May 4th, 12:00 AM

Hearing, Cognitive Decline, and the Value of Hearing Interventions

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Background

- In 2011, an estimated 28.6 million people aged 60+ had at least mild hearing loss[1]
- Correlations between social isolation and development or progression of neuropsychiatric disease, as well as between hearing loss and social isolation[2,3]
- Direct associations between cognition and age-related hearing loss (although possibly confounded by participants' difficulty hearing instructions for memory testing)[4–8]

Purpose

- Globally, 47 million people live with dementia, expected to increase to 131 million by 2050[9]
- Alzheimer's Disease affects estimated 6.2 million in the US, expected to increase to 13.8 million by 2060 [10]
- 15.3 billion hours of uncompensated care from over 11 million caretakers in the US[10]

Methods

- Searched Pubmed, Scopus, and Embase databases
- Search terms: "Hearing loss" OR" deafness" OR "Hearing aids" AND "dementia"
- Primary surveys, review articles, systematic reviews, meta-analyses, longitudinal studies, and cohort studies published in English between 2003 and 2021, inclusive
- Addressed relationships between hearing loss and dementia and/or examined effect of hearing aids and cochlear implants
- Primarily focused on elderly American population but included studies performed in populations in other countries

Outcomes and Data Analysis

- Measured association with and progression of dementia in individuals with hearing loss
- Biological correlates of proposed mechanisms for disease progression and a review of interventions.
- Study methodology, results, and conclusions extracted and analyzed
  - sample sizes
  - survey design
  - demographics of study populations
  - qualitative and quantitative analysis on outcomes of interest

Discussion

- Occasional discordant performance in individual subtests
  - different populations of patients
  - various stages of hearing loss
  - with and without treatment
- Most studies found that hearing loss impaired performance on cognitive testing
- Differences complicate establishing consensus of literature
  - enrollment criteria
  - study arm assignment
  - measures of cognitive performance
- Questions of statistical significance
  - studies with small numbers of patients
  - large number of subtest analyses
- Improved test results may be due to improved speech perception rather than improved cognition

Conclusion

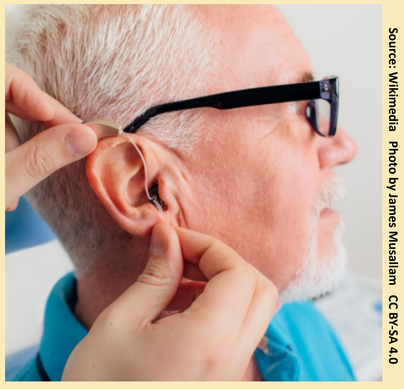
- Evidence somewhat mixed in understanding exactly which cognitive domains are impacted as hearing loss progresses
- Question of when to start hearing loss interventions to reduce the risk or progression of dementia remains somewhat unclear
- Generally, both hearing aids and cochlear implants reduce the impact on cognitive measures
- Increasing hearing can improve social connectedness
  - reduces depression, dementia risk, and impact.

Proposed Practice Changes

- As of August 17, 2022, FDA allows over-the counter purchase of hearing aids by individuals with subjective mild-to-moderate hearing loss
  - substantially expands access, as many insurance companies did not cover hearing aids
  - allows patients to start addressing hearing loss early, lowering lifetime risk and progression of dementia
- Need for test modalities that compensate for partial hearing loss
  - Many tests of cognition rely heavily on auditory instructions, which may be challenging for some patients to hear.
  - Heterogeneity of speech volume between test administrators may also lead to variance in test performance
  - Tests such as a MoCA, adapted for hearing loss, may more accurately assess cognitive ability

Results

Cognitive Load Theory of Information Processing and Hearing Loss	°Association between hearing loss and right temporal lobe beta amyloid levels consistent with Alzheimer's disease [11] °Hypothesized that hearing loss and dementia both impact ascending auditory pathway and multimodal cortex, with resources diverted to compensate for sensory loss[12–14]
Social Isolation Theory of Dementia	Hearing loss may lead to social isolation, which has a demonstrated association with accelerated progression of dementia[15]
Hearing loss and Cognitive Decline	°69% greater likelihood of developing dementia among the 18.3% of participants in a large study with self-reported hearing loss °Subclinical hearing loss associated with impaired cognition[17] °Mixed data regarding whether dementia risk or rate of dementia progression increases with severity of hearing loss[12–14]
Treating Hearing Loss May Improve Cognitive Test Performance	°In one study, those with untreated hearing loss scored worse than those with no hearing loss on cognitive testing[18] °Participants with treated hearing loss performed worse in global cognition, but better on recall[18]
Hearing Aids and Cochlear Implants	°Hearing aids improved performance on cognitive testing and improved depression, which can also affect cognitive performance[19,20] °Patients with mild cognitive impairment who used hearing aids less likely to develop dementia than those who did not[19,20] °Another study found experienced cochlear implant users had similar performance on cognitive testing as those with normal hearing, but cochlear implant candidates did substantially worse[21] ° 58% of participants in a later study passed the MoCAafter cochlear implant surgery, versus 40% preoperatively[21]
Timing of Hearing Interventions May Be Important	Cognitive testing showed greater benefit of cochlear implants for patients with either mild or advanced hearing loss benefited than for those with moderate hearing loss[22]



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