Promoting Healthy Cognitive Aging: Myth or Reality?

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My Better Mind:
Neurobiology and Cognition Mini-Symposium
Michigan State University

May 2, 2008
Outside of their own business, the ideas gained by men before they are twenty-five are practically the only ideas they shall have in their lives. They cannot get anything new. Disinterested curiosity is past, the mental grooves and channels set, the power of assimilation gone.”

William James (1893) *Principles of Psychology*
Exercise Your Brain!
“Use It or Lose It?”

“It’s a fortunate person whose brain
Is trained early, again and again,
And who continues to use it
To be sure not to lose it,
So the brain, in old age, may not wane.”

(Rosenzweig MR, Bennett EL. Behavioral Brain Research 1996;78:57-65)

“Despite the frequent assertions of the mental exercise hypothesis, its intuitive plausibility, and an understandably strong desire to believe that it is true......, there is currently little scientific evidence that differential engagement in mentally stimulating activities alters the rate of mental aging.”

(Salthouse TA. Mental exercise and mental aging: Evaluating the validity of the “Use it or lose it” hypothesis. Perspectives on Psychological Science 2006; 1:68-87.)
Recent Scientific Conferences on Cognitive Aging and Cognitive Training

- Symposium on Cognitive Training for Older Adults – NIA, March 2004
- Cognitive and Emotional Health Project: The Healthy Brain (NIH) - January 2006
- Does Mental and Physical Activity Promote Cognitive Vitality on Late Life – NIA R13 Conference Grant Meeting, March 2006
- Symposium on Cognitive Activity from Bedside-to-Bench – American Geriatrics Society, May 2006
- Cognitive Aging Conference Down Under, July 2007
- Cognitive Aging Summit, NIA/McKnight Brain Research Foundation, October 2007
Brain Aging and Public Health

- Cognitive decline and dementia now recognized as an important global public health problem
- Cognitive functioning in older adults predicts:
  - Performance of everyday tasks
  - Loss of independence
  - Institutionalization
  - Mortality
Cognitive Health

- Neuropsychological Performance
- Brain Morphology
- Socio-behavioral Resources
- Health Status
- Cognitive Reserve
- Biological Psychological Social
- Everyday Function
- Physical function

Systems affected
Aging, Cognitive Health, and Cognitive Decline

Age-Associated Cognitive Impairment
Mild Cognitive Impairment
Alzheimer's Disease

Cognitive Health?
Training on Basic Abilities: Background

• Programmatic Research on Basic Abilities: 1970’-1980’s
  – Early childhood education programs - plasticity
    • Does range of cognitive plasticity vary across life span?
  – Adult cognitive longitudinal studies: Variability in rate of cognitive decline

• Early Basic Ability Training in Old Age: 1970-1990
  – Focus on abilities showing “early” decline in 60’s (abstract reasoning, perceptual speed, working memory)
  – Ability-specific (single ability) training - focus on strategies associated with ability
  – Significant training effect compared to no-treatment or social contact control group (retest gain)
    • Training gain: 0.50-0.75 Sd
Training on Basic Abilities: Background (2)

- Some evidence for temporal durability of training effects (1 mo, 6 mo, 12 mo, 7 yrs)

- “New Questions” for Training Research:
  - Long-term clinical outcomes of interventions
  - “Transfer” to measures of functioning, everyday tasks

- Concerns re Generation 1 Training Research:
  - Representativeness of samples - regional, convenience samples; lack of diversity in samples
  - Clinical Trial Design - Intent to treat design - attrition
  - Replicability of findings
  - Clinically meaningful outcomes
  - ACTIVE
ACTIVE - Generation 2 of Cognitive Training Studies

- RFA initiated by NIA and NINR

- ACTIVE - Advanced Cognitive Training for Independent and Vital Elderly
  - Randomized Controlled Clinical Trial
  - Common multi-site intervention protocol with “proven interventions”
  - Include intent-to-treat analyses

- Primary Aim of ACTIVE
  - To test the efficacy of three cognitive interventions to improve or maintain the cognitively demanding activities of daily living.

- Important Shift in Major Outcome of Cognitive Training Research
  - Primary outcome is cognitively demanding activities, NOT Basic Cognitive Abilities. Outcome of ACTIVE trial specified by RFA
  - Thus, the pre-specified ACTIVE design necessarily had to use basic intervention strategies which are known to be challenging for achieving real-world transfer
ACTIVE Steering Committee

- University of Alabama-Birmingham
  Karlene Ball, Ph.D.
- Hebrew Rehabilitation Center for Aged, Boston
  John Morris, Ph.D.
- Indiana University
  Frederick Unverzagt, Ph.D.
- Johns Hopkins University
  George Rebok, Ph.D.
- Pennsylvania State University
  Sherry Willis, Ph.D.
- University of Florida / Wayne State University
  Michael Marsiske, Ph.D.
- New England Research Institutes, Coordinating Center
  Sharon Tennstedt, Ph.D.
- National Institute on Aging
  Jonathan King, Ph.D.
- National Institute of Nursing Research
  Kathy Mann-Koepke, Ph.D.
Baseline Characteristics (N=2,802)

- Mean Age: years 73.6 (5.9) Range 65-94
- Gender: Female 75.9%
- Race: African American 26.0%
- Education: H.S. diploma 88.6%
- Marital Status: Married 35.9%
- Cognitive Status: MMSE score 27.3 (2.0)
Age Distribution: Randomized Participants

Source: Morris et al., 2000
Study Outcomes include:

1. **Proximal outcomes**
   - Reasoning
   - Memory
   - Speed

2. **Primary outcomes**
   - Everyday problem solving
   - Everyday speed
   - Driving
   - ADL/IADL performance

3. **Secondary outcomes**
   - Service use
   - Health status
   - Life space

Source: Jobe et al., 2001
Hypothesized Model of Effects

- **Reasoning Training v. Control**
  - Reasoning
  - Everyday Problem Solving
  - Health-Related Quality of Life

- **Memory Training v. Control**
  - Memory
  - ADL/IADL Functioning
  - Mobility

- **Speed Training v. Control**
  - Visual Processing Speed
  - Everyday Speed
  - Health Service Utilization
  - Driving

Everyday Problem Solving
ADL/IADL Functioning
Everyday Speed
Driving

ADL/IADL Functioning
Everyday Speed
Driving

Health-Related Quality of Life
Mobility
Health Service Utilization
Common Structural Features of the Interventions

- Small-groups (3-5 participants per group)
- Led by a certified trainer with a scripted manual
- 10 sessions over a 6-week period
- 60-75 minutes per session
- Pre-specified order of sessions and rules for make-ups
- 80% compliance for successful completion
ACTIVE: Memory Training Techniques

- Begin with use of simple memory strategies (such as grouping) and move to more complex techniques (such as method of loci), progressively fading out external/retrieval cues.
- Subjects get at least 3 individual and group practice exercises per session, involving both lab-type tasks (word lists) and real-world tasks (shopping lists).
- Work with certified trainers in small groups of 3-5 with a manual, posters, and handouts.
Memory Man
Memory Man
ACTIVE: Inductive Reasoning Training

- Trainer demonstrates strategies to identify rule/pattern
- Participants practice solving problems using rule/pattern
- Participants receive feedback on performance
- Individual and group exercises involving application of the rule/pattern
### Finding the Pattern in Schedules

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Sunday</th>
<th>1. Scan or look over every word</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunday</td>
<td>Sunday</td>
<td>2. Underline repeated words</td>
</tr>
<tr>
<td>Monday</td>
<td>Monday</td>
<td>3. Say aloud the schedule</td>
</tr>
<tr>
<td>Tuesday</td>
<td>Tuesday</td>
<td>4. Make slashes between repetitions</td>
</tr>
<tr>
<td>Wednesday</td>
<td>Wednesday</td>
<td></td>
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<td>Thursday</td>
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<tr>
<td>Friday</td>
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</tbody>
</table>
Patterns in Medication Schedules

Look at Mr. Jones’ medication schedule. Fill in the calendar for one week. Put an A, B, or C in the calendar when he should take each medication. If he should take two pills of a certain medication at one time, put AA or BB. Below is a sample calendar:

<table>
<thead>
<tr>
<th>Time Of Day</th>
<th>Sun</th>
<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
<th>Thurs</th>
<th>Fri</th>
<th>Sat</th>
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<tbody>
<tr>
<td>Morning</td>
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<td>AA  B</td>
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<td>Evening</td>
<td>AA</td>
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<td>AA</td>
<td>AA</td>
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<td>AA</td>
<td>AA</td>
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<tr>
<td>Bedtime</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
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<td>C</td>
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</tbody>
</table>
# Weekly Medication Schedule – Mr. Jones

**Medication A:** Put an A in the schedule for when Medication A should be taken

**Medication B:** Put an B in the schedule for when Medication B should be taken

**Medication C:** Put an C in the schedule for when Medication C should be taken

<table>
<thead>
<tr>
<th>Time Of Day</th>
<th>Sun</th>
<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
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<tr>
<td><strong>Morning</strong></td>
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</tr>
<tr>
<td><strong>Bedtime</strong></td>
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</tr>
</tbody>
</table>
Effects of Cognitive Training Interventions With Older Adults
A Randomized Controlled Trial

Karline L.球, PhD
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Karen E. Holmes, PhD
Jared B. Davis, PhD
Mary J. Lewycky, PhD
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David M. Smith, MD
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Fredric W. Lassman, PhD
Sherry L. Walfas, PhD

for the ACTIVE Study Group

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, while also ensuring the independence and dignity of the aging population. A growing body of research supports the protective effects of late-life intellectual stimulation on incident dementia. Recent research from both human and animal studies indicates that neural plasticity endures across the lifespan, and that cognitive stimulation in the environment is an important predictor of maintenance and improvement in psychological variables. In the ACTIVE study, 2632 persons aged 65 to 94 years were randomly assigned to 1 of 4 groups: 10-session group training for memory (n=711), or reasoning (n=711), or both (n=711); or a no-contact control group (n=711). For the 3 treatment groups, 4-session booster training was offered to a 40% random sample 11 months later.

Main Outcome Measures: Cognitive function and cognitive demands every day 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 participants had 74% of reasoning, and 26% of memory-trained participants demonstrated reliable improvement immediately after the intervention period. Booster training enhanced training gains in speed and reasoning (P<.001) in participants receiving booster: 72%, no booster, 62%; 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 1 year.

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 7-14 year intervals. Because of minimal functional decline across all groups, longer follow-up is likely required to observe training effects on everyday functioning.

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Substantial and Durable Training Effects on Proximal Cognitive Outcomes

Memory Proximal Composite

Reasoning Proximal Composite

Speed Proximal Composite
Effect of Training on Cognitive Abilities: 5 yrs

- Memory composite
- Reasoning composite
- Speed composite

Standardized Training Effect Size (Control Group as Reference)
Effect of Training on Function: Self-Reported IADLs: 5 yrs

Mean IADL Difficulty Score

Time

Baseline (N=2802)  Year 1 (N=2325)  Year 2 (N=2234)  Year 3 (N=2101)  Year 4  Year 5 (N=1877)

Memory trained  Reasoning trained  Speed trained  Control
Training Effects on Daily Function: 5yrs

• All trained participants reported less difficulty with IADLs compared to control group; Significant only for Reasoning training.

• Training had no effect on performance-based measures of function. However, booster speed training improved performance in Everyday Speed.

• Training effects were modest, however have not been reported previously.
Timed IADL
Everyday Tasks Differ from Training
Other Studies Showing Training Effects on Daily Function
(Edwards et al., 2003; Roenker et al., 2005)

- Speed of Processing training has been shown to result in:
  - Fewer dangerous maneuvers while driving
  - Improved hazard detection in simulations
  - Faster reaction times to road signs
  - Increased mobility
  - Improved timed IADLs (e.g., selecting items from a grocery shelf)
Cognitive interventions vary in the type of memory processes invoked.
Responsiveness to Training

• Memory and Reasoning training are mediated by declarative memory systems

• Hypothesis: S’s with impaired declarative memory will have smaller training gains on Memory and Reasoning than non-memory impaired subjects

• Speed training is mediated by procedural memory systems

• Hypothesis: S’s with impaired declarative memory will not differ from non-memory impaired subjects on Speed training gains
Method

Subgroups based on memory ability:

• Rey-AVLT
• $T1+T2+T3+T4+T5 = \text{Sum Recall}$
• Age, education, ethnicity, ETS Vocabulary regressed on baseline Sum Recall score
• Memory Impaired: actual Sum Recall 1.5 SD below predicted level
• Memory Normal: actual Sum Recall at or above -1.5 SD of predicted level
Subject Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Memory Normal (n = 2580)</th>
<th>Memory Impaired (n = 193)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Age, years</td>
<td>73.5</td>
<td>5.8</td>
<td>74.5</td>
</tr>
<tr>
<td>Education, years</td>
<td>13.5</td>
<td>2.7</td>
<td>13.6</td>
</tr>
<tr>
<td>MMSE (0-30)</td>
<td>27.4</td>
<td>2.0</td>
<td>26.2</td>
</tr>
<tr>
<td>Gender (% Female)</td>
<td>75.9</td>
<td>-</td>
<td>74.6</td>
</tr>
<tr>
<td>Ethnicity (% White)</td>
<td>72.8</td>
<td>-</td>
<td>73.6</td>
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</table>
## Normal Memory vs Memory Impaired: Impact on Training on Memory, Reasoning, Speed

<table>
<thead>
<tr>
<th>Interven</th>
<th>Time</th>
<th>Memory</th>
<th>Reasoning</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory</td>
<td>PT</td>
<td>.300***</td>
<td>-.009</td>
<td>-0.050</td>
</tr>
<tr>
<td></td>
<td>A1</td>
<td>.254***</td>
<td>.033</td>
<td>-0.061</td>
</tr>
<tr>
<td></td>
<td>A2</td>
<td>.214***</td>
<td>.052</td>
<td>-0.057</td>
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<tr>
<td>Reason</td>
<td>PT</td>
<td>.001</td>
<td>.477***</td>
<td>0.025</td>
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<tr>
<td></td>
<td>A1</td>
<td>.013</td>
<td>.416***</td>
<td>-0.026</td>
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<tr>
<td></td>
<td>A2</td>
<td>-.003</td>
<td>.262***</td>
<td>-0.021</td>
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<td>Speed</td>
<td>PT</td>
<td>.004</td>
<td>-.017</td>
<td>-1.488***</td>
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<td>A1</td>
<td>.004</td>
<td>.009</td>
<td>-1.238***</td>
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<tr>
<td></td>
<td>A2</td>
<td>-.024</td>
<td>-.013</td>
<td>-0.886***</td>
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</table>

<table>
<thead>
<tr>
<th>Interven</th>
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<th>Memory</th>
<th>Reasoning</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory</td>
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<td>-.117</td>
<td>0.105</td>
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<td></td>
<td>A1</td>
<td>-.175</td>
<td>-.163</td>
<td>0.107</td>
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<tr>
<td></td>
<td>A2</td>
<td>-.100</td>
<td>-.015</td>
<td>0.400*</td>
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<td>Reason</td>
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<td>.573***</td>
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<td></td>
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<td>-.331</td>
<td>.276*</td>
<td>-0.434*</td>
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<tr>
<td>Speed</td>
<td>PT</td>
<td>-.108</td>
<td>-.111</td>
<td>-1.420***</td>
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<td></td>
<td>A1</td>
<td>-.163</td>
<td>-.097</td>
<td>-1.100***</td>
</tr>
<tr>
<td></td>
<td>A2</td>
<td>-.298</td>
<td>.079</td>
<td>-0.755***</td>
</tr>
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</table>

Unverzagt et al., 2007, *JINS*
Conclusions

- Memory function mediates response to structured cognitive interventions in ostensibly normal elders.
- Memory-impaired subjects do not benefit from memory-enhancement interventions.
- Memory-impaired subjects do benefit from training in reasoning and speed of processing.
- Examination of trainability of other cognitive subgroups (e.g., low reasoning, low speed) should be pursued.
Memory Strategy Use

1. To describe the effects of memory training on strategy use
2. To examine the effects of strategy use on verbal memory ability
3. To examine the effects of strategy use on everyday functional ability

Gross and Rebok, 2008, Cognitive Aging Conference (CAC)
Clustering Measures

- **Subjective Clustering**: Degree to which Ss cluster the same words together on sequential trials of a test (Heubrock, 1992)
- **Serial Clustering**: Degree to which Ss recall words together that were next to each other during the original word list presentation (Gershberg & Shimamura, 1995)
- **Semantic Clustering**: How often Ss recall together semantically related words in a given trial of a test (Bruce & Echemendia, 2003; Stricker et al., 2002)
Figure 5: HVL T Semantic clustering measures across trials

- - - - Baseline Controls
- - - Posttest Controls
- - Δ - Baseline Training
- - - - Posttest Training
- - - - 5th Year Controls
- - - - 5th Year Training

Baseline C ontrols
Posttest C ontrols
Baseline Training
Posttest Training
5th Year Controls
5th Year Training
Effects of Strategy Use on Everyday Functional Ability (CAC, 2008)

• Analyzed effects of specific mnemonic strategies used in verbal memory tests on functional outcomes.

• Conducted separate multivariate regression analyses controlling for age, gender, cognitive status (MMSE), race, health status, and education,

• All post-training strategy clustering scores strongly predicted cognitive function measured by OTDL and EPT five years later (p<0.05). HVLT semantic clustering scores appear most promising.
ACTIVE Phase III: Specific Aims

1. To determine if the cognitive interventions continue to have protective effects up to 10 years after initial training and 7 years after the last booster training on: a) basic cognitive abilities of memory, reasoning, and speed of processing; b) self-reported and performance-based instrumental activities of daily living; and c) health-related quality of life.

2. To determine if the cognitive interventions have beneficial effects on the distal outcomes of driving safety, personal care activities of daily living, health service utilization, and mortality.

3. To examine health, genetic, and cognitive moderators (including cardiovascular disease, diabetes, depression, APOE genotype, and low cognition and engagement) in individual response to training.

4. To estimate and project the effects of ACTIVE training to the general population of older adults by linking the measures and outcomes of ACTIVE to the Health and Retirement Study (and its subsidiary studies), a population-based, nationally-representative cohort.
Next-Generation Training Approaches

1. Experiential/engagement: global, non-ability specific interventions (e.g., Baltimore Experience Corps)

2. Trainer-less Training: collaborative, interactive (e.g., Willis’s work with older couples)

3. Technology-based: video training, computerized training, internet-based (e.g., In-Home Speed of Processing video training, Memory University, ACTIVE Memory Works)

4. Multimodal Training: combine different training modalities (e.g., Mind-Body training)
1. Experiential/Engagement

- “Engagement” hypothesis (e.g., Schooler & Mulatu, 2001; Verghese et al., 2003) – Age-related declines in cognitive functioning may to some extent be mitigated by a lifestyle marked by social and intellectual engagement
- Broad-based effects
- Evidence is correlational
We are an aging society

• By 2030:
  – 20% 65 and over, including 75 million baby boomers
  – 25% 60 and over
  – As many adults >65 as children <18
In an aging society...we will be living 1/3 of our lives after retirement
Major societal health challenges to be addressed

- Compression of morbidity for an aging society
- Educating the next generation: strong predictor of future health status
- Health disparities: young and old
- Competition for health resources between generations
Feelings of Usefulness as a Predictor of Disability & Mortality Over 7-Years in the MSSA

<table>
<thead>
<tr>
<th>Model</th>
<th>Mobility Disability (19.5%) OR^a</th>
<th>ADL Disability (13.3%) OR^a</th>
<th>Mortality (24.5%) OR^a</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model 1: Unadjusted</strong></td>
<td>Low feelings of usefulness^b</td>
<td>3.61**</td>
<td>3.22**</td>
</tr>
<tr>
<td></td>
<td>Moderate feelings of usefulness^b</td>
<td>1.21</td>
<td>1.14</td>
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<td><strong>Model 2: + Sociodemographic Covariates^c</strong></td>
<td>Low feelings of usefulness^b</td>
<td>3.18**</td>
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<td><strong>Model 3: + Behavioral psychosocial covariates^d</strong></td>
<td>Low feelings of usefulness^b</td>
<td>3.08**</td>
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<td>Moderate feelings of usefulness^b</td>
<td>1.07</td>
<td>1.05</td>
</tr>
</tbody>
</table>

p ≤ .05, ** p ≤ .01, *** p ≤ .001; N = 1,030

^a no change/slight improvement in disability used as reference category in analyses
^b high feelings of usefulness reference category in analyses
^c model 2 adds age, years of education
^d model 3 adds physical activity, alcohol use, smoking, volunteerism, social integration, depressed mood, and self-efficacy
The Experience Corps Program

A new model of senior service and health promotion that simultaneously creates generative roles for older adults while meeting unmet needs of public elementary schools. Designed in 1994-1995 by Linda Fried and Marc Freedman.

Funded by the Johns Hopkins Prevention Center, Maryland State Department of Education, Baltimore City Public Schools, Baltimore City Commission on Aging and Retirement Education, Greater Homewood Community Corporation, Corporation for National Service, Retirement Research Foundation, and the Erickson Foundation.
Baltimore Experience Corps Model

- Volunteers 60 and older
- Serve in public elementary schools: K-3
- Meaningful roles; important needs
- High intensity: ≥15 hours per wk
- Reimbursement for expenses: $150/mo
- Sustained dose: full school year
- Critical mass, teams
- Health behaviors: physical, social, and cognitive activity
- Leadership and learning opportunities
- Infrastructure to support program
- Program evaluation
- Diversity

- Freedman M, Fried LP; Experience Corps monograph, 1997
“YOU ARE A FRIEND IN THE CLASSROOM.”

AUDREY WEEMS, 70, READING A STORY TO STUDENTS IN A THIRD-GRADE CLASS AT WAVERLY. A MOTHER OF EIGHT, SHE WORKED AT THE SOCIAL SECURITY ADMINISTRATION FOR 35 YEARS, RETIRING IN 2002. WEEMS LEARNED ABOUT THE BALTIMORE EXPERIENCE CORPS PROGRAM THROUGH HER CHURCH.
Causal Pathway: Experience Corps

Experience Corps Participation - Generative Role Performance

Intervention

Primary Pathways

Mechanisms

Performance-based measures Secondary outcomes and intermediate mechanisms

Primary/ [Self Report] Outcomes

↑ or preserved function or delayed decline in:

Mobility Function

Physical Activity

Strength, balance

Walking Speed

Falls

Cortical plasticity; Memory Executive function

Frailty

Complex task performance

Social Activity, Engmnt.

Social Integration & Support Generativity

IADLs

Psycho-Social Well-being
Causal Pathway
Child Outcomes

Intervention | Primary Pathways | Mechanisms | Primary Outcomes

Experience Corps Participation - Generative Role Performance

Academic Stimulation

Behavioral Management

Readiness For Learning

Reading/ Academic Performance

Classroom Behavior

↑ vocabulary

↑ alphabet recognition

↑ reading

↓ disciplinary removals

↓ aggression

↑ social skills

↑ school attendance

↑ motivation to learn

↑ concentration/readiness

↑ ↓ school service utilization
Causal Pathway
School Outcomes

Intervention: Experience Corps Participation - Generative Role Performance

Primary Pathways: Child building pathway (direct impact on children K-3 from face-to-face interaction), Social capital pathway (indirect impact on the school)

Mechanisms:
- Child Parameters: Literacy Skills, Readiness to learn, Behavioral disruptions
- Teacher parameters: Teacher efficacy, Teacher morale, Time on task
- School Parameters: Community resources, Parent participation, Collective efficacy

Primary Outcomes:
- Improved aggregate academic performance
- Improved school climate
- Improved teacher retention
- Improved volunteer retention
  Higher program satisfaction
  Higher personal and collective efficacy

Cost Benefits: Children School
## Baseline Characteristics of Experience Corps Participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Range: 60-91)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60-65</td>
<td></td>
<td>31%</td>
</tr>
<tr>
<td>66-70</td>
<td></td>
<td>33%</td>
</tr>
<tr>
<td>&gt; 71</td>
<td></td>
<td>36%</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>18%</td>
</tr>
<tr>
<td>Race</td>
<td>Black</td>
<td>92%</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>8%</td>
</tr>
<tr>
<td>Married</td>
<td></td>
<td>24%</td>
</tr>
<tr>
<td>Education</td>
<td>High school or less</td>
<td>82%</td>
</tr>
<tr>
<td>Health</td>
<td>Excellent/very good</td>
<td>29%</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>Fair</td>
<td>12%</td>
</tr>
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</table>
What We’ve Learned So Far

• Can recruit and retain a large group of elderly volunteers
• Volunteers accept the need for randomization
• Program perceived as widely attractive to older adults, well-accepted by participants, including principals, teachers, and children
• Results show initial positive benefit in selected areas of function among older adults:
  – physical: improved chair stand
  – cognitive: improved executive functioning
Change in Blocks Walked Per Week

Walking Distance(block) per Week

% of Change from BL to F

-15.0%  -10.0%  -5.0%  0.0%  5.0%  10.0%  15.0%  20.0%  25.0%  30.0%  35.0%

Intervention  Control

31.4%  -9.0%

Fried 2004
Physical Performance by Health Status

Percent of volunteers demonstrating improvement in physical performance measures after volunteering for 4-9 months, by baseline health

- Improvement in grip strength
- Improvement in walking speed
- Improvement in chair stand speed
- Improvement in stair climbing speed

- Excellent or very good initial self-reported health
- Good initial self-reported health
- Fair initial self-reported health

P=0.05
Social support: EC Preliminary pilot data (@ 12mos)

- Want more emotional support
- Feel I made a difference
- Feel others need me
- # people around to check on you
- # reported ties

<table>
<thead>
<tr>
<th>Percent</th>
</tr>
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<tbody>
<tr>
<td>-30</td>
</tr>
<tr>
<td>-20</td>
</tr>
<tr>
<td>-10</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>20</td>
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EC Control
EC Functional Brain MRI (fMRI)
Pilot Study (Drs. Carlson, Kramer, & Colcombe)

Demographics of Intervention (N=8) & Controls (N=9)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Participants</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean years</td>
<td>68 (r: 62-78)</td>
<td>68 (r: 63-75)</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>8 (100)</td>
<td>9 (100)</td>
</tr>
<tr>
<td>African American, n (%)</td>
<td>8 (100)</td>
<td>9 (100)</td>
</tr>
<tr>
<td>Education, mean years</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Widowed, n (%)</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>MMSE, mean</td>
<td>24.5</td>
<td>25.6</td>
</tr>
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</table>
Circle Flanker Task
adapted from Botwinick et al. (1999)

Most difficult condition

- Press Left button when central arrow = <
- Press Right button when central arrow = >

<table>
<thead>
<tr>
<th>Small</th>
<th>Congruent</th>
<th>Incongruent</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;&gt; &gt;&gt; &gt;&gt; &gt;&gt;</td>
<td>&gt; &gt; &gt; &gt; &gt; &gt;</td>
<td>&lt;&lt; &gt; &lt; &lt; &lt;</td>
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<td>&gt; &gt; &gt; &gt; &gt; &gt;</td>
<td>&lt;&lt; &gt; &lt; &lt; &lt;</td>
</tr>
</tbody>
</table>
EC participants show improved performance on difficult condition after 6 months exposure
EC participants > Controls on test of executive function following 6 month exposure

PFC= prefrontal cortex; ACC= anterior cingulate cortex

Carlson, Erickson, Kramer, Colcombe, Mielke, Kim, & Fried, submitted
Randomized, Controlled Trial of Experience Corps in Baltimore

- Funded by NIA BSR
- Randomize:
  - 1046 people 60 and older to EC or control
  - Randomize 48 public elementary schools to EC or controls
- Outcomes:
  - Primary: Disability: mobility
  - Secondary: IADL disability; memory, frailty, falls
Hypothesized Outcomes for Children and Schools

• Selective improvements in reading/ academic performance, classroom behavior, and readiness-to-learn among urban children participating in the EC program
• Help reduce student absenteeism
• School climate will improve
• Increased teacher retention
• Direct positive association between improved school performance and older EC volunteer retention and satisfaction
3rd Graders' Mean Change (%) of Maryland School Assessment Scores from 2004-2005 to 2005-2006

*Significant difference between EC and non-EC schools
Change in Number of Suspensions from 2003-2004 to 2005-2006
(Original + New Schools)

<table>
<thead>
<tr>
<th>Class</th>
<th>Kindergarten</th>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Grade 3</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Series 1</td>
<td>EC</td>
<td>Non-EC</td>
<td>EC</td>
<td>Non-EC</td>
<td></td>
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<tr>
<td>Series 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Change of Suspensions

- Kindergarten
- Grade 1
- Grade 2
- Grade 3
- Total

Legend:
- EC
- Non-EC
2. “Trainerless” Training: Collaborative Pairs
(Saczynski, Margrett & Willis, 2004; Margrett & Willis, 2006)

- Participant-directed training, rather than trainer-directed
- Examination of collaborative vs Individual-level training
- Context: Out of the lab, into the natural context of elderly (home-based)
- Older Couples
- 10-session inductive reasoning protocol
Does increase in strategy use differ by reasoning training condition?

PAIRS: Immediate Posttest
3 Month PAIRS: Delayed Posttest

Delayed Posttest Letter Series

Occasion

Pretest Delayed Posttest

Collaborative Individual Control
3. Technology-Based: In-Home Video ACTIVE Training Study

• Developed and evaluated a modification of the standardized Speed of Processing training protocol for home use.

• Emphasis on accessibility and affordability.
Standard versus Home-based Training

• STANDARD
  – Lab-based
  – Trainer-facilitated
  – Computer-based
  – 8-10 sessions
  – 5 weeks

• HOME-BASED
  – Home-based
  – Self-administered
  – Videotape-based
  – 8-10 sessions
  – 5 weeks
Results: Improvements in Processing Speed

-350 -300 -250 -200 -150 -100 -50 0

-350 -300 -250 -200 -150 -100 -50 0

no contact social contact standard training home based training

- **Primary Aim:** to compare the Mind-Body Program, a combined life style and computer-based memory training program to the Memory-Web program, a combined web experience and computer-based memory training program.

Funded by the Erickson Foundation
Primary Aim Hypotheses:

1. Participants in the Mind-Body program will have an enhanced effect on memory performances compared to the participants in the Memory-Web program and no contact control.

2. Participants in the Mind-Body and Memory–Web programs will show improvements in memory performance as compared to the no contact control group.
Intervention

• Mind-Body-Sessions
  – 40-45 minutes working on specific activities using Facts and Figures CD-ROM
  – Engage in 20-25 minutes group activity
    • Discuss the benefits of mental and physical exercise
    • Set goals for improving their memory and physical activity step count for the week (↑step count by 5%)
Memory Works Training

- Memory Works: **Facts and Figures** (list learning and numbers)
- One-on-one individualized training
- Self-guided and paced
- Trainers facilitate computer use

[Memory Works Training](http://www.memoryzine.com)
Some Caveats about Cognitive Training for Promoting Healthy Cognitive Aging

• Training gains may be of lower magnitude than many elderly, patients, and caregivers expect and progress may not be steady; problem of raising “false hope” and “blaming the victim” for cognitive declines

• Training effects tend to be highly task-specific and show limited generalizability; effects are reasonably durable but maintenance doesn’t automatically occur.

• Training may not prevent cognitive decline, BUT it can boost performance and may delay normative cognitive decline. A few sessions of cognitive training may not be sufficient to alter the life course with respect to decline, BUT it may compress the point of cognitive disability into a smaller window at the end of life.
“Bottom-up” or “top-down” interventions?

- The extreme “top down” position would be to train at the level of complex activities, and not at the level of basic abilities
  - Through planful, deliberate exercise of complex tasks, we may simultaneously exercise the underlying constituent abilities on which those tasks depend, and their coordination. This is the implied mechanism from correlational data suggesting that complex activity as a protective mechanism for late life cognition (e.g., Wilson et al., 2002; Arbuckle, Schooler, Mulatu, & Oates, 1999; Schaie, 1983; but see Hertzog, Hultsch, & Dixon, 1999)

- Do our cognitive interventions need to be “activity prescriptions”?
“Bottom-up” or “top-down” interventions?

- The problem of intervening at the level of complex activity is that we do not yet have a good understanding of which activities, at which intensity, exercise particular abilities.
  - What we need is the equivalent of understanding which “muscle groups” are moved by particular physical exercises.

- Careful experimental work needs to be done to link particular abilities to particular activities...
To be determined:

• What are the best methods for specific training and transfer outcomes?
• How can current cognitive theory inform cognitive training, and vice versa?
• How should we define successful training and transfer?
• Who are the best candidates for successful training?
• Does cognitive training in later adulthood develop cognitive reserve or serve a protective function?
• How do we make training accessible and cost-effective?
Contact Information

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