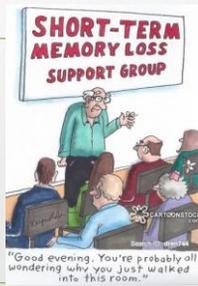# Healthy Brains Still Change: What is Normal Cognitive Aging

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Disclosure Information

- I have no financial relationships to disclose.

- I will not discuss off label use and/or investigational use in my presentation.

Outline

- Demographics of Aging Population: Silver Tsunami
- Normal Cognitive Changes and Aging
- Normal Aging vs. Mild Cognitive Impairment vs. Major Neurocognitive Disorder (Dementia)
- When do I refer for a neuropsychological evaluation?

Aging: Who is old?

- Biological and psychological aging changes occur gradually
  - Over years or decades
  - No single age when person is considered "OLD"
- Common to say people age 65 and older are "OLD"
  - Young-old < 75
  - Old-old > 75
  - Oldest-old > 85
  - "Super agers" > 95

Demographics of Aging Population: Silver Tsunami

- Exponential growth of older adult population (Ortman, Velkoff, & Hogan, 2014)
- In 2050, the population aged 65 and over is projected to be 83.7 million, almost double its estimated population of 43.1 million in 2012. (Hogan, Perez, & Bull, 2008)
- Baby boomers are largely responsible for this increase
  - Began turning 65 in 2011.
  - By 2050, the surviving baby boomers will be over the age of 85.

Figure 1.
Population Aged 65 and Over for the United States: 2012 to 2050

Source: U.S. Census Bureau, 2012 Population Estimates and 2012 National Projections.
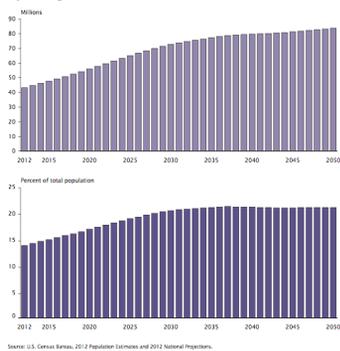
Limitations of Studying Aging and Cognition

- Recruitment bias
  - May underestimate degree of cognitive decline in normal aging
- Misclassification bias
  - May overestimate the degree of cognitive decline attributed to normal aging
- Study biases
  - Cohort bias
    - Cross sectional designs
  - Practice effects
    - Longitudinal designs
      - May underestimate degree of cognitive decline in normal aging
  - Attrition (survival) bias
    - Longitudinal designs
      - May underestimate degree of cognitive decline in normal aging

Cognitive Changes in Normal Aging

- Cattell & Horns (1966) Intelligence Theory
  - Crystallized Intelligence
    - Skills, ability, and knowledge that are overlearned, well-practiced and familiar
    - Influenced by environment, culture, experiences
    - Remain stable or gradually improve though 6th and 7th decade (Harada, Love, & Trisebel, 2013; Salthouse, 2010)
    - Example: Vocabulary, General Fund of Knowledge

Cognitive Changes in Normal Aging

- Cattell & Horns (1966) Intelligence Theory
  - Fluid Intelligence
    - Abilities involving problem solving and reasoning about less familiar concepts
    - Innate ability to process and learn new information, solve problems, attend to and manipulate information
      - Influenced by genetics and biology
    - Peak in 3rd decade and decline over time (Harada, Love, & Trisebel, 2013; Salthouse, 2010)
    - Example: Executive function, processing speed, memory, psychomotor ability

Cognitive Changes in Normal Aging
(Carlson, Hasher, Zacks, & Connelly, 1995; Harada, Love, & Triebel, 2013; Salthouse, Fristoe, Lineweaver, & Coon, 1995)

- Processing speed
  - Speed at which cognitive activities performed & speed of motor task
  - Begins to decline in 3rd decade and continues in lifespan
  - Negatively impacts other cognitive abilities

Cognitive Changes in Normal Aging
(Carlson, Hasher, Zacks, & Connelly, 1995; Harada, Love, & Triebel, 2013; Salthouse, Fristoe, Lineweaver, & Coon, 1995)

- Attention
  - Ability to focus and concentrate on specific stimuli
  - Simple auditory attention
    - Slight decline in late life
  - Selective and divided attention & working memory
    - Decline with older age after 3rd/4th decade

Cognitive Changes in Normal Aging
(Harada, Love, & Triebel, 2013; Singh-Manoux, Kivimak, Glymour et al., 2012; Zec, Markwell, Burkett, & Larsen, 2005)

- Language
  - Mixed
  - Language ability remains intact with aging
  - Exceptions: Naming (declines after age 70), Verbal Fluency (declines with age)

Cognitive Changes in Normal Aging
(Harada, Love, & Triebel, 2013; Singh-Manoux, Kivimak, Glymour et al., 2012; Zec, Markwell, Burkett, & Larsen, 2005)

- Visuospatial/Construction
  - Visuospatial
    - Ability to understand space in 2 and 3 dimensions
    - Remains intact with age
    - Ex: object perception, spatial perception
  - Construction
    - Ability to put individual parts together to make a whole
    - Declines with age
    - Ex: Assembling furniture from a box of parts

Cognitive Changes in Normal Aging
(Delis, Kramer, Kaplan, & Ober, 2000; Haaland, Price, & Lauro, 2003; Lezak et al., 2012; Whiting, & Smith, 1997)

- Memory
  - Encoding (Learning), Storage, Retrieval components
    - Piggy bank analogy
    - Acquisition (Learning) rate declines with age
    - Retention of information is preserved (storage)
    - Retrieval of information declines with age

  - Declarative vs. Non-declarative memory
    - Explicit vs implicit
      - Explicit: declines with age while implicit remains intact

Slide 1

Cognitive Changes in Normal Aging
(Delis, Kramer, Kaplan, & Ober, 2000; Haaland, Price, & Laure, 2003; Lezak et al., 2012; Whiting, & Smith, 1997)

- Executive Functioning
  - Capacity to successfully engage in independent, appropriate, and self-serving behaviors
  - Mixed
    - Concept formation, abstraction, mental flexibility decline with age, especially after age 70
    - Response inhibition & reasoning with unfamiliar material declines with age
    - Similarities, proverb understanding, reason with familiar material remains intact

Slide 2

Cognitive Changes in Normal Aging (Cargin et al., 2007; Price et al., 2004; Schnitzspahn et al., 2012)

Declines with age	Remains stable with age
Delayed free recall: spontaneous retrieval of information from memory without a cue[16,25] Example: Recalling a list of items to purchase at the grocery store without a cue	Recognition memory: ability to retrieve information when given a cue Example: Correctly giving the details of a story when given yes/no questions
Source memory: knowing the source of the learned information Example: Remembering if you learned a fact because you saw it on television, read it in the newspaper, or heard it from a friend	Temporal order memory: memory for the correct time or sequence of past events Example: Remembering that last Saturday you went to the grocery store after you ate lunch with your friends
Prospective memory: remembering to perform intended actions in the future[26] Example: Remembering to take medicine before going to bed	Procedural memory: memory of how to do things Example: Remembering how to ride a bike

Summary of Neurocognitive Changes with Age

	Crystallized vs. Fluid	Declines with age?
Processing speed	Fluid	Yes
Attention	Fluid	Simple tasks- no Complex tasks- yes
Memory	Fluid	Mixed
Language	Crystallized > Fluid	In general- no Visual confrontation naming, verbal fluency- yes
Visuospatial	Mixed	Simple tasks- no Complex tasks- yes
Executive Function	Fluid	Mixed

Slide 3

Normal Aging vs. Mild Neurocognitive Disorder (MCI) vs. Major Neurocognitive Disorder (Dementia)

- Normal Aging
- Mild Neurocognitive Disorder
  - Modest cognitive decline
  - Does NOT interfere with IADLs
- Major Neurocognitive Disorder
  - Significant cognitive decline
  - Interferes with IADLs/ADLs

"Successful Cognitive Aging" (Crowe et al., 2003; Fratiglioni et al, 2004; Marioni et al., 2012; Wang et al, 2002)

- Lifestyle-Cognition Hypothesis
  - Older adults with high cognitive function participate in certain activities with greater frequency than older adults with low cognitive function
  - Activities associated with high cognitive function in older adults
    - Intellectually Engaging Activities
      - Puzzles, discussion groups, playing musical instruments, using the computer
    - Physical Activities
      - Exercise, Gardening, Dancing
    - Social Engagement
      - Travel, cultural events, socializing with family/friends

"Successful Cognitive Aging" (Cabeza et al., 2002; Economou, 2009; Sambataro et al., 2012; Stern, 2002)

- Cognitive Reserve
  - High levels of education, participation in certain activities, higher SES, and baseline intelligence (g) protect against clinical manifestations of brain disease
  - Passive vs. Active reserve

Should I refer for a Formal Neuropsychological Evaluation?

- Assess whether subjective reports of cognitive changes are related to normal aging, neurological/medical, or psychiatric condition
  - Differential diagnosis
  - Providing psychoeducation about brain and behavior relationships
- Identify individual cognitive strengths and weaknesses
  - Tailored recommendations
- Serial assessment to track cognitive change over time
  - Monitor cognition, update recommendations, assist with treatment planning
- Offer guidelines for rehab, vocational, caregiver planning and support
  - Better to know early and prepare

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Summary

- Normal aging process involves cognitive changes
  - Processing speed, memory, executive functioning
- Participation in certain activities and building cognitive reserve may contribute to normal aging
- Formal neuropsychological assessment can be incredibly helpful
  - Disentangle impact of aging, medical, and psychiatric conditions on cognition
  - Tailored recommendations: treatment planning, decision making, provide psychoeducation on aging process

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Thank you!

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