

Hearing Aids and Cochlear Implants in the Prevention of Cognitive Decline and Dementia—Breaking Through the Silence

Michael W. Denham, MPhil; Rachel E. Weitzman, MD, MPH, MS; Justin S. Golub, MD, MS

Dementia is extremely common and presents a sizable economic cost to societies.^{1,2} Given that its prevalence and resulting financial burden on health care systems are expected to balloon in the context of an aging population and a lack of a cure, public policy strategies aimed at reducing the prevalence of this disease often focus on addressing its modifiable risk factors. Hearing loss has recently been recognized as one of the greatest of these modifiable risk factors.³ Hearing interventions, including both hearing aids and cochlear implants, have previously been investigated as possible means of lowering the incidence of dementia. These research efforts have mostly consisted of observational studies due to the high costs of providing hearing aids or cochlear implants to large groups in randomized clinical trials (RCTs) and the need for lengthy follow-up.⁴⁻¹¹ In the case of cochlear implants, recruitment challenges arise for trials that would randomize individuals to an elective surgery involving device implantation. Because of these impediments to running RCTs, there is a critical need in the literature for robust meta-analyses to justify further inquiry.

In *JAMA Neurology*, Yeo and colleagues¹² present a systematic review and meta-analysis of the association between hearing intervention (primarily hearing aids but also cochlear implants) and cognitive decline/dementia. The authors included 31 studies (25 observational studies and 6 trials) in their report, 19 of which were analyzed quantitatively. Cognitive outcomes included diagnoses of dementia or cognitive impairment as well as commonly used clinical measures of cognitive function, such as the Mini-Mental State Examination and/or the Montreal Cognitive Assessment. Studies relying on measures that were not extensively validated were not included. Bias assessment was conducted using the Newcastle-Ottawa Quality Assessment Scale, a scale developed to assess the quality of non-RCTs in meta-analysis. When possible, the authors used a mixed-effects model to pool covariate-adjusted hazard ratios and compare the overall hazard of cognitive decline between participants who used hearing interventions and those who did not. The associations were also adjusted for possible confounders, such as age, sex, education, socioeconomic status, and comorbidities. The authors conducted subgroup analyses based on types of cognitive impairment, cognitive assessment, and hearing intervention, as well as study quality and geography.

In a pooled analysis of about 127 000 participants across 8 studies, the authors found that hearing aid users had a 19% lower risk of long-term cognitive decline compared with non-users. Interestingly, both individuals with baseline normal cog-

nition and those with baseline mild cognitive impairment were found to have a risk reduction associated with hearing aid use. Additionally, through a meta-analysis of 11 studies with 568 participants, the authors calculated that use of hearing restorative devices (hearing aids and cochlear implants) was associated with a modest but significant 3% improvement in general cognitive test scores.

We take away 3 key points from this study. First, this meta-analysis provides convincing evidence that hearing aid usage is associated with a considerable risk reduction of cognitive decline. While this finding does not prove a causal relationship, it provides convincing evidence that physicians should consider hearing evaluation, which is noninvasive and usually covered by insurance, as part of a standard workup for patients who may be experiencing cognitive decline. Second, future studies should examine patients with no baseline cognitive impairment and patients with mild cognitive impairment. Limiting analysis to either of these groups risks generalizing potential benefits to the other group, whereas each may have unique risk profiles and trajectories for cognitive decline.

Lastly, this report is a testament to the power of pooling studies in meta-analysis. Most individual studies did not reach statistical significance. However, when the studies were analyzed in aggregate, significance was reached. This result emphasizes the importance of this methodology within our field as well as the utility in standardizing measures of hearing loss and cognitive outcomes across studies of different populations to make conducting meta-analysis easier.

This meta-analysis faces several limitations, largely reflective of the studies included and limitations common to this field of research. The authors acknowledged many of these limitations, such as an inability to compare hearing loss severity and a focus on general cognitive measures rather than inclusion of domain-specific cognitive measures. Because the included studies did not always robustly account for potential confounders, adjustment for certain important factors such as socioeconomic status and comorbidities was limited. Richer data on potential confounders such as ethnicity, education, income, and wealth would allow future studies to make stronger conclusions while better parsing out the nuances that often get bundled into socioeconomic factors.

The field of dementia and hearing loss research is at a crossroads where RCTs are needed, and this meta-analysis by Yeo and colleagues¹² provides among the highest evidence to support such trials. While there have been prior reviews of studies examining the association between hearing interventions and cognition/dementia, this report is arguably the strongest to date. Much of this strength is due to the breadth of studies

 [Related article](#)

included, assessment of bias, and depth of statistical analysis of outcomes and potential confounders. While we await results from RCTs such as the ongoing Aging and Cognitive Health Evaluation in Elders (ACHIEVE; [NCT03243422](https://doi.org/10.1111/jgs.15363)) trial and the upcoming Early Age-Related Hearing Loss Investigation (EARHLI) trial, this meta-analysis provides substantial reason to pursue further study of the relationship between hearing loss and cognitive decline/dementia.¹³

In conclusion, Yeo and colleagues¹² offer a much-needed reminder that abundant evidence exists in support of an association between hearing loss and cognitive decline/dementia. While we await the completion of additional studies to test if hearing loss may cause cognitive decline/dementia—and if hear-

ing restorative devices could mitigate that possible pathway—we recommend physicians consider hearing evaluation as part of a standard dementia workup. Thanks to the recent creation of over-the-counter hearing aids, access to hearing loss treatment will increase.¹⁴ Clinicians have a unique opportunity to encourage hearing assessment and, if needed, use of hearing restorative devices such as hearing aids and cochlear implants. Not only can hearing loss contribute to symptoms of dementia, such as difficulty with communication, but hearing restoration remains an active area of investigation as a potential mitigator against the slow creep of cognitive decline. Simply put, assessment for hearing loss remains a crucial part of caring for patients with cognitive impairment.

ARTICLE INFORMATION

Author Affiliations: Department of Otolaryngology–Head and Neck Surgery, NewYork-Presbyterian/Columbia University Irving Medical Center, Columbia University Vagelos College of Physicians and Surgeons, New York (Denham, Weitzman, Golub); Department of Otolaryngology–Head and Neck Surgery, NewYork-Presbyterian/Weill Cornell Medical Center, New York (Weitzman).

Corresponding Author: Justin S. Golub, MD, MS, Department of Otolaryngology–Head and Neck Surgery, Columbia University Vagelos College of Physicians and Surgeons, New York-Presbyterian/Columbia University Irving Medical Center, 180 Ft Washington Ave, HP8, New York, NY 10032 (justin.golub@columbia.edu).

Published Online: December 5, 2022.
doi:[10.1001/jamaneurol.2022.4155](https://doi.org/10.1001/jamaneurol.2022.4155)

Conflict of Interest Disclosures: Dr Golub reported consulting expenses from Alcon. No other disclosures were reported.

REFERENCES

- Wimo A, Guerchet M, Ali G-C, et al. The worldwide costs of dementia 2015 and comparisons with 2010. *Alzheimers Dement*. 2017; 13(1):1-7. doi:[10.1016/j.jalz.2016.07.150](https://doi.org/10.1016/j.jalz.2016.07.150)
- Nichols E, Steinmetz JD, Vollset SE, et al; GBD 2019 Dementia Forecasting Collaborators. Estimation of the global prevalence of dementia in 2019 and forecasted prevalence in 2050: an analysis for the Global Burden of Disease Study 2019. *Lancet Public Health*. 2022;7(2):e105-e125. doi:[10.1016/S2468-2667\(21\)00249-8](https://doi.org/10.1016/S2468-2667(21)00249-8)
- Livingston G, Huntley J, Sommerlad A, et al. Dementia prevention, intervention, and care: 2020 report of the Lancet Commission. *Lancet*. 2020; 396(10248):413-446. doi:[10.1016/S0140-6736\(20\)30367-6](https://doi.org/10.1016/S0140-6736(20)30367-6)
- Lin FR, Ferrucci L, Metter EJ, An Y, Zonderman AB, Resnick SM. Hearing loss and cognition in the Baltimore Longitudinal Study of Aging. *Neuropsychology*. 2011;25(6):763-770. doi:[10.1037/a0024238](https://doi.org/10.1037/a0024238)
- Rönnberg J, Hygge S, Keidser G, Rudner M. The effect of functional hearing loss and age on long- and short-term visuospatial memory: evidence from the UK biobank resource. *Front Aging Neurosci*. 2014;6:326. doi:[10.3389/fnagi.2014.00326](https://doi.org/10.3389/fnagi.2014.00326)
- Amieva H, Ouvrard C, Giulioli C, Meillon C, Rullier L, Dartigues JF. Self-reported hearing loss, hearing aids, and cognitive decline in elderly adults: a 25-year study. *J Am Geriatr Soc*. 2015;63(10): 2099-2104. doi:[10.1111/jgs.13649](https://doi.org/10.1111/jgs.13649)
- Cosetti MK, Pinkston JB, Flores JM, et al. Neurocognitive testing and cochlear implantation: insights into performance in older adults. *Clin Interv Aging*. 2016;11:603-613. doi:[10.2147/CIA.S100255](https://doi.org/10.2147/CIA.S100255)
- Qian ZJ, Wattamwar K, Caruana FF, et al. Hearing aid use is associated with better Mini-Mental State Exam performance. *Am J Geriatr Psychiatry*. 2016;24(9):694-702. doi:[10.1016/j.jagp.2016.03.005](https://doi.org/10.1016/j.jagp.2016.03.005)
- Maharani A, Dawes P, Nazroo J, Tampubolon G, Pendleton N; SENSE-Cog WP1 group. Longitudinal relationship between hearing aid use and cognitive function in older Americans. *J Am Geriatr Soc*. 2018; 66(6):1130-1136. doi:[10.1111/jgs.15363](https://doi.org/10.1111/jgs.15363)
- Curhan SG, Willett WC, Grodstein F, Curhan GC. Longitudinal study of self-reported hearing loss and subjective cognitive function decline in women. *Alzheimers Dement*. 2020;16(4):610-620. doi:[10.1016/j.jalz.2019.08.194](https://doi.org/10.1016/j.jalz.2019.08.194)
- Sorrentino T, Donati G, Nassif N, Pasini S, Redaelli de Zinis LO. Cognitive function and quality of life in older adult patients with cochlear implants. *Int J Audiol*. 2020;59(4):316-322. doi:[10.1080/14992027.2019.1696993](https://doi.org/10.1080/14992027.2019.1696993)
- Yeo BSY, Song HJMD, Toh EMS, et al. Association of hearing aids and cochlear implants with cognitive decline and dementia: a systematic review and meta-analysis. *JAMA Neurol*. Published online December 5, 2022. doi:[10.1001/jamaneurol.2022.4427](https://doi.org/10.1001/jamaneurol.2022.4427)
- Deal JA, Goman AM, Albert MS, et al. Hearing treatment for reducing cognitive decline: design and methods of the Aging and Cognitive Health Evaluation in Elders randomized controlled trial. *Alzheimers Dement (N Y)*. 2018;4:499-507. doi:[10.1016/j.trci.2018.08.007](https://doi.org/10.1016/j.trci.2018.08.007)
- Medical devices; ear, nose, and throat devices; establishing over-the-counter hearing aids. Fed Regist. 87 CFR §50698 (2022).