

HEARING LOSS and DEMENTIA

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About the Author

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Hearing loss, does it *cause* dementia and Alzheimer’s? Around November 2013 I saw an article called “Brain Atrophy & Hearing Loss” (Healthy Hearing, June 25, 2013). Health magazines like these are intended for the general public. Their articles are written in terms that are meant to be digested and understood, and they often draw their sources from latest research in various medical health-related fields. I thought I’d look up the actual source cited in “Brain Atrophy & Hearing Loss”; this turned out to be an article by authors Peele, J., Troiani, V., Grossman, M., and Wingfield, A., titled: “Hearing Loss in Adults Affects Neural Systems Supporting Speech Comprehension,” and it appears in the *Journal of Neuroscience*, August 31, 2011 (see Figure 1, left side).

Like many peer-reviewed articles in behavioural research, this one began with an *Abstract* giving an overall summary of the paper, and moved on to its *Introduction* where the topic relevance is described and the purpose of the paper is laid out. It then explained its *Methods*, where the subject pool is described and what kinds of experimentation will take place. It then analyzed its *Results* using statistics, in order to show proof of its findings, and then it concluded with its *Discussion* of the results.

The authors hypothesize that there is a *relationship* or *association* between SNHL and the ability to process auditory linguistic information, and that this processing involves perception and cognition at a neural level. With SNHL, an “impoverished acoustic signal” arrives at the brain to be processed as speech. As time goes on, this will result in actual

changes in the cells of the auditory areas of the cortex. They did two experiments: the first one used Functional Magnetic Resonance Imaging (fMRI) to examine the effects of hearing loss upon actual cortical *activity*. The second experiment went on to find out what *actual brain atrophy* might have occurred and exactly where this was located. For both experiments,



Figure 1. Two general articles that have appeared recently are pictured at the top of this slide. In each of these articles a more specific scholarly article is cited and discussed. These are shown respectively, in the bottom of the figure..

the average hearing loss of the subjects was only mild; borderline-normal in the lows to about 30–35 dB HL for the highs. Subjects were presented with sentences that were progressively increased in syntactic difficulty, as well as at different rates of speech presentation. Their task was to indicate whether the speaker was male or female.

In both experiments, they used the statistic of something called “Pearson r .” This family of statistics works to establish if there is a *co-relation*; it does not focus on proving cause-effect (see Figure 2). For example, it’s one thing to say that lung cancer happens to be *associated* with smoking; it’s much stronger to say that the link is direct, that smoking *causes* cancer. The first experiment in their study indeed showed a statistically significant reduction in cortical activity for both right and left primary auditory areas, in the temporal lobes of the brain. The second experiment showed a statistically significant reduction in gray matter volume for the right (not the left) auditory cortex.

At the end of their paper they discuss that peripheral hearing loss may result in *increased effort* in hearing for speech. This would be increasingly evident as hearing loss becomes worse and also as the listening task becomes more difficult. Increased efforts to hear will deprive one from concentrating on, and processing higher cognitive functions. The authors concluded that although they do not have conclusive evidence, they “...think it plausible that changes in older adults’ peripheral hearing ability had a *causal role* (italics mine) in reducing gray matter volume in auditory cortex.” In summary, while they managed to show a *co-relation or association* between HL in the elderly and brain atrophy, they also wondered if there is more, perhaps a cause-effect connection.

One might wonder if hearing loss itself results in brain atrophy, then is this happening in *young* people with hearing loss as well? The authors posit that the effects will be most pronounced for the elderly, because compared to young adults with the same SNHL, the elderly

perform more poorly on speech and linguistic experimentation. As an aside, it is interesting that they found most atrophy for the right temporal auditory areas, because it is normally well known that the *left* auditory cortex is dominant for speech in most people.

Right around the same time as I saw the first article, a second one followed. This one was a news release out of Johns Hopkins University School of Medicine, once again intended for readership by the general public (see Figure 1, right side). Its title was “Use It or Lose It; Hearing Loss & Dementia Linked.” Like the first general article did, it referred to another scholarly article by the authors Lin, F., Metter, E., O’Brien, R., Resnick, S., Zonderman, A., and Ferrucci, L., titled: “Hearing Loss and Incident Dementia” (Archives of Neurology, February 2011).

Once again, I went on the Internet and pulled up the original, detailed article and once again I painstakingly examined it, statistics and all. It is no wonder that the health magazines simplify things; have you ever tried to actually read these kinds of articles? Again like the first article did, right at the outset, at the top of its first page this second paper declares its objective: to determine if there is an *association* between hearing loss and Dementia and Alzheimer disease. In contrast to the first article however, where experimentation was done on a group of subjects, this article is a longitudinal study, one that followed the lives and course of events for subjects over a time span of about 12 years. The subject pool had over 600 people, and in the years between 1990–1994, they were all between the ages of 39–90 years old and were described as “dementia-free.” The demographic characteristics of all the subjects were assessed in terms of their

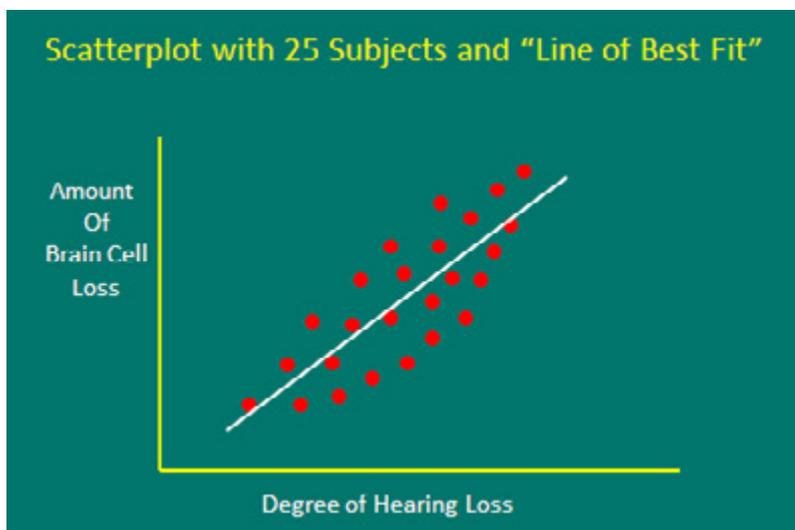


Figure 2. A co-relationship or association is shown here between degree of hearing loss and amount of brain cell loss. Each dot represents one subject in this hypothetical study. The diagonal line represents a “line of best fit,” which shows that there is a positive linear relationship between these two variables; namely, with increased hearing loss there tends to be more brain cell loss.

gender, age, race, education, whether they had diabetes, were smokers, had hypertension, used hearing aids, their scores on a test of dementia, and lastly, whether they developed dementia over the time line of the study. Subjects were then divided into groups of different degrees of SNHL: normal hearing, mild, moderate, and severe.

Results of their analysis showed a statistically significant association between hearing loss and dementia. The study also did a complex assessment of risk of developing dementia due to degree of hearing loss. It found that for hearing loss greater than borderline-normal (25 dB HL), the risk increased as the hearing loss increased. The findings remained the same even after even after the analysis was adjusted for gender, age, race, education, diabetes, smoking, and hypertension, and subjects with a history of aphasia (stroke) were excluded.

Interestingly, they also said that, “There was no evidence to suggest that self-reported hearing aid use was associated with a reduction in dementia risk.” They admit, however, that they did not investigate the number of years or the length of time per day that hearing aids were worn, and consequently, they could not conclude with certainty that hearing aid use could reduce the risk of dementia.

Just as the authors of the first article did, these authors also discuss a possible causal link. Like the first article, they conclude that hearing loss makes listening more difficult and as a result, more cognitive resources are dedicated to listening, and this is to the detriment of other cognitive processes. Okay fine; but it’s that causal thing again. . .

It is a mistake – and too easy – to believe

articles that show an *association* between hearing loss and dementia prove that hearing loss *causes* dementia. This may be proven further on down the road, but is hasn’t yet been proven. Maybe that’s never been the intent here behind these articles, but just in case readers think it might be, we all need to step above this.

A third general article about hearing loss and dementia from sources “closer to home” just popped into my email the other day! This one was the announcement of a joint study to be completed late this year (2015) between A. Amlani, an associate professor of speech and hearing at the University of North Texas and B. Taylor, director of practice development and clinical affairs at Unitron. The slant of this third study is *rehabilitative*, in that it seeks to show that the use of hearing aids may be able to delay mild dementia onset. The subjects are adults between the ages of 50–90 years of age, who already have mild dementia, and who have no previous experience wearing hearing aids. The investigators want to assess their abilities for hearing speech in noise, their overall cognitive abilities, as well as their own self-reported improvements in quality of life. Their question is whether improved hearing can help those with dementia to “...lead more active and engaged lives, particularly if hearing loss is identified and treated early.”

Well okay, that makes perfect sense! Isolation from social activities is certainly not going to do any good for someone who is in the stages of developing mild dementia. Providing better hearing sensitivity for these people, so as to increase contact with the on-goings of the outside world, would obviously be a prudent endeavour. *This is a positive way of encouraging clients who need hearing aids to get hearing aids.*

Guess what? We have actually encountered this whole topic before, but from a perspective well ensconced within our own hearing health care field – audiology – as opposed to that of researchers from neuroscience, psychology and medicine. Have a look at an article called, “Hearing aid use, central auditory disorder, and hearing handicap in elderly persons” by Rose Chmiel and James Jerger, in the *Journal of the American Academy of Audiology* in 1996; issue 7(3). The whole May-June issue 7(3) of JAAA deals specifically with aging and hearing loss. The specific paper cited here describes why the very elderly (those 85 years and older) may not always benefit much from *binaural hearing aid fittings*. The reasoning is posited as follows: the whole body ages, not just the cochlear hair cells. This “central presbycusis” may explain why the very elderly brainstem simply cannot fuse together very well the input from each ear; as a result, they cannot always make the best use of binaural amplification. Similar findings are laid out more recently in 2005, when Martin and Jerger published an article titled “Some effects of aging on central auditory processing” (*Journal of Rehabilitation Research & Development*, Volume 42 Number 4, July/August 2005, Supplement 2). Hmmm...Maybe people simply grow older...Food for thought. . .

To conclude here, humans are creatures of communication. Hearing involves communication, and communication keeps us in the game of living. We wear glasses the better to see; similarly, we should acknowledge that we wear hearing aids the better to hear! That’s the take I get from all of these articles. Let’s love our elderly and do all that we can to help them to hear!