

Hearing Loss and Dementia; Uncharted Territory

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## Abstract

Dementia is a disease affecting millions of people worldwide. While there are genetic dispositions for developing this condition, there are also modifiable risk factors that remain undiscovered. The project is an investigation of the rate of dementia and cognitive decline as a direct result of hearing loss while focusing on the effects of hearing-aids. Research evidence was gathered from five studies that were done within recent years to obtain the most updated information available on the effect hearing loss has on cognitive functioning. The participants in this study ranged from ages of 50-100, and most were first-time hearing-aid users. A link between hearing loss and dementia is real and a possible modifiable risk factor. Further long-term studies are needed to track the rate of cognitive function and allow for more accurate results. Finding modifiable risk factors would change the impact this uncharted disease has on people in society and healthcare.

*Keywords:* hearing loss, dementia, cognitive decline, hearing aids

### Hearing Loss and Dementia; Uncharted Territory

Hearing loss affects more people every day. Many assume that this is a common factor of aging, however, if it was discovered that there was a link between hearing loss and dementia would society be as accepting? According to Searchfield, Fok, and Sanders (2019), “the number of people with dementia worldwide is projected to double in the next three decades” (p. 17). This disease is devastating a large part of the population and it is critical that we start investigating into what may save millions of people’s quality of life in the future. If there is a relationship between hearing loss and dementia, it is one that deserves to be discovered through the study of immediate hearing aid intervention and accurate detection of hearing loss. It also can be observed through various routes of cognitive hypothesis, detailed long-term studies, and early hearing-aid implementation. Evidence-based recommendations for nursing interventions were identified and are included in this manuscript.

#### **The Effects of Hearing Aid Implementation on Cognitive Function**

If studies show there is a connection between decreased hearing viability and increased risk for cognitive decline, the older population is at large risk for acquiring a chronic disease that degenerates cognitive function. Weinstein and Crofts (2018), state that “by 2061, 74 million...adults are projected to have a hearing loss” (p. 22). In adults between the ages of 50-100, will there be a decreased cognitive decline with adequate hearing aid implementation compared to delayed hearing loss treatment over ten years? If so, it is critical to start hearing aid correction methods as soon as loss is detected. While incidence of dementia may only decrease by 5% with these interventions, that is

roughly 376 million people that will not have to suffer through cognitive difficulties. Many people are struggling with hearing loss and it is considered the fourth highest chronic condition in people across the world (Weinstein & Crofts, 2018, p. 22). If immediate hearing aid implementation reduces the risk of acquiring dementia in later years, it is a subject worth discovering.

### **Hearing, Social Engagement, Cognitive Function, Physical Health, and Mortality**

Dawes et al. (2015) studied with the intent of uncovering the link between hearing loss and implementation of hearing aids. The investigation focused on how those worked in conjunction related to cognitive function, mental health, social engagement, hearing handicap, and general health. This study was expanded over an 11-year timeline and started with pre-data and a population of 2800 baseline patients between the ages of 48-92. These patients were required to be first-time hearing aid users and commit to a study that lasted over a decade. All patients were also eligible by having a hearing aid impairment and Dawes et al. (2015), states that was “defined as having an average threshold over 3 and 4 kHz greater than 40 dB HL in the better ear” (p. 839). At the 5-year check in there were 2395 patients, and 1812 lasted through 11-years. The overall topic was the impact hearing aids had on a range of cognitive and general outcomes. For tests of cognition, patients went through a mini mental state examination while physical health was tested through the SF-12 short form health survey (Dawes et al., 2015, p. 839). Other factors tested with quantitative results included hours socializing with peers, self-perceived quality of mental health, and demographic characteristics and access. According to the study, participants in the

11-year check-up experienced a rate of incident cognitive impairment of 11.1% for hearing-aid users, versus 15.5% for non-users. While there was not a significant amount of difference between the two categories over short periods of time, a long-term approach did demonstrate the increased cognitive function with hearing aid usage. It was also concluded that hearing aids decreased hearing handicap (Dawes et al., 2015, p. 842). Overall, data from this study suggests hearing aids can be helpful in decreasing the hearing handicap and promotion of quality physical health. Hearing aid implementation in this study showed a decrease in cognitive decline over an 11-year study and evidently supports the bridge between hearing loss and dementia. If there is a higher level of cognitive functioning related to hearing improvement, then more areas of the brain are being used in a productive manner and help prevent cognitive deterioration.

### **Hearing Loss and Cognitive-Communication: Effects of Amplification**

Hopper, Slaughter, Hodgetts, Ostevik, and Ickert (2016) worked to identify the connection between hearing loss and cognitive dementia. They also focused on whether long-term care staff are correctly recognizing hearing loss and needs for implementation. Thirty-one patients were included in this study hailing from five separate long-term care facilities. Each patient had to be suitable for the study and were required to have the existing factors of English speaking, dementia diagnosis, visual sufficiency, and mild-moderate hearing impairment (Hopper, Slaughter, Hodgetts, Ostevik, & Ickert, 2016, p. 1535). This is a qualitative study that used audiological

methods, amplification testing, and cognitive assessments. This study was conducted over a period of 14 days and included a brief cognitive rating scale, recall conditioning, word recognition testing, and a clock-drawing test (Hopper et al., 2016, p. 1537). There was a varied level of dementia presentation in patients and the treatments were adjusted based on severity level. A result from the study “suggested that the current study adds to the literature in this area and are consistent with positive reports from other studies in which hearing aids were successfully used by individuals with dementia” (Hopper et al., 2016, p. 1539). There was a decrease in dementia-related problems or behaviors and amplification might provide a use in clarity between the connection between hearing loss and dementia. While this study does suggest that the hearing loss impact regarding dementia should be studied over a longer period of time, the positive effects of cognitive testing show the importance of proper treatment and intervention. Within the long-term care setting specifically, it is important that hearing loss concerns are addressed immediately to hopefully preserve as much cognitive function as possible.

### **Hearing Loss Treatment in Older Adults with Cognitive Impairment:**

#### **A Systematic Review**

Mamo et al. (2018) created this research in order to investigate multiple studies for various treatments regarding hearing decline in the older adult population to notice trends in line with cognitive diminishing. This study included research from thirteen separate trials, studying around three-hundred and fifty patients, while also focusing on quantitative data. Patients were tested through basic training and auditory resolution,

binaural hearing aids, spaced retrieval training, headset amplification with rapid eye movement, and other variations of similar treatments (Mamo et al., 2018, p. 2597). Also, within this study, patients ranged from ages 57-100, and was created in order to discover “best practices for managing hearing loss in this vulnerable and growing population” (Mamo et al., 2018, p. 2597). In one specific study, a group of patients from a long-term care center were initiated into an 7-8-week auditory training that was meant to retrain the brain on sounds and understanding (Mamo et al., 2018, p. 2598). It was concluded that the patients treated with hearing aids did experience a benefit surrounding communication and a decline in dementia-related behavioral symptoms (Mamo et al., 2018, p. 2599). The treatments studied were able to show a general overview of increased cognitive functioning in patients and opened the door for alternative consistent treatments in long-term care patients. From this research, it supports the question regarding the effects of early implementation towards hearing loss and how that can possibly show a decline in cognitive deterioration. Overall, it was a generalized study that concluded all patients received a sliding scale of benefit but that there was a noticed cognitive improvement with hearing loss correction.

### **Relationships Between Decline in Speech-in-Noise Recognition and Cognitive Functioning**

Pronk et al. (2019), centered their research on the multiple directional hypothesis that connect hearing loss and decreased cognitive function including cognitive load, information degrading, sensory deprivation, and common cause reasonings. This research was conducted with the involvement of 3,107 people between the ages of

55-85 in the first round. The second round was then re-tested at the 4-year mark and included 1,002 participants (Pronk et al., 2019, p. 1170). Tests used to monitor cognitive functioning and auditory measures included the SiN-test, global cognitive functioning, information processing, verbal memory recall, and retention measures. The study ranged over a 7-year time period in which participants were re-evaluated using the same techniques and a qualitative functioning scale. In using the longitudinal aging study Amsterdam, these tests were given in the participants home in order to mimic a comfortable environment. Overall, it was concluded that all four hypotheses were supported and in particular “support for the common cause hypothesis was found for all cognitive measures” (Pronk et al., 2019, p. 1184). The study produced evidence supporting each hypothesis including decreased auditory stimulation leading to declining cognitive function. However, there are more complex pathways at work behind the various hypotheses. Throughout the study there was a high incidence of declining cognitive function in relation to hearing loss and sensorineural delay. This would support the research evidence by suggesting that hearing aid implementation allowed for a decline in decreased cognitive function and allowed a new cognitive activism.

### **Working Memory, Sleep, and Hearing Problems in Patients**

Zareno, Hällgren, Andersson, and Ledin (2017) studied research regarding how hearing loss is in an intertwined relationship with tinnitus and decline in cognitive functioning. There is not a one-step method that allows for curative procedures, instead it is critical to turn our focus on researching the complicated association between hearing loss and cognitive function. This study centers around data collected from 92



patients who had “mild-to-moderate sensorineural hearing loss and were first-time hearing aid users” (Zareno, Hällgren, Andersson, Ledin, 2017, p. 143). The users in the study were between the ages of 40-82 years old and participated through a quantitative research testing cycle including questionnaires from hearing handicap inventory for the elderly, tinnitus handicap inventory, Pittsburgh sleep quality index, and hearing-in-noise test. Within this investigation, the relation between hearing loss and working memory was studied and gathered from a variety of patients. Not only does a delayed hearing function, such as tinnitus, affect understanding, but it is also considered to affect the cognitive, emotional, and conscious processing (Zareno et al., 2017, p. 142). It was concluded that “patients with hearing loss and tinnitus have more problems with cognition as...the processing of distorted speech signal is likely to consume cognitive resources” (Zareno et al., 2017, p. 150). With this result, it clearly indicates that by providing patients with more adaptability to the sounds in their environment, they will then be able to execute tasks that require a higher functioning cognitive ability. This study relates to the evidence behind how immediate hearing loss intervention can decrease the rate of cognitive decline and presentation of dementia. The research shows that the warped sounds can have a higher task load on the brain, and if the resources are going towards that they are not being as active in other parts of life. This is relevant to the beginning question as it does show increased cognitive function with quick treatment.

### **Assumptions**

One assumption made going into this evidence-based practice was the belief that all participants in the studies did not have any other existing mental health condition ranging from bipolar-disorder to depressive tendencies. A categorization of patients into a box of simply being diagnosed with a version of dementia without considering other factors might influence categories of the various studies was assumed. This heavily relates to the project as other diseases or diagnosis might impact the results taken from the study and the accuracy in cognitive effect. If there is another disease attacking the brain it is possible these are not fully clear results. Secondly, prior to this project, it was assumed that all the participants had access to readily available healthcare. That is almost never the case and it is important to factor in, because then it leads to wondering how often the patient was being taken care of before the diagnosis. If participants did not have access to healthcare, it is possible they had late reports of hearing loss or other issues delaying treatment.

### **Recommended Evidence-Based Interventions**

From the research there are various methods that might provide a benefit to cognitive decline. The first intervention aligns with the initial question stated to determine if hearing aid implementation decreases the decline of cognitive deterioration. In the research done by Zarano et al., (2017), studies found that by patients exhausting their efforts in attempts to understand garbled speech it is possible they are diminishing their cognitive resource supply. With that finding, hearing aids increase sounds, and would in-turn allow patients to spend their cognitive resources performing

higher demand tasks that stimulate advanced cognitive function. This intervention of immediate hearing aid implementation could be monitored through long-term studies and yearly annual check-ins. This would allow for an assured documented progression of cognitive function and comparison with other non-hearing-aid users.

Another intervention that might show improvement is directed towards long-term care patients who have consistent access to healthcare resources. In a 7-8-week trial, patients who participated in hearing aid auditory training focusing on consonant identification and frequency discrimination showed a significant change though memory scores pre and post-auditory training (Mamo et al., 2018, p. 2598). This would change the way healthcare providers treat patients in long-term care settings and possibly lead to cognitive changes with constant and steady training alongside hearing aid adjustment. A way this intervention could be evaluated is through individualized care plans that incorporate the results into weekly updates. When new results are found for each patient it will be documented and the care plan team would get together to discuss a new plan with the patient. It also could be monitored by rate of cognitive decline in a long-term setting while also identifying an increase in cognitive function.

Thirdly, a study focusing on the audiology assessment was critical in the primary steps of identifying sound barriers. Multiple patients have cerumen impaction decreasing hearing ability. It was found that the removal of cerumen from patients allowed significant improvements in hearing and higher testing scores. It is important that long-term care facilities are keeping up with the cerumen management and the intervention of cerumen removal can become a constant in facilities to help treat hearing

loss (Hopper et al., 2016, p. 1540). An evaluation method for intervention would be monthly chart evaluation list's in patient's rooms. Once a month each patient will be seen specifically to assure they are receiving appropriate cerumen removal. This allows a consistent responsibility on healthcare providers to notice any changes with hearing loss and cognitive function. Another method of evaluation would be engaging the patients in cognitive functioning tests before and after removal to document differences or change in state.

### **Conclusion**

The relationship between hearing loss and dementia is one that is critically complex and not yet fully uncovered. Multiple studies have been done with patients ages ranging 50-100, and this population is the most affected by hearing loss and cognitive decline. Many patients facing risk of dementia have genetic unmodifiable markers that put them at risk. However, for the rest of the population there are modifiable risk factors that could decrease incidence of dementia. As the research shows, it is fully possible that there is a solid connection between hearing loss and dementia. This means early implementation of hearing-aid use can be the key to protecting cognitive function. From studies, hearing aids are evidenced to help improve the quality of life. Also, many people receive auditory correction years after first discovering hearing loss and that might result in possible cognitive decline. Hearing aids related to cognition are also best recorded when studied over a long-term time frame with multiple check-ins allowing progression to be seen. With the various studies being done, it is clear to see there are multiple hypotheses that all garner an evidence-based

response from populations tested. Due to that, it is difficult to pinpoint one exact cause for dementia, but it does allow some factors to be adjusted such as the use of hearing aids. Lastly, early hearing-aid implementation has shown significant changes in accomplishing tasks that require higher levels of cognitive functioning. Numerous interventions are available but the ones with the most data research support include early hearing-aid implementation, auditory and individualized training, and monthly cerumen wax removal. Dementia is a disease that affects the worldwide population and it does not discriminate against age, race, gender, money, or class. This disease is unmerciful and changes the lives of those it touches. With this in-mind, it is important for us as a society to focus our efforts on researching modifiable risk factors for obtaining this cognitive degenerative disease. While it might not be a large amount, the researchers found that the link between hearing loss and dementia is very much a real possibility and it is important to start regarding this evidence as critical. This connection is uncharted territory and one that deserves to be conquered for the betterment of humanity.

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