Brain Power: Maintaining Cognitive Health

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Cognitive Changes with Normal Aging

Some abilities remain stable
- Vocabulary
- Fund of information
Cognitive Changes with Normal Aging

Some abilities decline with normal aging
- Cognitive speed
- Rapid novel problem solving

![Graph showing the decline of processing speed with age](image)
Cognitive Changes with Normal Aging

What about memory??

![Graph showing correlation between chronological age and memory Z-score](image-url)
Normal Aging Versus Dementia

- Minimal memory impairment
- Little or no progression of impairment
- No functional consequences
Dementia

A syndrome characterized by a decline in cognitive functions sufficient to cause impairment in social and occupational performance.
Implications of an Aging Society for Alzheimer’s Disease Prevalence

- 40% of persons who turned 65 in 2000 will survive to age 85
- 30-50% of persons reaching age 85 will have Alzheimer’s disease

Source: NEJM, 2000
Projected # of Americans’ with AD

In two years, the first of the baby boomers will reach 65

In 25 years, all baby boomers will be aged 65 or over
Projected Changes Between 2000 and 2025 in Alzheimer Prevalence by State

- 81.1% – 127.0%
- 49.1% – 81.0%
- 31.1% – 49.0%
- 24.1% – 31.0%
- 0 – 24.0%

Created from data from Hebert et al. [1, 2]
Percentage Changes in Selected Causes of Death Between 2000 and 2006

- Alzheimer’s Disease $^{a,c}$
- Stroke $^{a,c}$
- Prostrate Cancer $^{b,d}$
- Breast Cancer $^{b,d}$
- Heart Disease $^{a,c}$

-30  -20  -10  0  10  20  30  40  50  60

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$c$ Heron et al. 
Ages of Alzheimer and Other Dementia Caregivers, 2003

Created from data from Families Care: Alzheimer’s Caregiving in the United States.
Age

Cognitive Function

Death

Normal aging

MCI

Interventions

AD syndrome

Interventions
Importance of Lowering the Risk of AD

- Delaying the onset of AD by 10 years would translate into 3.5 million cases instead of the predicted 14.3 million cases over 50 years.
- A 2 year delay would translate into 2 million fewer cases over 50 years.

Source: NEJM, 2000
Wisconsin Registry for Alzheimer’s Prevention (WRAP)

- Current enrollment: 1051 family history and 407 non family history controls
- Undergo extensive neuropsychological testing
- Undergo APOE genotyping and laboratory testing for suspected risk factors for AD
- Serum, plasma and DNA are stored at -80°C
Risk of AD by APOE in **Men**

**Risk of AD by APOE in Women**

- General Population
- First Degree
- APOE 34

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40 45 50 55 60 65 70 75 80 85

100 90 80 70 60 50 40 30 20 10 0
Wisconsin Registry for Alzheimer’s Prevention (WRAP)

62 counties as of 4/2010
Wisconsin Registry for Alzheimer’s Prevention (WRAP)
Age

Cognitive Function

Death

1st wave

2nd wave

3rd wave

Normal aging

MCI

AD syndrome

WISCONSIN ALZHEIMER’S INSTITUTE
List Learning Serial Position Effects

- Primacy
- Mid Position
- Recency

Normal:
- Primacy: 1, 2, 3
- Mid Position: 7, 8
- Recency: 13, 14, 15

AD:
- Primacy: 1
- Mid Position: 8
- Recency: 13, 14, 15
Serial Position Changes

FH+

1
8
11
12
13
14
15

Primacy
Mid Position
Recency

FH-

1
2
3
8
11
12
13
14
15

Primacy
Mid Position
Recency
Looking ahead…
So what can we do NOW?

• Researchers now know that AD is a life-span illness

• There is increasing emphasis on prevention or at least delaying onset of serious symptoms
What do we know about brain fitness and cognitive aging?
What are we doing to improve Brain Health?

In the ASA-Metlife poll, 84% reported doing activities they believed to be good for their brains.

- 68% arts/crafts/hobbies
- 44% sports/exercise,
- 35% games/puzzles
- 25% working
- 22% socializing
- 13% nutrition
- 7% learning new things
- 3% resting

*ASA-Metlife Foundation Brain Health Poll, 2006*
Observational Studies

What factors are associated with preserved cognitive function and/or reduced dementia risk
Lowering the Risk of Alzheimer’s Disease – Lifestyle and Environment

- Education and occupation
- Alcohol consumption
- Psychological stress
- Cognitive and leisure activities
- Physical exercise
- Insulin resistance – obesity, exercise, diet, hypercholesterolemia, stress, steroid use
PET Scans

PET Scan of 20-year-old Brain

PET Scan of 80-year-old brain
PET Scans

PET Scan of Normal Brain

PET Scan of Alzheimer’s Disease Brain
Exercise and Dementia

“Most longitudinal studies have found that high physical activity is associated with
✓ a 30% to 50% reduction in the risk of dementia and cognitive decline

Barnes et al., 2007
Exercise and Dementia (Two Prospective Studies)

- Older women
  - Who walked ≥50 blocks per week
  - Were 34 – 37% less likely to develop AD
  - Compared to women who walked < 22 blocks per week

- Older men
  - Who walked ≥ 2 miles per day
  - Were 44% less likely to develop AD
  - Compared to men who walked < ¼ mile per day

Osteoporosis study; Yaffe et al., 2001
Honolulu-Asia aging study; Abbot et al., 2004
Exercise Recommendations

- Aerobic – aim for 30 minutes a day of any exercise that raises your heart rate and makes you breathe faster (e.g., brisk walking, swimming, or cycling)

- Other important aspects of exercise
  - Muscle strength and endurance
  - Flexibility
  - Balance
  - May be less directly related to brain health but are important for overall wellness and reducing risk of injury

National Institute on Aging
Diet and Cognitive Aging

• “At this time, we cannot say with certainty that any particular nutritional component causes or prevents Alzheimer’s disease”

• But…”much of the evidence …reflects a pattern of dietary associations very similar to more established dietary risk factors for cardiovascular disease”

Martha Morris, 2004
Fish and n-3 Fatty Acids
Fish: Brain Food

50% to 60% Lipid

DHA
cerebral cortex
synaptosomes
mitochondria
n-3 Polyunsaturated Fatty Acids

leaves, algae, oils (linseed, rapeseed, soy)

Fish, marine organisms

\[
\begin{align*}
C_{18:3} \text{ n-3} &: \alpha\text{-linolenic acid} \\
C_{20:5} \text{ n-3} &: \text{eicosapentaenoic acid} \\
C_{22:6} \text{ n-3} &: \text{docosahexanoic acid}
\end{align*}
\]

EPA

DHA
α-linolenic acid (18:3n-3)

Wheat Germ

Black current oil
Canola oil
Mustard seed oils
Soybean oil
Walnut oil
Wheat germ oil

Soybeans, walnuts

Human milk
Dietary Recommendations

- Most convincing support for AD protection is for foods rich in:
  - antioxidants, especially vitamin E (leafy green vegetables, avocados, apples, melon, whole grains, egg yolk, nuts)
  - omega-3 fatty acids (> 1 fish meal/week)
  - unhydrogenated, unsaturated fats

- Vitamin supplements not as clearly associated with reduced AD risk
Cognitive Activity and Dementia (3 prospective studies)

Over 5 years of follow-up, older adults who frequently participated in cognitively stimulating activities had:

✓ about one-half the risk of developing AD

✓ compared to those with infrequent cognitive activity.

Wilson & Bennett, 2003
Cognitive Activity Rating Scale (Chicago Health and Aging Study)

How often do you engage in the following activities?

- Watching television
- Listening to the radio
- Reading newspapers
- Reading magazines or journals
- Reading books
- Playing games such as cards, checkers, crosswords or other puzzles
- Going to museums
- Going to concerts or plays
- Attending lectures or CE courses
## Mentally Stimulating Leisure Activities and Dementia

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Age (yrs)</th>
<th>Years of follow-up</th>
<th>Activities</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilson et al., 2002 (USA) (Chicago Health &amp; Aging Project)</td>
<td>842</td>
<td>M = 76</td>
<td>4</td>
<td>Seven mental activities; physical activity</td>
<td>Lower AD risk with higher cognitive activity</td>
</tr>
<tr>
<td>Verghese et al., 2003 (USA) (Bronx Aging Study)</td>
<td>469</td>
<td>&gt;75</td>
<td>M = 5</td>
<td>Six cognitive activities, 11 physical activities</td>
<td><strong>Lower dementia &amp; AD risk with reading, board games, musical instruments</strong></td>
</tr>
<tr>
<td>Crowe et al., 2003 (Swedish Twin Registry)</td>
<td>107</td>
<td>&gt;75</td>
<td>from middle adulthood</td>
<td>Intellectual-cultural, self-improvement, domestic</td>
<td>Lower dementia risk with more activity</td>
</tr>
</tbody>
</table>
Cognitive Activity Recommendations

- Make time for cognitively stimulating activities that you’ve always enjoyed
- Add some new cognitive challenges, as your time and enjoyment permit
- Aim to engage in cognitively stimulating activities several times a week or more
- There is no one cognitive activity, or combination of activities, that is uniquely good for reducing AD risk
- Social interactions can be a great way to stimulate the mind
Buyer Beware

- MANY products now being marketed to improve brain fitness
- More products than research at this point