Canadian Audiologist

The Official Publication of the Canadian Academy of Audiology

The Latest Headline: Hearing Loss and Diet Soda CAUSE Cognitive Decline

Published September 3rd, 2017

Kelly Tremblay



News stories provide alarming headlines suggesting that hearing loss ***"might"*** cause hearing loss but the word "might" often goes unheard. As a result, audiologists may experience patients coming into the clinic asking tough questions and carrying advertisements that promote buying a hearing aid in order to prevent getting Alzheimer's disease. Sifting through the scientific literature can feel daunting to the clinician; so, here we address three common questions that clinicians hear.



1. Does Hearing Loss Affect Brain Structure and Function?

Yes. There is a long line of research, dating back over 30 years, showing that auditory deprivation in the form of conductive or sensorineural hearing loss, alters structural mechanisms as well as physiological processes in the brain. However, these effects are not specific to hearing loss nor are such changes limited to sensory function. Albers et al. reviewed evidence to show that many sensory regions of the central nervous system are affected by Alzheimer pathology and deficits in hearing, vision, and olfaction precede symptoms of cognitive decline.[1] Even more recently, Fisher et al.[2] and Schubert et al.[3] reported that when modelled together hearing, visual, and olfactory impairment were each significantly and independently associated with the development of cognitive impairment, suggesting that impairments in these sensory systems may be indicators of brain aging that can be detected as early as middle age. So, it appears that the relationship between sensory impairment and cognitive decline is complicated and not specific to hearing loss, which makes sense because cognitive function involves more than just hearing. Auditory, visual, and olfactory signals are processed in the brain; thus, these authors and others (e.g., Guerreiro, Van Gerven[4]) question if there are underlying pathophysiological changes related to aging or disease that are responsible for the association between sensory and cognitive decline (rather than hearing loss alone).

2. Do Physiological Changes in the Brain, Resulting from Hearing Loss, “Cause” Cognitive Decline?

Readers can turn to Wingfield and Peele for a review of the literature but in a nutshell there are a number of studies that show correlations between audiometric and/or self-reported hearing loss and physiological measures associated with cognitive decline.[5] One example is that people with poorer hearing also have lower grey matter volume in auditory cortex. This research finding raised

concerns when first published because brain shrinkage has been tied to an increased risk of Alzheimer's disease. What gets lost in the headlines, however, is, two things. First, many of the perceptual and neuroscience studies fail to account or control for hearing loss when researching the brains of older adults with cognitive decline. Disregarding hearing loss can lead to an overestimation of age-related cognitive decline as emphasized in a recent publication by Guerrero.[4] Second, correlation is not the same as "causation." Many variables have been found to correlate with brain shrinkage, including the ingestion of artificially-sweetened sodas. People who drink 1–2 diet sodas per day are reported to have a higher risk of stroke and dementia than people who don't.[6] Does this mean hearing loss and diet soda cause dementia? What is more, does this mean wearing hearing aids and switching to sweetened beverages will prevent dementia? As silly as this example is meant to be, the general public often misses the subtleties in the research and interpolates their own cause and effect relationship, in addition to their own solutions. After all, if treating hearing impairment by fitting hearing aids can be effective in reducing the adverse impact of hearing loss on cognition then one might also expect to see a positive impact of treatment of hearing impairment on cognitive decline and risk of dementia. Or should we?

3. Is There Evidence That Amplification Devices Prevent Cognitive Decline?

To date there is no consensus that hearing amplification prevents cognitive decline. There are many reasons why such a conclusion has not been made at this time. First, the relationship between hearing loss and cognition is relatively new and it requires large, long-term studies to disentangle the relationships among variables. For example, a randomized controlled trial involving hearing assistive technology (HAT) and cognitive measures would be needed. The mere concept of a control group that is denied the use of hearing aids or other form of HAT in itself introduces a problem because denying someone the use of hearing aids could be viewed as being unethical. Second, the relationship between hearing ability and grey matter volume is correlational, without direct evidence as to its causality, thus altering hearing ability on its own is highly unlikely to be the singular variable that modulates cognitive function. There is evidence in the literature to suggest that many other factors may be involved that would be unaffected by the adoption of hearing aids (e.g., chronic inflammation, oxidative stress, hormonal changes, genetic susceptibility, and environmental/lifestyle risks). Finally, it is difficult to scientifically prove that an intervention is ***preventing*** something from happening, especially when that something is multi-facetted and complex (like cognitive decline). So, rather than focus on the fear of potentially experiencing cognitive decline, audiologists can choose to focus on the positive and promote changes that can impact a person's life today. Until clear conclusions about hearing loss and cognitive decline can be made, I suggest we reinforce the fact that improving audibility through the use of hearing aids (or other form of technology) can be improve a person's current quality of life today.[7,8]

References

1. Albers MW, Gilmore GC, Kaye J, et al. At the interface of sensory and motor dysfunctions and Alzheimer's disease. Alzheimers Dement 2015;11:70–98. doi:10.1016/j.jalz.2014.04.514
2. Fischer ME, Cruickshanks KJ, Schubert CR, et al. Age-related sensory impairments and risk of cognitive impairment. J Am Geriatr Soc 2016;64:1981–87. doi:10.1111/jgs.14308
3. Schubert CR, Cruickshanks KJ, Fischer ME, et al.Sensory impairments and cognitive function in middle-aged adults. J Gerontol A Biol Sci Med Sci 2017 May 23. doi: 10.1093/gerona/glx067. [Epub ahead of print]

4. Guerreiro MJS, Van Gerven PWM. Disregarding hearing loss leads to overestimation of age-related cognitive decline. Neurobiol Aging 2017 Aug;56:180–89. doi: 10.1016/j.neurobiolaging.2017.05.001. Epub 2017 May 10.
5. Wingfield A and Peelle JE. How does hearing loss affect the brain? Aging Health 2012;8(2):107–9. http://doi.org/10.2217/AHE.12.5
6. Pase MP, Himali JJ, Beiser AS, et al. Sugar- and artificially sweetened beverages and the risks of incident stroke and dementia. Stroke 2017;48:1139–46.
7. Chisolm TH, Noe CM, McArdle R, and Abrams H. Evidence for the use of hearing assistive technology: The role of the FM system. Trends Amplification 2007;11:73–89.
8. Chisolm TH, Johnson CE, Danhauer J, et al. A systematic review of health-related quality of life and hearing aids: Final report of the American Academy of Audiology taskforce on the health-related quality of life benefits in adults. J Am Acad Audiol 2007;18. 151–83