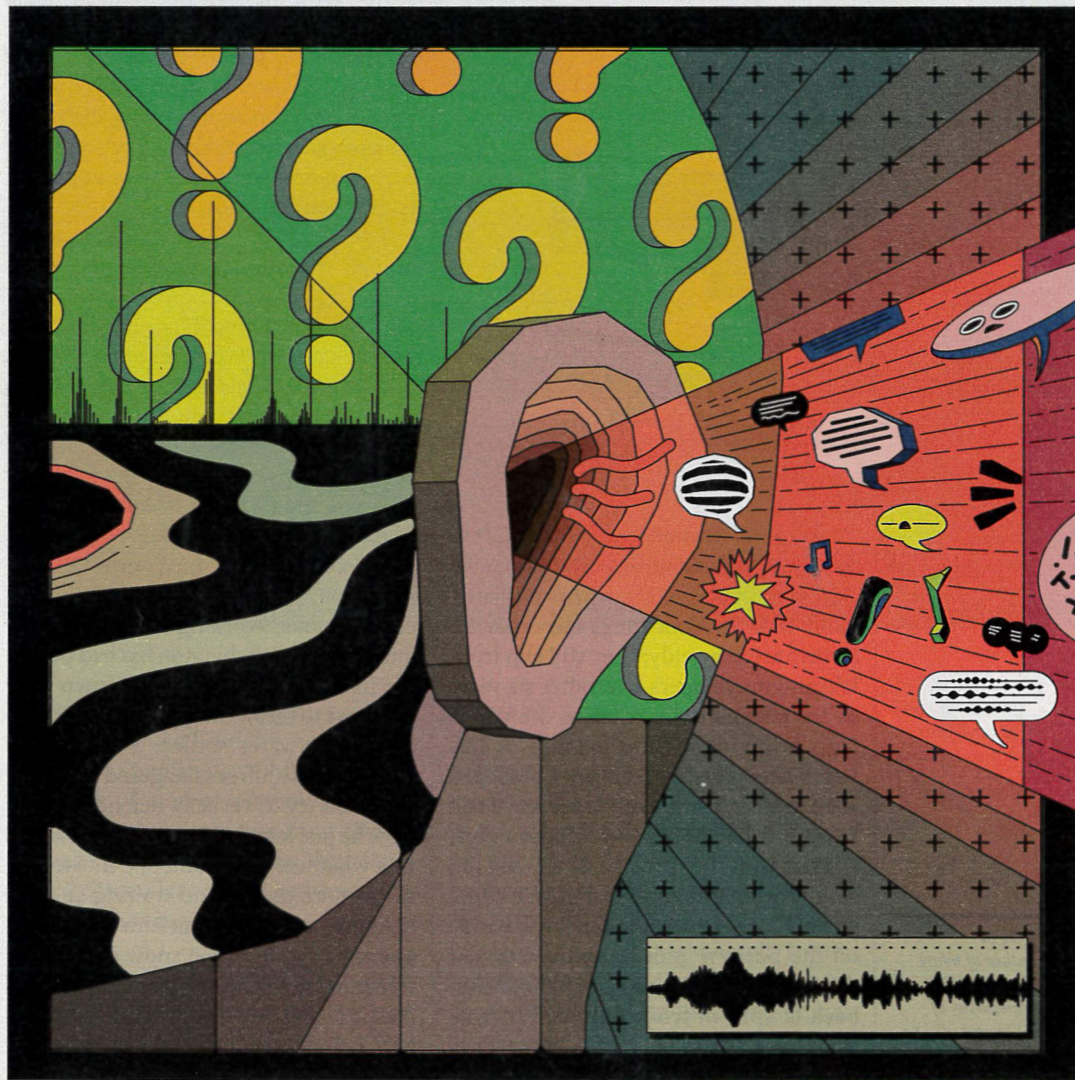


# Could paying more attention to the ‘invisible disability’ of hearing loss help improve our brains?

**Hearing loss** has long been considered a normal, and thus acceptable, part of aging. It is common: Estimates suggest that it affects two out of three adults age 70 and older. It is also rarely treated. In the U.S., only about 14 percent of adults who have hearing loss wear hearing aids. An emerging body of research, however, suggests that diminished hearing may be a significant risk factor for Alzheimer’s disease and other forms of dementia — and that the association between hearing loss and cognitive decline potentially begins at very low levels of impairment.

In November, a study published in the journal *JAMA Otolaryngology — Head and Neck Surgery* examined data on hearing and cognitive performance from more than 6,400 people 50 and older. Traditionally, doctors diagnose impairment when someone experiences a loss in hearing of at least 25 decibels, a somewhat arbitrary threshold. But for the *JAMA* study, researchers included hearing loss down to around zero decibels in their analysis and found that they still predicted correspondingly lower scores on cognitive tests. “It seemed like the relationship starts the moment you have imperfect hearing,” says Justin Golub, the study’s lead author and an ear, nose and throat doctor at the Columbia University Medical Center and NewYork-Presbyterian. Now, he says, the question is: Does hearing loss actually cause the cognitive problems it has been associated with and if so, how?

Preliminary evidence linking dementia and hearing loss was published in 1989 by doctors at the University of Washington, Seattle, who compared 100 patients with Alzheimer’s-like dementia with 100 demographically similar people without it and found that those who had dementia were more likely to have hearing loss, and that the extent of that loss seemed to correspond with the degree of cognitive impairment. But that possible connection wasn’t rigorously investigated until 2011, when Frank Lin, an ear, nose and throat doctor at Johns Hopkins School of Medicine, and colleagues published the results of a longitudinal study that tested the hearing of 639 older adults who were dementia-free and then tracked them for an average of nearly 12 years, during which time 58 had developed Alzheimer’s or another cognitive impairment. They discovered



that a subject's likelihood of developing dementia increased in direct proportion to the severity of his or her hearing loss at the time of the initial test. The relationship seems to be "very, very linear," Lin says, meaning that the greater the hearing deficit, the greater the risk a person will develop the condition.

In 2017, the medical journal *The Lancet* convened a commission to review all published research on risk factors for dementia that might be modified to prevent or delay the onset of symptoms. The surprising conclusion was that hearing loss is the largest — accounting, statistically speaking, for approximately 9 percent of all current diagnoses. That, Lin says, was "a big wake-up call." Historically, hearing loss has received relatively little attention from clinicians, scientists and the general public simply because, Lin believes, "it's something everyone gets as they get older. Everyone gets white hair and wrinkles, it can't really matter, right? It's an invisible disability."

What's unclear is how hearing loss affects the structure and function of the brain over the long term. There are hints, though. fMRI scans have shown that if the ear sends a garbled signal to the brain — whether a result of poor hearing or background noise that interferes with good hearing — regions in the frontal cortex related to reasoning, decision making and memory, as opposed to speech comprehension, are activated, "overloading" them and making them work harder in order for the listener to comprehend what is being said in the moment.

Hearing loss has also been associated with an atrophy of brain tissue in auditory regions, potentially from lack of use. People who can't hear well tend to be less likely to go out and engage with others socially too, which is another known risk factor for dementia. It's possible to imagine any of these processes leading to cognitive decline. "The brain is made up of all these interconnected networks, and if you throw off the balance a little bit over years and years, that may have these widespread effects that are hard to measure clearly," says Jonathan Peelle, an associate professor of otolaryngology at Washington University, in St. Louis.

If that's the case, Lin says, "there's every reason to think if you treat hearing loss, that those interventions could directly modify those pathways,"

preventing that decline. (There is no evidence yet to say whether people who are deaf or hard of hearing and develop alternative ways to communicate have any greater risk of developing cognitive problems.) But it's harder to see how those processes might relate to the buildup of amyloid and tau proteins that characterize Alzheimer's disease specifically. "You're never going to stop Alzheimer's disease with a hearing aid," Peelle says, "but you may help people to function better by supporting their cognition that way."

Indeed, researchers believe that Alzheimer's and other types of dementia result from a combination of factors, a majority of them genetic (scores of genes have been identified that may increase or decrease risk). But other risk factors have to do with a person's environment and lifestyle, which includes hearing. Treating impaired hearing thus has the potential to decrease the number of people living with the disease. The National Institute on Aging is currently funding the first randomized control trial, led by Lin, to see whether older adults who get hearing aids (compared with those who participate in a program to manage nutrition, diet and exercise) are less likely to develop dementia.

Encouragingly, there are no known risks to treating hearing loss with

hearing aids, though doing so can be prohibitively expensive. That may soon change. In 2017, Congress passed an act requiring the Food and Drug Administration to regulate some hearing aids as over-the-counter products that don't require a prescription; already, technology companies like Apple and Bose are marketing products that try to help users hear conversations more clearly in noisy environments. And if passed, the Medicare Hearing Act of 2019, introduced in October, would amend the program to cover hearing aids and services.

But the JAMA study and others suggest that perhaps we should be working harder to respond to hearing loss earlier. In 2018, Peelle and colleagues published a small study of university students who reported no hearing difficulties. They nonetheless found that those whose hearing was poorer — even within normal levels — had more atypical activity in their frontal cortex when listening to spoken sentences. "Most of the discussion has been around, if you have an older adult with hearing loss and you give them a hearing aid, does that help them?" Peelle says. "What we don't know is if the whole problem is living for 20 years with a little bit of hearing loss. Maybe we need to be intervening earlier." In 2008, the National Institute on Deafness and Other Communication Disorders introduced a hearing-protection campaign to get 8- to 12-year-olds to avoid prolonged exposure to loud noise or to block it with earplugs or earmuffs. And experts advise anyone who is having trouble communicating to get his or her hearing checked. (A primary-care doctor can do an initial screening.)

Golub believes changing how we think about the relationship between hearing and health might inspire people to take precautions to prevent hearing loss and to treat it sooner. "We always frame it as a disability," he says. "But I like the idea of hearing fitness. Better hearing is better for you and better for your mind. If you tell a college student, 'Don't blast your ears with loud noise because when you're 70 and you have a lot of hearing loss, you're at an increased risk of dementia,' they're not going to care about that. But if you say, 'Hey, hearing is good for your brain, the more hearing you have is better,' that has immediate implications." ♦

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