Ewald W. Busse, MD, ScD.
Cognitive Aging: What Every Clinician (and Patient) Should Know

Dan Blazer MD, MPH, PhD
JP Gibbons Professor Emeritus
Psychiatry and Behavioral Sciences
Duke University School of Medicine
Disclosures

• I chaired the Institute of Medicine Consensus Committee from which large portions of this talk derive.
Thanks for Slides and Collaboration

- Sharon Inouye, MD – Harvard
- Bob Wallace MD – University of Iowa
- Kristine Yaffe, MD – University of California, San Francisco
Statement of Task Highlights

The IOM committee was convened to examine cognitive health and aging, as distinct from Alzheimer's disease. The committee was asked to make recommendations focused on the public health aspects of cognitive aging with an emphasis on:

- Definitions and terminology,
- Epidemiology and surveillance,
- Prevention and intervention opportunities,
- Education of health professionals,
- Public awareness and education.
IOM Committee

DAN G. BLAZER (Chair), Duke University Medical Center
KRISTINE YAFFE (Vice-Chair), University of California, San Francisco
MARILYN ALBERT, John Hopkins University
SARA J. CZAJA, University of Miami
DONNA FICK, Pennsylvania State University
LISA P. GWYThER, Duke University
FELICIA HILL-BrIGGS, Johns Hopkins University
SHARON K. INOuye, Harvard Medical School
JASON KARLAWISH, University of Pennsylvania
ARTHUR F. KRAMER, University of Illinois at Urbana-Champaign
ANDREA Z. LACROIX, University of California, San Diego
JOHN MORRISON, Icahn School of Medicine at Mount Sinai
TIA POWELL, Albert Einstein College of Medicine
DAVID REUBEN, University of California, Los Angeles
LESLIE SNYDER, University of Connecticut
ROBERT B. WALLACE, The University of Iowa College of Public Health
What is Cognitive Aging?

- **Cognition** refers to the mental functions involved in attention, thinking, understanding, learning, remembering, solving problems, and making decisions.

- **Cognitive aging** is a process of gradual, ongoing, yet highly variable changes in cognitive functions that occur as people get older.

- **Cognitive aging** is a lifelong process. It is not a disease or a quantifiable level of function.

- In the context of aging, **cognitive health** is exemplified by an individual who maintains his or her optimal cognitive function with age.
Cognitive aging is not the same as Alzheimer’s disease.

<table>
<thead>
<tr>
<th>ALZHEIMER’S DISEASE</th>
<th>COGNITIVE AGING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic neurodegenerative disease</td>
<td>Part of aging</td>
</tr>
<tr>
<td>Extensive neuron loss</td>
<td>Neuron number remains relatively stable, but neuronal function may decline</td>
</tr>
<tr>
<td>Affects approximately 10 percent of older Americans</td>
<td>Occurs in everyone, but the extent and nature of changes varies widely</td>
</tr>
<tr>
<td>Declines are often severe and progressive</td>
<td>Changes are variable and gradual</td>
</tr>
</tbody>
</table>
Key Features of Cognitive Aging

- **Inherent in humans** and animals as they age
- Occurs **across the spectrum of individuals** as they age regardless of initial cognitive function
- Highly dynamic process with **variability within and between individuals**
- **Includes cognitive domains that may not change**, may decline, or may actually improve with aging, and there is the potential for older adults to strengthen some cognitive abilities
- **Only now beginning to be understood biologically** yet clearly involves structural and functional brain changes
A Lifecourse Approach to Aging and Cognitive Performance

The continuum of Alzheimer’s disease

Cognitive function

Preclinical

Aging

MCI

Dementia

Years

Years
Proportions of people ages 65 and older with moderate or severe memory impairment versus no or mild memory impairment


Differences in Cognitive Function by Age Based on Different Cognitive Tests, MIDUS II, N=4,268

Intra-individual changes in cognition scores over time (random sample of 500 adults, ages 50 and older)

Punctuated Declines and Recovery

• Rather than a smooth longitudinal progression, the actual process is more likely to be one of *punctuated* acute decline and recovery

• The summated curves represent the accumulation of declines and improvements over time
Assessment of Cognitive Aging

- **Best assessed within an individual over time** so that he or she serves as his own norm, though this approach incorporates practice effects

- **Need to regularly revisit the norms** that we use to statistically norm cognition

- Cognitive Aging is not normal aging or successful aging
Implications Of The Definition

• As concepts of disease and syndromes change, cognitive aging changes
  – MCI was once not MCI, not a diagnosis, so prior cohorts that defined cognitive aging likely included people who had MCI who would not be in contemporary cohorts

• Over time, the norms change; they should change
Brain Changes with Cognitive Aging

• Human and animal studies

• Mechanisms of cognitive aging:
  – Decreases in neuronal function, not number
    • Declines in synaptic number
    • Declines in synaptic function
  – Neurotransmitter changes
Declines in Synaptic Integrity

• Studies on non-human primates
• Specific classes of dendritic spines lost in dorsolateral prefrontal cortex
• These spines are very important for synaptic plasticity
• Loss correlates with declines in working memory
What are some Functional Measures Reflecting Cognitive Aging? (IADLs)

- Filling out your tax form
- Downloading and using an app
- Renewing your drivers’ license and tags online
- Preparing a meal from a recipe
- Going from Terminal 1 to Terminal 2 at O’Hare
- Serving on a committee for a volunteer social goal
- Fixing a minor appliance problem
- Adapting to challenging personal, social situations
- Preparing Powerpoint slides
Personal Adaptations to Cognitive Aging  
(Examples)  

- “External” Behaviors
  - Shopping lists
  - Bookmarks
  - Note birthdays
  - Telephone numbers

- “Internal Behaviors
  - Memory tricks
  - Think about a plan
  - Link old and new
  - Mental images

- “Reliance”
  - Ask for help to remember _________

- “Time”
  - Slow down speech
  - Read more slowly

- “Effort”
  - In conversation
  - Concentration
  - Trying hard to remember
Risk Factors for Cognitive Aging

• Factors which may accelerate the decline

• Factors which may be open to intervention.
Earlier “Lifecourse” Risk Factors and Conditions

- Educational development
- Adverse child and adolescent exposures
- Child and early adult mental/psychological conditions
- Potential occupational and other environmental exposures
Importance of Behavioral Conditions as a Window into Early Cognitive Problems

Behavioral conditions:
- Attention Deficit Hyperactivity Disorder
- Language disorders/ Dyslexia
- Autism Spectrum Disorder
- Conduct disorders
- Substance Abuse

Other childhood psychiatric disorders:
- Depression
- Eating disorders
- Gambling
External Contributors to Cognitive Aging

• In process of normal aging, older adults are exposed to many factors which may accelerate cognitive aging:
  – Nearly every older adult will experience at least one acute illness, surgery, or hospitalization
  – Nearly 1/3 will be hospitalized each year

• These factors are known to contribute to cognitive dysfunction.

Ref: HHS, Profile of Older Americans, 2013
Impact of Hospitalization

Wilson RS et al. Neurology 2012; 78: 950-56
### External Contributors to Cognitive Decline

<table>
<thead>
<tr>
<th>Medications (psychoactive)</th>
<th>Vascular risk and disease (cerebro- and cardio-vascular)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticholinergics</td>
<td></td>
</tr>
<tr>
<td>Polypharmacy</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hospitalizations</th>
<th>Multimorbidity:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute medical illness</td>
<td>Hypertension</td>
</tr>
<tr>
<td>Major surgery</td>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td>Intensive care unit stay</td>
<td>Chronic renal disease</td>
</tr>
<tr>
<td>Serious Infections</td>
<td>Cancer</td>
</tr>
<tr>
<td>Alcohol abuse</td>
<td>Thyroid disease</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Delirium</th>
<th>Depression</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Hearing and vision loss</th>
<th>Head trauma</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Sleep disorders, sleep apnea</th>
<th>Genetic factors</th>
</tr>
</thead>
</table>
Medications and Cognitive Decline

• Older adults are prescribed 14 drugs per year on average
• High risk meds include anticholinergic drugs, benzodiazepines, and sedative/hypnotics,
• 20 – 50% on anticholinergic drugs (associated with cognitive impairment)
• Potent anticholinergics and over-the-counter antihistamines such as diphenhydramine (Benadryl) especially a risk
What are people doing to intervene in cognitive aging?

- Computerized brain games
- Drugs (incl. caffeine)
- Stimulants: (methylphenidate/amphetamines)
- Transcranial electric stimulation
- Nootropics

(See Science 350:379)
Evidenced Based Messages for Clinicians and the Public
Key messages for patients about cognitive aging

- **The brain ages, just like other parts of the body.** The brain is responsible for “cognition,” a term that describes mental functions including memory, decision making, processing speed, and learning. As the brain ages, these functions may change—a process called “cognitive aging.”

- **Cognitive aging is not a disease.** It is not the same as Alzheimer’s disease or other types of dementia. Cognitive aging is a natural, lifelong process that occurs in every individual.

- **Cognitive aging is different for every individual.** Some people may experience very few effects, while others may undergo changes that can affect cognitive abilities needed to carry out daily tasks, such as paying bills, driving, and following recipes.

- **Some cognitive functions improve with age.** Wisdom and knowledge often increase with age, and older adults report greater levels of happiness and satisfaction than their younger counterparts.

- **There are steps patients can take to protect their cognitive health.** Although aging is inevitable, it is possible to promote and support cognitive health and adapt to age-related changes in cognitive function.
### Know the facts about cognitive aging

<table>
<thead>
<tr>
<th>MISCONCEPTION</th>
<th>FACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintaining cognitive health means preserving your memory.</td>
<td>Cognitive health is far more than having a good memory. It also involves decision making, attention, and problem solving.</td>
</tr>
<tr>
<td>Cognitive function always declines with age.</td>
<td>Aging can have both positive and negative effects on cognition. Wisdom and expertise can increase with age. Older adults experience fewer negative emotions, such as anger and worry, than people in young adulthood and middle age, and they report feeling greater satisfaction with life in general.</td>
</tr>
<tr>
<td>There’s nothing you can do to improve your cognitive health.</td>
<td>There are actions individuals and families can take to help support their cognitive health and adapt to age-related cognitive changes. See the next page for more information.</td>
</tr>
<tr>
<td>Brain neurons die as you age, so there is no way to prevent cognitive decline.</td>
<td>In the absence of disease, neuron death is minimal. There are a number of actions you can take to support your cognitive health.</td>
</tr>
</tbody>
</table>
Recommendations to Individuals and Families

The top 3 actions you can take to help protect your cognitive health as you age

1. **Be physically active.** Staying physically active can promote cognitive health in middle-aged and older adults.

2. **Reduce your cardiovascular risk factors (including hypertension, diabetes, and smoking).** Maintaining cardiovascular health supports cognitive health.

3. **Manage your medications.** A number of medications can have a negative effect on cognitive function when used alone or in combination with other medications. The effects can be temporary or long-term. It’s important to review all of your medications with a health care professional and learn about their effects on cognitive health.
Other actions that may promote cognitive health

- Be socially and intellectually active, and continually seek opportunities to learn.
- Get adequate sleep and seek professional treatment for sleep disorders, if needed.
- Talk to your health care provider to learn more about preventing delirium (a decline in cognitive function that can be associated with some medications and hospitalization).
RESOURCES RELATED TO COGNITIVE AGING AND FINANCIAL DECISION MAKING

Age-related declines in cognitive function may make older adults vulnerable to financial fraud or abuse at a time when significant financial decisions need to be made, such as planning for retirement. In 2010 alone, victims of elder financial abuse lost an estimated $2.9 billion, which includes loss of money and goods to legitimate businesses, scams, family, and friends and indirectly through medical insurance fraud. According to the National Council on Aging, the top 10 financial scams targeting older adults include telemarketing, Internet scams, and sales of anti-aging products.

Fortunately, there are many resources available to raise awareness and help older adults, their families, and financial advisers avoid abuse and make sound financial decisions, including AARP’s “Scam Jams” and “Fraud Watch Network,” the Consumer Financial Protection Bureau’s Office of Financial Protection for Older Americans, and the Federal Trade Commission’s “Pass It On” financial fraud campaign.

Visit www.iom.edu/cognitiveaging to access a list of resources related to cognitive aging and financial decision making.
Brain Stimulation Activities (Brain Games)

• No question that if most persons practice using brain games, they will improve in function on the games.
• Brain stimulation games have not as yet been demonstrated to
  – Transfer to everyday activities over time
  – Maintain gains over time once the games are no longer played

Brain games do come with a cost
  A small but for some significant financial cost
  Anxiety over performance on the game and comparison with others.

The ACTIVE Study
Institute of Medicine

Cognitive Aging: Progress in Understanding and Opportunities for Action

Free PDF of the report: www.iom.edu/cognitiveaging

Sponsors:

• McKnight Brain Research Foundation
• National Institute on Aging
• National Institute of Neurological Disorders and Stroke
• Centers for Disease Control and Prevention
• Retirement Research Foundation
• AARP