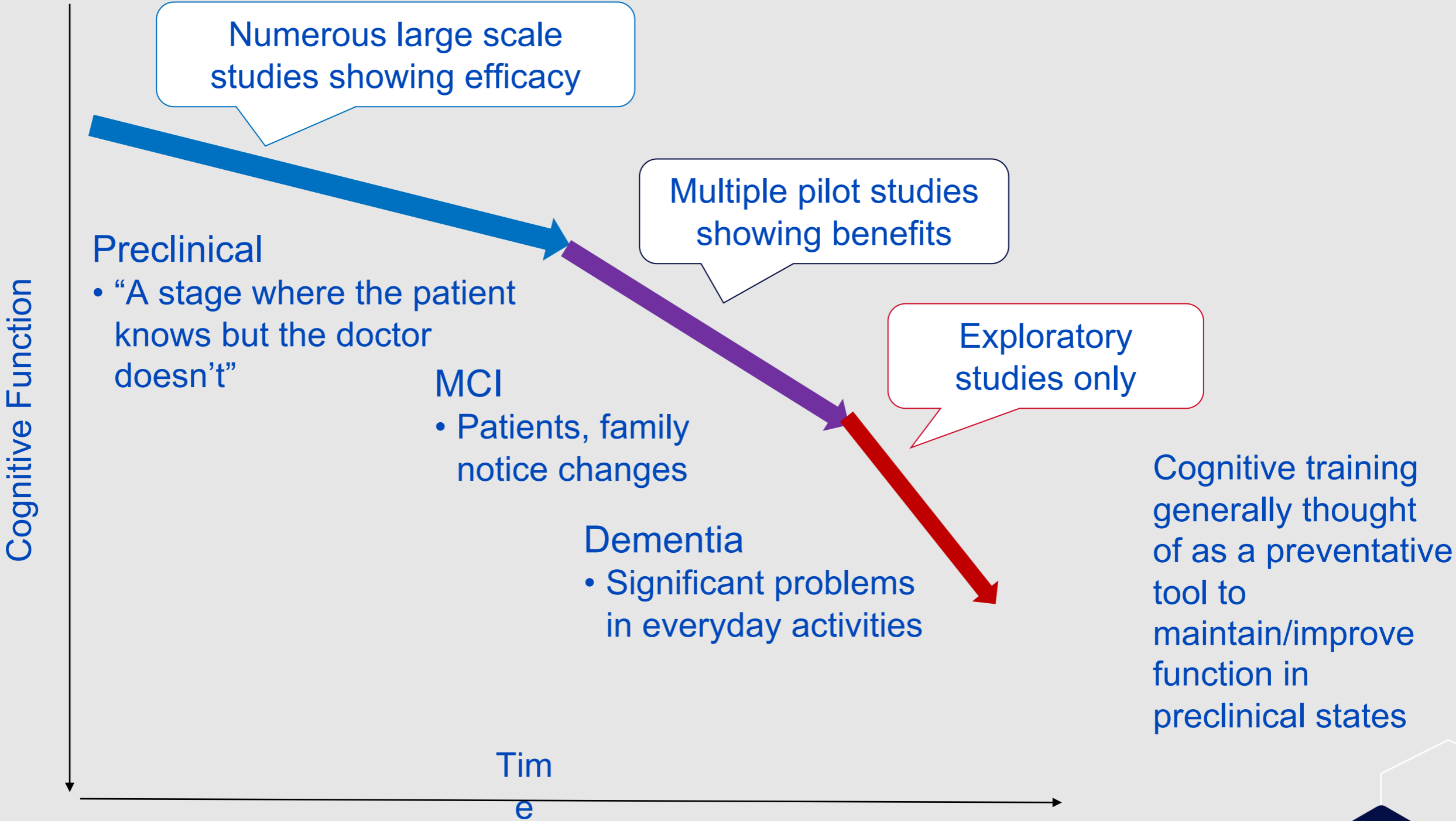
- Meta-analyses show that cognitive training effect size (0.29) is similar to physical exercise (0.29)

05

# Cognitive Training recommendations for primary prevention of cognitive decline



# When Is Cognitive Training Effective?



Adapted from the UCI MIND Institute

# Multiple Organizations Have Issued Clinical Guidelines for Brain Health

## Guidance

## Core Recommendations

National Academies

*Preventing Cognitive Decline and Dementia: A Way Forward*

- Physical exercise
- Cognitive training
- Blood pressure control

World Health Organization

*Risk Reduction of Cognitive Decline and Dementia*

- Physical exercise
- Cognitive training
- Nutrition/diet

American Academy of Neurology

*Practice guideline update summary: Mild cognitive impairment*

- Physical exercise
- Cognitive training

Alzheimer's Association

*Summary of the evidence on modifiable risk factors for cognitive decline and dementia: A population-based perspective*

- Physical <sup>32</sup>exercise
- Cognitive training
- Nutrition/diet

- HHS recently added a prevention goal to NAPA's Alzheimer's strategy
- Medicare approved "memory fitness" programs as a supplemental health benefit



# How To Select Evidence-Based Cognitive Training Programs

## Background

Most “cognitive training programs” are “computerized cognitive training programs” – with a few exceptions (does your hospital/clinic offer an in-person cognitive training program?)

There (unfortunately!) is no “FDA approved” list of evidence-based cognitive training programs

You and your patients (unfortunately!) have to evaluate cognitive training programs to make a good choice

## What To Look For

Strong evidence for efficacy

- Published RCTs available (not just white papers)
- Not just “designed to engage brain plasticity”

Good support for patients and coaches

- Patients will may need technical help
- Clinicians should have the ability to remotely monitor patient usage, progress, and performance and help as coaches

## What To Avoid

No evidence for efficacy

- “Brain games”

No support

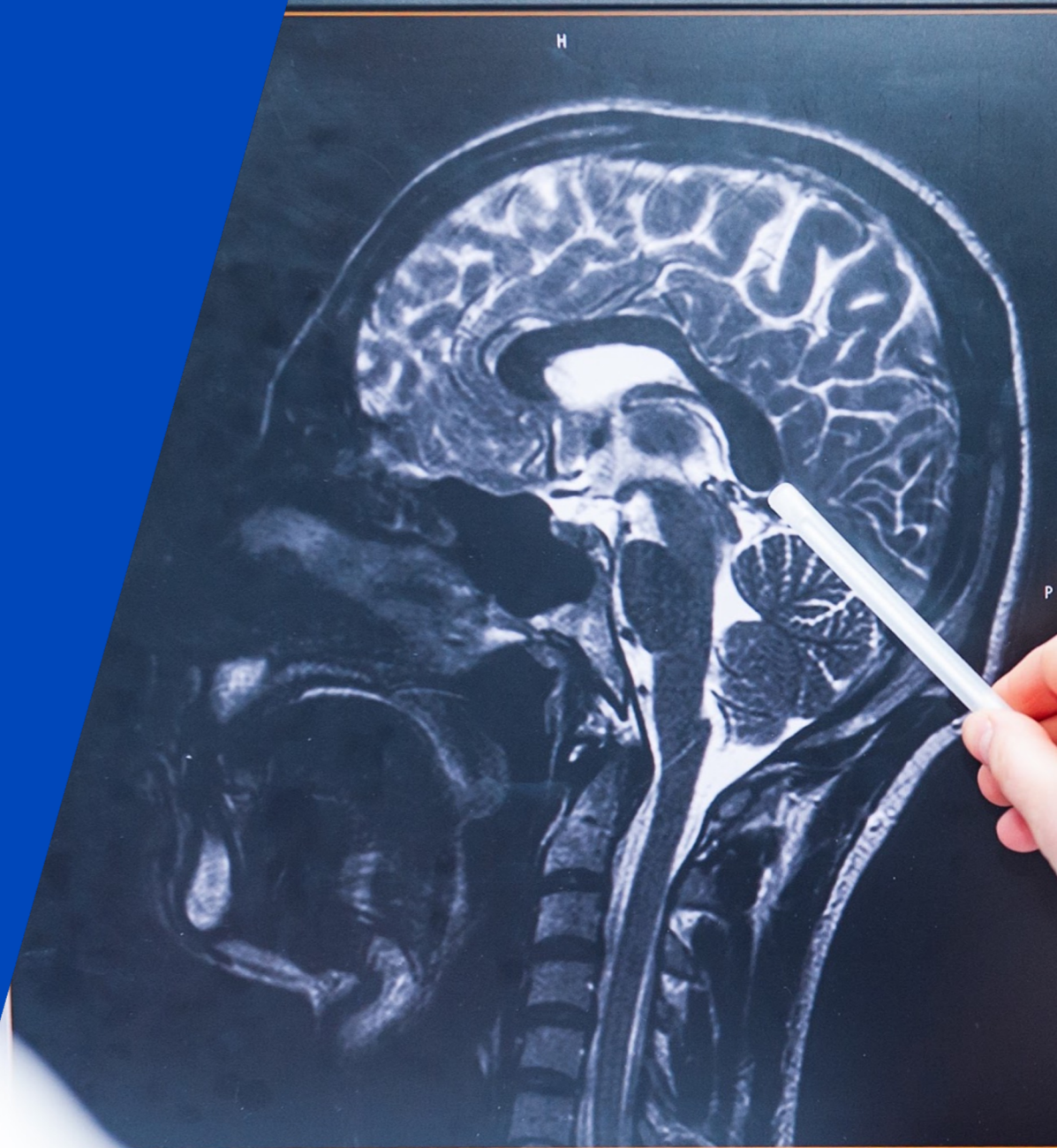
- Also “brain games”

Programs with withdrawn claims

- Federal Trade Commission
- Better Business Bureau

06

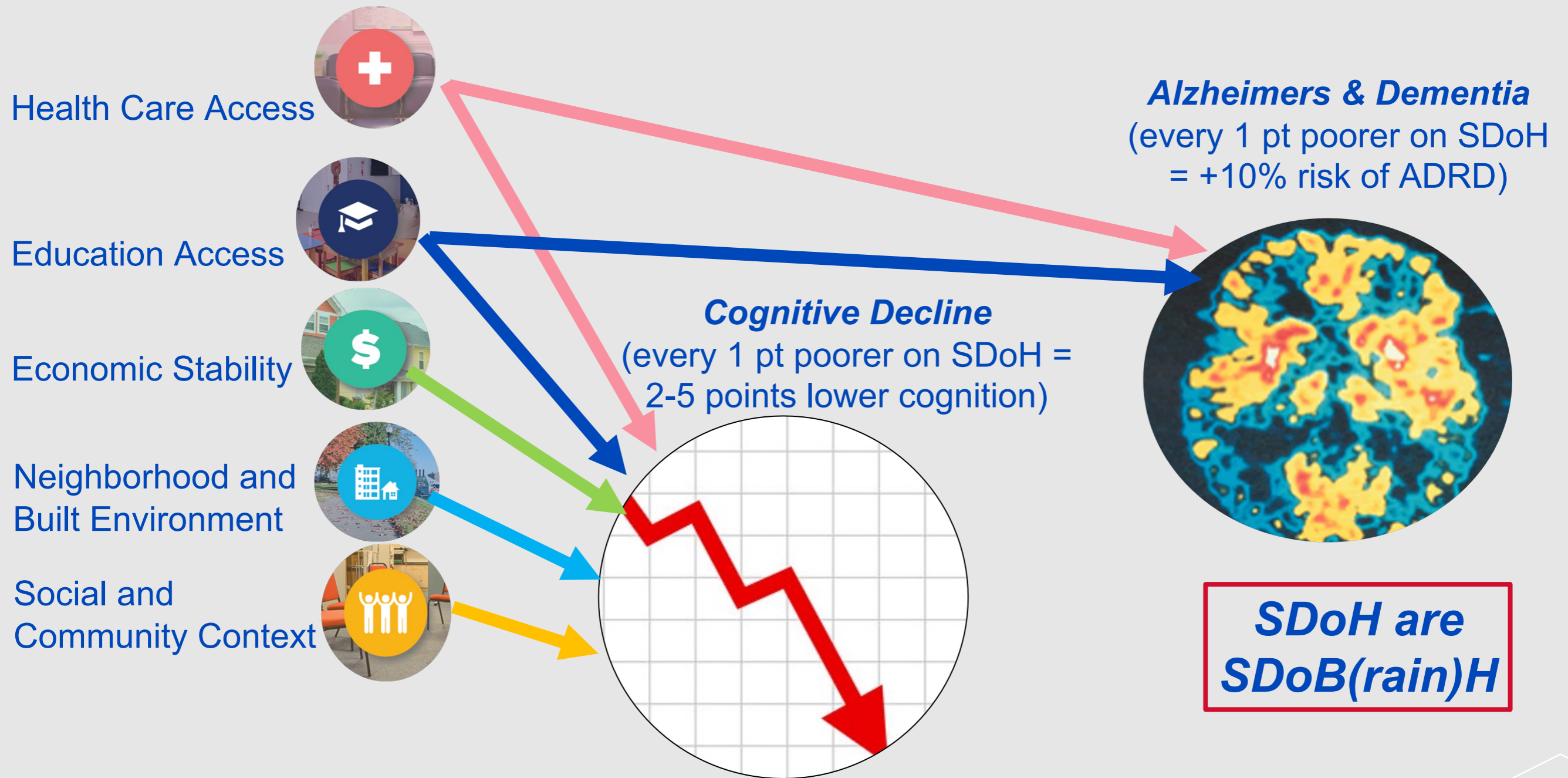
# Cognitive Training disparities and the impact of social determinants of health



**BRAIN HEALTH  
ACADEMY™**  
UsAgainstAlzheimer's

# Brain Health Is Determined By Social Environment

(well, significantly influenced by the social environment)



Clay 2023, Rebok 2023

# Digital Divide and Access Issues

*SDoH, Digital Divide, and Access Issues Can All Influence Access to and Success With Cognitive Training...*

I can't travel to group sessions

I don't have a computer and internet

I'm not going to be able to stick with it

You can't teach an old dog new tricks

*...But Many Of These Issues Can Be Addressed*

Zoom classes can be done remotely; Computerized cognitive training can be done remotely

Computerized cognitive training can be done on a cell phone, or library computer

Computerized speed training equally effective in low vs. high SDoH users

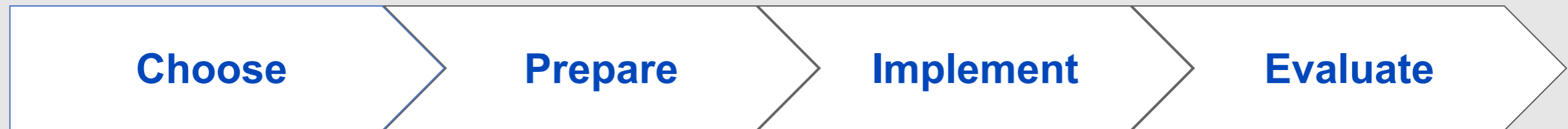
Classes and CCT can be engaging, compelling, social, and fun

07

# Considerations for implementation



# How To Implement Evidence-Based Cognitive Training in Health Care



- Review programs and services
- Evaluate efficacy
- Identify fit-for-use in your setting and population

- Train clinicians and coaches
- How to identify patients
- How to recommend to patients
- How to help patients start

- Train clinicians and coaches
- How to identify patients
- How to recommend to patients
- How to help patients start
- Integrate into Medicare Annual Wellness Visit

- Qualitative feedback from patients
- Quantitative surveys and cognitive assessments
- Integrate into Medicare Annual Wellness Visit

08

# What patients think



**BRAIN HEALTH  
ACADEMY™**  
UsAgainstAlzheimer's

# What Matters Most Insights Survey: Cognitive Training

- **84%** believe that cognitive training affects the brain & brain health
  - **46%** say the impact is significant
- **41%** experienced difficulties with concentration or problem-solving
  - **51%** of this group are at high risk for or living with ADRD
- **12%** experienced changes in their ability to perform daily tasks
  - **70%** of this group are officially diagnosed or at high risk for ADRD
- **41%** have spoken with their provider about their cognitive health
  - **42%** feel their provider does not address the importance of cognitive health or are unsure
  - **87%** respondents said their provider has not recommended activities to improve their brain health

- **64%** frequently engage in mentally stimulating activities
- Popular Mental Stimulation Activities: **77%** nutrition, **72%** exercise, **70%** good sleeping habits, **69%** games like cards or checkers, and **36%** playing music.
- **20%** participate in formal “brain training” apps or programs
- **91%** likely to share information on cognitive training/dementia prevention to peers/family

Respondents largely over age 65 (67%), Caucasian (94%), female (77%), college educated or greater (75%)

N=824 (ADRD/MCI diagnosis: 54; high risk for ADRD: 283; current caregivers: 89; former caregivers: 212; general interest in brain health: 186)



07

# Tools and resources for health professionals



**BRAIN HEALTH  
ACADEMY™**  
UsAgainstAlzheimer's

# Tools & Resources

- [Preventing Alzheimer's Disease: What Do We Know?](#)
- [Brain Health Equity Practical Guide](#)
- [BrainGuide™](#)
- [Primary Prevention Recommendations to Reduce the Risk of Cognitive Decline](#)
- [Provider Toolkit](#)

# References

1. Alzheimer's Association. (2022). 2022 Alzheimer's Disease Facts and Figures. Alzheimer's Association. <https://www.alz.org/media/Documents/alzheimers-facts-and-figures.pdf>
2. Alzheimer's Association. (2022). Causes and Risk Factors for Alzheimer's Disease. Alzheimer's Association. <https://www.alz.org/alzheimers-dementia/what-is-alzheimers/causes-and-risk-factors>
3. Alzheimer's Association. (2022). Younger/Early-Onset Alzheimer's. Alzheimer's Association. <https://www.alz.org/alzheimers-dementia/what-is-alzheimers/younger-early-onset>
4. Aranda, Maria P., Vega, William A., Richardson, Jason R., Resendez, Jason. (2019). Priorities for Optimizing Brain Health Interventions Across the Life Course in Socially Disadvantaged Groups. Florida International University and UsAgainstAlzheimer's.
5. Ball K et al. Effects of cognitive training interventions with older adults: A randomized controlled trial. *JAMA*. 2002;288(18):2271-2281.
6. Clay OJ et al. Evaluating social determinants of health domains and their predictive validity within Black/African American and White older adults from the ACTIVE trial. *J Aging Health*. 2023;35(9\_suppl):11S-18S.
7. de Villers-Sidani E et al. Recovery of functional and structural age-related changes in the rat primary auditory cortex with operant training. *Proceedings of the National Academy of Sciences*. 2010;107(31):13900-13905.
8. Ericsson KA et al. Acquisition of a memory skill. *Science*. 1980;208(4448):1181-1182.
9. Jobe JB et al. ACTIVE: A cognitive intervention trial to promote independence in older adults. *Controlled Clinical Trials*. 2001;22(4):453-479.
10. Rebok GW et al. Ten-year effects of the Advanced Cognitive Training for Independent and Vital Elderly cognitive training trial on cognition and everyday functioning in older adults. *JAGS*. 2014;62(1):16-24.
11. Rebok GW et al. The ACTIVE study: Association of race and social determinants of health (SDoH) with long-term outcomes and cognitive training effects. *J Aging Health*. 2023;35(9\_suppl):3S-10S.
12. Smith GE et al. A cognitive training program based on principles of brain plasticity: Results from the Improvement in Memory with Plasticity-based Adaptive Cognitive Training (IMPACT) study. *J Am Geriatr Soc*. 2009;57(4):594-603.
13. Willis SL et al. Long-term effects of cognitive training on everyday functional outcomes in older adults. *JAMA*. 2006;296(23):2805-2814.
14. Verghese J et al. Leisure activities and the risk of dementia in the elderly. *New England Journal of Medicine*. 2003;348(25):2508-2516.
15. Yates LA et al. Cognitive leisure activities and future risk of cognitive impairment and dementia: systematic review and meta-analysis. *International psychogeriatrics*. 2016;28(11):1791-1806.

# Acknowledgments



# Thank you!



This presentation and related resources are available at:

<https://www.usagainstalzheimer.org/cognitive-training-and-dementia>

Please register for additional courses at:

<https://www.usagainstalzheimer.org/brain-health-academy>

For more information, contact:

Latonya Aaron

UsAgainstAlzheimers

[laaron@usagainstalzheimer.org](mailto:laaron@usagainstalzheimer.org)