Cognitive Training Interventions for Delaying Cognitive Decline

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Disclosures

• No relevant financial disclosures
Brain Fitness is Popular!
Major focus in a 2015 report from the Institute of Medicine

http://www.nap.edu/catalog/21693/cognitive-aging-progress-in-understanding-and-opportunities-for-action
Cognitive Stimulation vs. Training

- **Cognitive stimulation**: crossword puzzles, card games, etc.

- **Cognitive training**: formal instruction and strategies
Key Questions

- **Does stimulation and/or training:**
  - help maintain or enhance memory and thinking ability?
  - help with real world tasks?
  - transfer to another, non-trained cognitive domain?
Training Examples

• Randomized clinical trial - the ACTIVE trial
• Training + non-pharmacological treatment - FINGER
• Embed in “real world” community settings - Experience Corps
ACTIVE

• Advanced Cognitive Training for Independent and Vital Elderly
• Memory, reasoning, or speed of processing training vs. control group
ACTIVE Participants

- Targeted older adults at risk for decline recruited from 6 sites across United States

- Excluded:
  - Age < 65 years
  - Substantial cognitive decline
    - MMSE < 23
    - Self-reported Alzheimer's disease
  - Substantial functional decline
    - Assistance with dressing, personal hygiene, bathing
  - Specified predisposing medical conditions
### Baseline Characteristics (N = 2,802)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age [range]</td>
<td>73.6±5.9 [65-94]</td>
</tr>
<tr>
<td>Gender, % Female</td>
<td>75.9%</td>
</tr>
<tr>
<td>Race, % African American</td>
<td>26.0%</td>
</tr>
<tr>
<td>Education, % HS diploma</td>
<td>88.6%</td>
</tr>
<tr>
<td>Marital status, % married</td>
<td>35.9%</td>
</tr>
<tr>
<td>Mean MMSE score [range]</td>
<td>27.3±2.0 [23-30]</td>
</tr>
</tbody>
</table>
Training in ACTIVE

• 10, 60-75 minute training sessions
• Small groups, led by instructor, individual & group exercises
• Focus on strategies for problem solving, remembering, or responding quickly to information
• Goal to apply learned strategies to real-world tasks
• Did not “teach to the test”
ACTIVE Conceptual Model

Willis et al, JAMA. 2006;296(23):2805-2814.
ACTIVE Training

• Memory Training
  – Grouping items into meaningful categories
  – Visual imagery & associations
  – Hierarchical ordering
  – External aids & cues

• Reasoning Training
  – practice solving problems using rule/pattern

• Speed of Processing
  – Useful field of view
ACTIVE: Memory Training

Memory Man

1. Hair—Fish
2. Forehead—Flower
3. Eye—Hammer
4. Ear—Leaf
5. Nose—Baseball
6. Mouth—Soda
7. Shoulder—Barn
8. Chest—Piano
9. Elbow—Telephone
10. Forearm—Truck
11. Hand—Book
12. Thigh—Sailboat
13. Knee—Bucket
14. Ankle—Gloves
15. Toes—Cheese
ACTIVE: Memory Training

Memory Man
ACTIVE Reasoning: Finding the Pattern in Schedules

- **Sunday**  
  1. **Scan or look over** every word

- **Sunday**  
  2. **Underline** repeated words

- **Monday**  
  3. **Say aloud** the schedule

- **Tuesday**  
  4. **Make slashes** between repetitions

- **Tuesday**

- **Wednesday**

- **Thursday**

- **Thursday**

- **Friday**

- **Friday**
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>
</tr>
</thead>
<tbody>
<tr>
<td>Morning</td>
<td>AA  B</td>
<td>AA  B</td>
<td>AA  B</td>
<td>AA  B</td>
<td>AA  B</td>
<td>AA  B</td>
<td>AA  B</td>
</tr>
<tr>
<td>Noon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evening</td>
<td>AA</td>
<td>AA</td>
<td>AA</td>
<td>AA</td>
<td>AA</td>
<td>AA</td>
<td>AA</td>
</tr>
<tr>
<td>Bedtime</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
</tbody>
</table>
Courtesy of Karlene Ball, UAlabama Birmingham Roybal Center for Research Applied Gerontology
ACTIVE 5 Year Results

Willis et al, JAMA. 2006;296(23):2805-2814.
ACTIVE: 10 Year Results: Memory

Rebok et al. JAGS 2014
ACTIVE: 10 Year Results: Reasoning

Rebok et al. JAGS 2014
ACTIVE: 10 Year Results: Speed of Processing

Rebok et al. JAGS 2014
Impact on Everyday Activities

Rebok et al. JAGS 2014
ACTIVE Findings To Date

- Observable benefits 5-10 years after training
- Effects appear earliest for speed of processing participants
- Memory-impaired participants only benefited from speed of processing and reasoning training
- No subjective memory improvement
- Reduces age-related declines in health-related quality of life
Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability (FINGER)

- **Intervention Information Conference**
  - Diet and nutrition
  - 8 group meetings
  - 3 individual appointments

- **Physical exercise**
  - Strength: 1 to 2 times a week
  - Cardio: 2 to 4 times a week

- **Physical exercise**
  - Strength: 2 times a week
  - Cardio: 4 to 5 times a week

- **Physical exercise**
  - Strength: 2 times a week
  - Cardio: 4 to 5 times a week

- **Cognitive exercises**
  - 9 group meetings
  - Independent training

- **Cognitive exercises**
  - 2 group meetings
  - Independent training

- **Monitoring and controlling cardiovascular diseases**
  - Nurse: 6 appointments / Physician: 3 appointments

- **To avoid overwhelming the participants, not all lifestyle changes were implemented at once.**
- **The level of difficulty of the physical and cognitive exercises was increased over the course of the study.**
- **Efforts were made throughout the study to improve the participants’ diet.**
FINGER Results: 2 Years

Novel Approach to Delaying Cognitive Decline

http://www.aarp.org/experience-corps/
Experience Corps

Fried et al. (2004) *J Urban Health*

www.banneralz.org/
# Experience Corps Participants

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intervention (N = 70)</th>
<th>Control (N = 58)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, M (SD)</td>
<td>70.1 (6.42)</td>
<td>68.4 (5.15)</td>
</tr>
<tr>
<td>Education (years), M (SD)</td>
<td>11.9 (2.54)</td>
<td>11.2 (2.66)</td>
</tr>
<tr>
<td>Baseline MMSE score, M (SD)</td>
<td>24.96 (3.45)</td>
<td>25.3 (2.60)</td>
</tr>
<tr>
<td>Annual income &lt;$15,000, %</td>
<td>65</td>
<td>82</td>
</tr>
<tr>
<td>Black, %</td>
<td>94</td>
<td>95</td>
</tr>
<tr>
<td>Female, %</td>
<td>83</td>
<td>93</td>
</tr>
<tr>
<td>Married, %</td>
<td>24</td>
<td>28</td>
</tr>
<tr>
<td>Number of health conditions</td>
<td>2.6 (1.7)</td>
<td>2.6 (1.3)</td>
</tr>
<tr>
<td>Persons with health conditions diagnosed by a physician, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Angina</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>High blood pressure</td>
<td>68</td>
<td>73</td>
</tr>
<tr>
<td>Diabetes</td>
<td>30</td>
<td>24</td>
</tr>
<tr>
<td>Stroke</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Arthritis of knees/hip</td>
<td>43</td>
<td>40</td>
</tr>
<tr>
<td>Arthritis of hands</td>
<td>26</td>
<td>41</td>
</tr>
<tr>
<td>Cancer</td>
<td>9</td>
<td>5</td>
</tr>
</tbody>
</table>

Experience Corps Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intervention</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Follow-Up</td>
</tr>
<tr>
<td>Trail Making Test</td>
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</tr>
<tr>
<td>Part A (s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impaired</td>
<td>95.2</td>
<td>56.5</td>
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<tr>
<td>Normal</td>
<td>56.3</td>
<td>51.1</td>
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<tr>
<td>Part B (s)</td>
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</tr>
<tr>
<td>Impaired</td>
<td>297.5</td>
<td>173.0</td>
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<tr>
<td>Normal</td>
<td>118.7</td>
<td>154.7</td>
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<tr>
<td>Word list memory</td>
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<tr>
<td>Immediate recall</td>
<td></td>
<td></td>
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<tr>
<td>Impaired</td>
<td>19.3</td>
<td>20.9</td>
</tr>
<tr>
<td>Normal</td>
<td>21.4</td>
<td>19.9</td>
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<tr>
<td>Delayed recall</td>
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<td></td>
</tr>
<tr>
<td>Impaired</td>
<td>5.0</td>
<td>7.0</td>
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<tr>
<td>Normal</td>
<td>5.9</td>
<td>5.6</td>
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<tr>
<td>Rey-Osterrieth</td>
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<td>Copy score</td>
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<tr>
<td>Impaired</td>
<td>18.4</td>
<td>17.8</td>
</tr>
<tr>
<td>Normal</td>
<td>20.0</td>
<td>17.8</td>
</tr>
<tr>
<td>Delayed recall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impaired</td>
<td>9.1</td>
<td>12.8</td>
</tr>
<tr>
<td>Normal</td>
<td>12.0</td>
<td>11.5</td>
</tr>
</tbody>
</table>

Note: *p < .05.
Experience Corps Findings

• Improved executive functioning and memory, particularly in participants with impaired executive functioning at start of program
• Improved social and physical activity (walking, stair climbing speed, strength) levels
• Short-term participation in community-based program focused on increasing cognitive & physical activity in a social, real-world setting may benefit abilities that are critical to functional independence
Brain Fitness & Computer Games

• Handful of small studies with brief follow-up
• Minor, short-term improvements that do not transfer to other domains
• Do not improve to the same level as a “young” (20s) person
• Take home: they don’t hurt, but no evidence they help
Summary

- Cognitive training may delay cognitive decline in healthy older adults
- Limited evidence of training benefits in older adults with cognitive impairment
- Do not know if training delays progression to MCI or dementia
- Real world training offers short-term benefit → more research is needed for long-term effects
- Multi-faceted approach provides benefits up to 2 years after intervention
Thank you!

Questions?