

Aging, Cognition, and Hearing Aids

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A little about me

- Clinic
- Teaching
- Research
- VA
- University Clinic

• The views expressed here are that of the author and not the United States Government or the Department of Veterans Affairs

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What is aging?

The Two Main Aging Theory Categories

- Programmed Theories
 - Aging has a biological timetable or internal biological clock.
- Error Theories
 - Aging is a result of internal or external assaults that damage cells or organs so they can no longer function properly.



Many theories are a combination of programmed and error theories.

Theories of Aging

- All aging begins with genetics
- Aging changes the biochemical and physiological processes in the body
- Cell and molecular biologists examine and propose theories to explain the aging process
 - What causes aging?
 - How can you influence aging ...prolong life?

When Does Aging Begin?

- Aging begins the day we are born
- No single measure of how "old" a person is
- Aging is highly individualized
- Aging proceeds at different rates in different people, and within different systems of the body



Why Do People Age?

Many theories to include:

- Hereditary Factors
- Loss of cellular mass and ability of cells to divide and replicate
- Accumulation of waste materials that clog cells and cause them to die
- Changes in structure of connective tissue

No single theory adequately describes the aging process

Normal Changes of Aging

Physical changes related to "Normal" aging ARE NOT disease

Changes occur in most body systems to include:

- Sensory System
- Brain and Central Nervous System
- Muscles and Bones
- Digestion
- Heart/Circulatory System
- Respiratory System

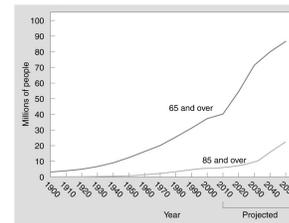


Aging

- Presbycusis
 - Peripheral (we all know)
 - Central (we all "know")
 - Age-related change in CNS =changes auditory perception, speech- communication performance, or both (Humes et. al., 2012)
 - How?
- Multi-sensory impairment
- Is it normal?



Number of Americans Age 65 and Older (in millions), Years 1900–2000, and Projected 2010–2050



Memory Changes with Age

- Information processing:
 - Encoding new information
 - Reduced efficiency and speed with aging
 - Short term memory declines
 - Storage and retrieval
 - Recall slows with age
 - Recognition changes little

Memory Changes with Age

- Consistent theme:
 - Speed of performance slows with aging
 - "Less bandwidth"
- **Fear** of memory loss increases
 - Complaints of nonspecific memory losses
 - Depression, alcohol and illness can adversely affect memory

Aging Changes in Cognition

- Reading
 - Vocabulary
 - Long term factual memory
 - Immediate memory span
 - Sustained attention
 - Serial(practice-related) learning
 - Delayed recall
 - Motor speed
 - Visuo-spatial skills
- Least change
↑
↓
Most change

What does not change?

- Intelligence
 - Speed of processing information declines
 - Complex ideas are more affected than simple ones
 - Ability to perform under stress declines
 - Prior experiences may aid considerably
- Language
- Reading ability
- Vocabulary acquisition
- Long-term memory
 - Crystallized memory does not change
 - Any declines likely represents difficulty in processing new information

What Can Worsen Memory?

- Any drug that affects the brain:
 - Sleeping pills, pain pills, antihistamines, incontinence meds, tranquilizers, alcohol, etc.
- Undiagnosed depression
- Fatigue, stress, anxiety
- Acute illness with Delirium(Acute confusion)
- Stroke...most "TIAs" are really small strokes

The New "Age Wave"

- 5.3 million persons today have dementia and this number could triple by 2050
- Death rates for heart disease, stroke and cancer are declining.....death rates for dementia are rising!
- Dementia is currently the 5-6th leading cause of death and rising quickly

Dementia

- 60-80% of long stay nursing home residents
- Nearly 2/3 of Assisted Living residents
- Estimated 1/2 million Americans have early onset Alzheimer Disease...defined as <65
- Only half of all dementia has been diagnosed and only half of those receive any current treatment

Dementia Facts

- A *very* common problem in US:
 - 1 in 10 persons have a relative in the family
 - 1 in 4 knows someone who has the disease
 - Diagnosed every 70 sec in the US

Source: Alzheimer's Association

Alzheimer and Dementia

- 60% of all dementias in US are probably related to Alzheimer Disease
- One can have Alzheimer Disease and not be demented....yet
- Dementia is a diagnosis not a disease

When is it Alzheimer?

- **Definite:** typical clinical history and tissue confirmation(biopsy or autopsy)
- **Probable:** typical clinical history, insidious onset, progressive course, and no other obvious cause of dementia
- **Possible:** patients with a second systemic or brain disorder sufficient to cause dementia but not thought to be the primary cause

Alzheimer Dementia Facts

- Life expectancy: 3 to 20 years after diagnosis
 - Average is about 8 years
- Dementia affects 6-8% of all those over 65
 - Incidence doubles every 5 years >60
 - Estimated 1/3 of those 85 years or over
 - 47% of >85yo have Alzheimer pathology in their brains at autopsy

Alzheimer Facts

- No single test exists to make the diagnosis
- Plaques and tangles are the lesions seen in the brain at autopsy
- Certain areas of the brain are more affected than others (hippocampus for example)
- Marked decline in acetylcholine in the brain (neurotransmitter), high levels of amyloid

Diagnostic Changes

- Earliest changes occur in medial temporal lobe structures (e.g., hippocampus, entorhinal cortex) that are critical for episodic memory
- Characterized by prominent amnesia with additional deficits in language and semantic knowledge, abstract reasoning, executive functions, attention, and visuospatial abilities
- Impact daily life

The Diagnosis of Impairment

- Memory impairment (not essential):
 - Inability to learn new information
 - Memory abilities that decline from a prior baseline
 - Education, high intelligence, cultural factors, etc.

Source: *Diagnostic and Statistical Manual of Mental Disorders*. DSM-5

Neurocognitive Disorders

- Must interfere with one of the following:
 - Complex attention
 - Executive abilities
 - Learning/Memory
 - Language
 - Visuoconstruction
 - Visuoception
 - Social cognition

Diagnosis of Minor Impairment

- Decline from a previous level of performance
- Concerns of the individual, a knowledgeable informant, or the clinician
- Test performance in the range of one and two standard deviations below appropriate norms
- Greater effort, compensatory strategies, or accommodation may be required to maintain independence
- Not primarily attributable to another mental disorder (eg, major depressive disorder, schizophrenia, delirium)
- Sufficient to interfere with independence (ie, requiring minimal assistance with instrumental activities of daily living)

Diagnosis of Dementia: Testing

- History that is consistent
- Physical exam that rules out significant neurologic or other disease
- Evaluation of mental status
 - Mini-mental status exam (30 pt screening test)
 - Clock drawing test, current events, serial 7's
 - Formal neuropsychological testing

Battery testing

- Neuropsychological test battery including:
 - Imaging (atrophy and white matter)
 - Variety of tests
 - MMSE/MoCA
 - Trails making test
 - California Verbal Learning Test
 - Category fluency (semantic memory and executive function)
 - Visual reproduction test (immediate and delayed)
 - Interviews

The Mini-Mental State Exam

Patient _____ Examiner _____ Date _____

Maximum	Score	Orientation
5	()	What is the year (month) (date) (day) (month)?
5	()	Where are we (state) (county) (town) (hospital) (floor)?
3	()	Registration Name 3 objects. I named to you each. Then ask the patient. If 3 after you have said them. Give 1 point for each correct answer. Then repeat them until he/she learns all 3. Count trials and record. Trial: _____
5	()	Attention and Calculation Serial 7's. 1 point for each correct answer. Stop after 5 answers. Alternately spell "world" backward.
3	()	Recall Ask for the 3 objects reported above. Give 1 point for each correct answer.
2	()	Language Name a pencil and watch.
1	()	Repeat the following "No ah, um, or hah"
3	()	Follow a 3-stage command. "Take a paper in your hand, hold it in your hand, and put it on the floor."
1	()	Read and obey the following: "CLOSE YOUR EYES"
1	()	Write a sentence.
1	()	Copy the design shown.



Total Score: _____

ASSESS level of consciousness along a continuum _____

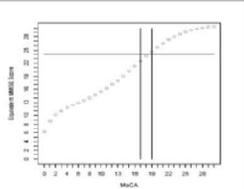
100% 200% 300% 400% 500% 600% 700% 800% 900% 1000%

MMSE vs MoCA (differences)

MMSE:	MoCA:
Language heavy test (repeat words and command tests)	More sensitive for mild cognitive impairments
Widely used among physicians	Electronic versions available
Good for diagnosis of severe dementia cases	Newer versions developed for hearing and vision impairments
11 Test Items	3 different versions for repeat testing
	8 test domains

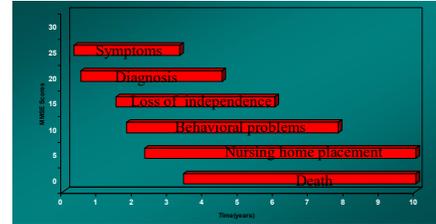
MoCA vs MMSE Equivalent Scores

MoCA	Equivalent MMSE	MoCA	Equivalent MMSE
0	6	16	21
1	9	17	22
2	10	18	24
3	11	19	25
4	12	20	26
5	12	21	27
6	13	22	27
7	14	23	28
8	14	24	29
9	15	25	29
10	15	26	30
11	16	27	30
12	17	28	30
13	18	29	30
14	19	30	30
15	20		



MoCA mapped to MMSE scores using equi-percentile equating method with log-linear smoothing in 618 subjects. Lines in graph indicate MMSE cutoff of 24 and MoCA cutoffs of 17 and 19. The MoCA value equivalent to a MMSE cutoff of 24 is shaded.

Progression of Alzheimer Disease



Feldman H and Gracon S in *Clinical Diagnosis and Management of Alzheimer's Disease* 1996

How typically diagnosed

- Family report
- Verbally presented test
-
- BUT – is this okay?

Is it dementia or untreated hearing loss?

Dementia	Untreated Hearing Loss
Social Isolation (Johnson, Johnson, & Whitted, 2000)	Social Isolation (Wolstein & Venter, 1978)
Decreased Comprehension (Pugner & Williams, 1983)	Decreased Understanding/ Discrimination (Johnson, et al., 1983)
Repeating Questions (Ostmann et al., 2003)	Repeating Questions
Short term memory problem (Gillier, 1973)	Working memory problem (Schlomer, 1999)
Stereotyped/inappropriate word use (Cochran et al., 2003)	Stereotyped/inappropriate word use (Crandall, 1997)
Difficulty following conversation (Gross, Grogger, Lashon, & Hodges, 2003)	Difficulty following conversation (Johnson et al., 2003)

Jorgensen, Palmer, & Fischer – 2013

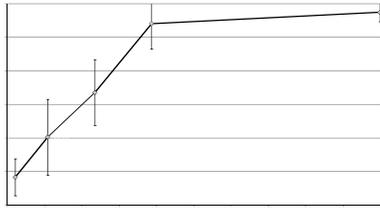
Hearing Loss & Physicians

- NIH (1991) : by 2010 dramatic increase in PCP referral 65+ for evaluation and treatment of hearing loss
 - Still "under development"
- Physicians:
 - Think they "know" when someone has HL
 - Medical textbooks don't mention HL (1/84) (Jorgensen et al 2013)
 - Ask patients if have HL (1-51% accurate)(Boatman, et al, 2007)
 - Bedside testing (5-60% accurate) (Boatman, et al, 2007)

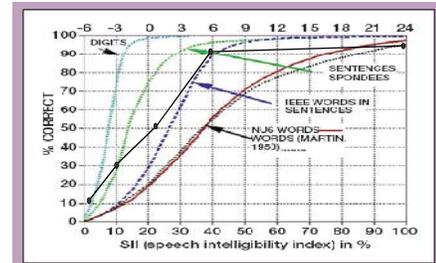
Results

- Overall score impacted by audibility (< .001)
- Every item impacted by audibility (all < .001)
-
- Overall MMSE score
 - Groups 1 & 2 are not different
 - All the rest are different from each other (< .001)

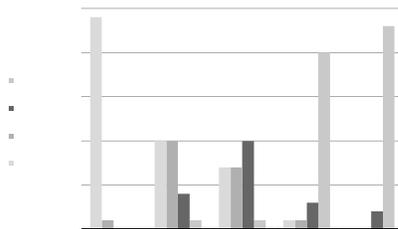
Overall MMSE by Audibility



Known SII calculations (Killion & Mueller 2010)



Diagnosis of Dementia



Us or the Physicians?

- Job of both – we need to screen
 - Meds
 - Cognition
 - Depression
 - Dexterity

6 item screener

- 3 word repeat: APPLE, TABLE, PENNY.
- What year is this? Month? Day of the week?
- Repeat 3 words again

Hearing loss + Cognitive decline

- Increased HL in memory clinic
- Increased dx of dementia in HL
- Slower cognitive decline in those with HA
 - Population?
 - Those with long-standing HL

Voting

- Send them on to do a CI evaluation**
- Discuss cognition and hearing loss**
- Get new aids**
- Phone a friend - lime**

Ms. Liv Alonee

- Long standing patient
- Seeing decline
- Attends appointments alone
- Can't see – but drives
- Can't walk – but no walker/cane
- Can't remember appointments – jus shows up
- Looks disheveled



Voting

- It is not within your scope of practice**
- Call Protective Services**
- Talk with family**
- Talk with patient - lime**

Ingrid Dunnough

- Long time patient (typically seen with husband)
- Noticed/documentated decline
- Son drove today – recent husband passing
 - Does not want son involved
- Needs new hearing aids – wants new aids
- Willing to write check today
- Is her own POA



Voting

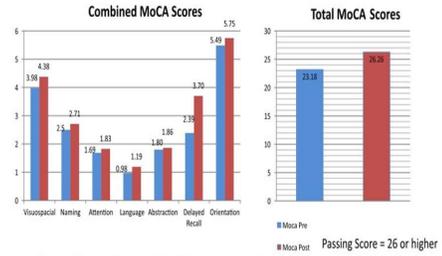
- Let her write the check and buy the aids**
- Bring in the son**
- Discuss with son later about your concerns**
- Tell her you can't sell them to her - lime**

The Final Stretch

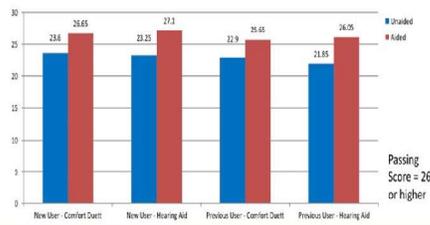
Cognition and hearing aids

- How does this impact your:
 - Pre-appointment
 - Selection
 - Fitting
 - Orientation
 - Follow-up
- What is your role as an audiologist

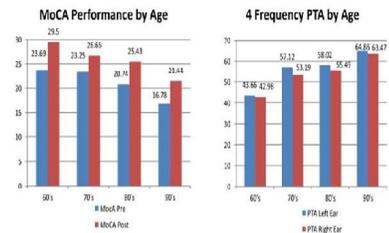
Does Amplification Matter? Yes



Does Amplification Type Matter? No Does Amplification History Matter? No



Does Age Matter? Yes



Some Delayed Recall Facts

- The 5 item Delayed Recall test allows for better detection of mild cognitive impairment.
- Average scores on this test for normal controls in the MoCA validation study was 3.77. In our study: Pre-MoCA - 2.38, Post-MoCA - 3.69.
- Noted Impairments that may influence performance in this domain: white matter loss, sub-cortex damage, vascular cognitive impairment, Parkinson's, Huntington's, depression, dementia, sleep apnea, stroke, hydrocephalus, hippocampal atrophy, & hang nails (just kidding).
- **BUT NO ONE MENTIONED HEARING LOSS AS A POSSIBLE IMPAIRMENT!**

Neuroline 25, Phillips SA, Bellar Y, Charbonneau S, Whithead V, Colin L, et al. The Montreal Cognitive Assessment, MoCA: a brief screening tool for mild cognitive impairment. *Journal of the American Geriatrics Society*. 2005 Apr;53(4):695-9.

Aging and emotion

- Older adults have better emotion regulation
- Older adults react more strongly with their emotions
- PARC study suggests those who are aided are better at identifying emotion
- Implications?

Aging and anxiety

- Generalized anxiety disorder (GAD) is common
 - Traffic, weather, falling
- How does rushing into the appointment impact your appointment?

Initial appointment

- What do you know?
- Who is coming with them?
- What technology do they use?

- Audiometry
- Other tests
 - Speech in noise?
 - What are you really testing

Does HA fitting differ?

- Hearing aid verification?
- Anxiety and loudness judgements
-
- “It’s too loud”

Features of HA and cognition

- Attack and release times
- DNR
- Feedback suppression
- Adaptive directional microphones

- Use of assistive devices

Does follow-up differ?

- How often
- What to cover
- Who should come



Thank you

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