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Hearing Health Care for Individuals with Hearing Loss and Cognitive Decline: A Literature Review

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Hearing Health Care for Individuals with Hearing Loss and Cognitive Decline: A Literature Review

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Abstract

While recent research has suggested that hearing loss is associated with cognitive decline, a direct connection between the two is not clear. With the steady increase of dementia and Alzheimer's Disease in older adults, it is important to note that there are precautions that may be taken in order to slow the process of cognitive decline. Despite the fact that the causality between hearing loss and cognitive decline remains unclear, research in the area of treating the hearing loss has shown a positive impact on people with dementia. The aim of this literature review is to collect research regarding hearing loss and its relationship to cognitive decline. The literature review explores different studies and their findings in relation to hearing loss and cognitive decline. Therefore, this review hopes to highlight the devastating impact hearing loss can play, both socially and emotionally, in older adults and their families. This collection of articles provides insight for professionals to grasp a better understanding of the impact of hearing loss on an individual and their cognition. This literature review can also be used as a reference to give direction to future studies focused on a better understanding of hearing loss and its relationship to cognitive decline, dementia, and Alzheimer's disease.

Key Words

Hearing Loss, Hearing Impairment, Cognitive Decline, Cognitive Impairment, Social Isolation, Dementia, Alzheimer's Disease, Audiology, Cognition, Aging

Introduction

Hearing loss plays a significant role in a person's health, especially their mental health. The following literature review has been conducted to provide information on the association between hearing loss and cognitive decline. While the exact relationship has not been determined, there have been many studies which show a strong connection.

The World Health Organization explains that dementia is a general term used to describe the daily interference of loss of memory, language, problem-solving and other cognitive abilities (2020). Depending on the changes in the brain, the type of dementia can vary. The types of dementia include Alzheimer's Disease, Lewy Body dementia, Vascular dementia, frontotemporal dementia, and a category of "others" which includes Parkinson's Disease and Huntington's Disease. Among older adults, Alzheimer's Disease is the most common cause of dementia. According to the National Institute on Aging (2020), Alzheimer's Disease is ranked as the 6th leading cause of death in the United States. Per the World Health Organization, there are approximately 50 million people diagnosed with dementia worldwide with nearly 10 million new cases of dementia every year. By 2030, the total number of people with dementia is projected to reach 82 million and nearly double to 152 million by 2050. The Alzheimer's Association estimates 6.2 million Americans currently have dementia and by 2050 they estimate 12.7 million people will be diagnosed with dementia. This increased rate of dementia will have a direct impact on the health care system. While there is no cure, an early diagnosis can promote optimal management and well-being for the individual.

According to the Dementia Care Center, cognitive impairment and cognitive decline are interchangeable words used to describe when a person has minor difficulty remembering,

learning new things, and concentrating (2020). It is important to acknowledge that cognitive impairment is not considered a form of dementia.

A notable risk factor associated with the diagnosis of dementia is hearing loss. The appropriate diagnosis and management of hearing loss can lead to improved quality of life, better communication, reduced social isolation, and likely delay the development of dementia in older adults.

Literature Review

Hearing Loss and Cognitive Decline

The exact relationship between cognitive ability and hearing loss is unclear; however, there is evidence which links an individual's hearing ability with their cognitive function. Many longitudinal research studies (Amieva et al., 2018; Deal et al., 2017; Bernhard et al., 2019; Lin et al., 2011) have revealed a link between hearing loss and cognitive decline. It has been hypothesized that hearing loss can be associated with cognitive decline through increased social isolation which can also lead to depression. These studies provide evidence that hearing loss is likely a contributing factor in the development of cognitive impairment. Literature reviews conducted by Limongi et al. (2015) and Loughrey et al. (2017) compiled evidence that further supports the link between cognition and hearing ability.

To identify a possible relationship between hearing impairment, death, depression, and dementia, Amieva and colleagues (2018) conducted a 25-year-long study in which 3,777 individuals aged 65 or older were given the Mini-Mental State Examination (MMSE) and a short questionnaire assessing self-perceived hearing loss. The overall findings of this research study concluded a connection between hearing loss, depressive symptoms, and social isolation. The researchers determined that hearing aids can restore communicative abilities and slow cognitive decline. Negative associations between self-reported hearing trouble and depression were eliminated in old adults using hearing aids. The implications of these findings are that hearing aids are a useful tool to assist in staying engaged in the conversation. Amplification allows individuals to participate in conversations and social interactions instead of withdrawing. When people are engaged in conversations, social isolation is less likely to occur.

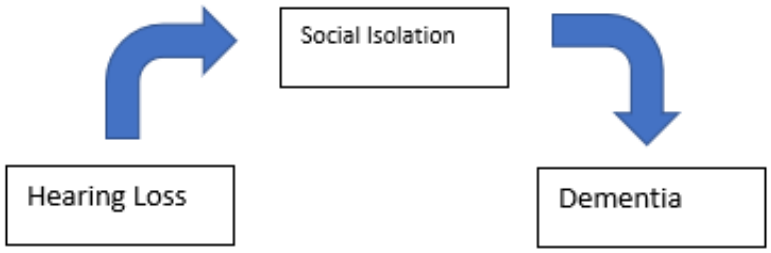

Figure 1

One study which identified hearing impairment as being a link to dementia was Deal et al. (2017). This study followed 1,889 adults aged 70-79 years. Over 9 years, 299 participants developed dementia. The participants who developed dementia also reported the greatest level of hearing impairment. Due to the study's findings, it was concluded that hearing impairment is associated with increased risk of the development of dementia because the risk coincided with hearing impairment.

Similarly, a longitudinal study conducted by Bernhard and colleagues (2019) between January 2013 and December 2017, followed patients who had just been diagnosed with dementia. In total, 122,708 individuals (61,354 patients with dementia and 61,354 patients without dementia) aged 65 and older were followed. The goal of this study was to see if sensory impairments could be associated with decreased cognitive function. They found that visual impairment was not significantly associated with dementia; however, patients with hearing loss were at a significantly higher risk for the development of dementia. This finding again supports the relationship between hearing loss and the increased risk of developing dementia.

Furthermore, Lin and colleagues (2011) directed an analysis of data from The Baltimore Longitudinal Study of Aging which associated a higher risk of cognitive decline with hearing impairment. This study followed 347 participants from 1990-1994. They found a reduction in cognitive performance by 6.8 years for individuals with hearing loss, meaning people with 25 dB

of hearing loss performed similarly to people who were approximately 7 years older than them on cognitive measures. This study concluded that the brain aged quicker when hearing loss was present. Therefore, the risk of cognitive decline increased with hearing loss.

Further evidence of the relationship between hearing loss and cognitive decline includes research done by Limongi and colleagues (2015). The purpose of this study was to provide updated epidemiological data regarding the aging population and their association to dementia and hearing loss. They found that the prevalence of hearing loss in American adults aged 70 years and older is 63%. They reported multiple studies which have highlighted an association between dementia and age-related hearing loss, with the risk of dementia increasing three-fold for every 10 decibels of hearing loss.

Hearing loss has an impact on brain function which was evidenced by Loughrey et al. (2017). These researchers gathered information regarding age-related hearing loss, cognitive function, cognitive impairment, and dementia. They wrote a literature review of 36 studies with an estimated 20,264 participants. The study analyzed data of cognitive domains such as, executive function, episodic memory, processing speed, visuospatial ability, etc. They found a significant association between hearing loss and dementia in cross sectional and cohort studies. This is significant because age-related hearing loss can be a biomarker and a notable risk factor for cognitive decline.

There have been many research studies which have identified an association between hearing loss and cognitive ability. Several studies have determined an increased risk of cognitive decline when hearing loss is present. Limongi and colleagues (2015) noted an association between hearing loss and cognitive decline. Deal et al. (2017) found that people who developed dementia also had the greatest level of hearing impairment. Similarly, Bernhard and colleagues

(2019), and Loughrey et al. (2017) found people with hearing loss to be at a significantly higher risk of developing dementia. The higher risk of cognitive decline could be linked to what the hearing loss does to the brain. Lin et al. (2011) determined the brain aged at a quicker speed when hearing loss was present. While these studies observed a relationship between hearing loss and cognition, a study done by Amieva, and colleagues (2018) found a link between hearing loss, depressive symptoms, and social isolation. More findings of this study concluded that hearing aids could be beneficial to help people with hearing loss stay engaged in conversation.

Neural Processing

Cognitive decline is also related to a change in neural processing. When the auditory stimulation is weakened as a result of hearing loss and peripheral auditory distortion, changes in the central auditory nervous system are likely occur. Boyle et al. (2008) found that the brain compensates for hearing loss through neural changes. Another study which found neuronal changes was Campbell and Sharma (2018). They specifically studied the frontal lobe and determined changes take place when hearing loss is present. Both studies identified the change in neural pathways when hearing loss is present. Ultimately, it is believed the neural pathways should respond differently if the auditory stimulation is restored. Martini and colleagues (2014) determined that if the hearing sense is restored, it lessens the cognitive load, which benefits the neural processing.

When hearing loss is present, the brain must work harder to identify sounds. A research article written by Boyle, et al. (2008) wanted to further investigate the neural change with cognitive decline in patients with hearing impairment. When there is cognitive decline, a neural change occurs because it is the brain's way to compensate for the hearing loss. The researchers

found that people who had hearing loss, had an increased cognitive load which adversely affected cognitive processes like memory or executive functioning.

Other evidence suggests that neuronal changes happen in the frontal lobe. Based on that ideology, Campbell and Sharma (2013) wanted to see compensatory plasticity changes within the brain on adults with mild-moderate hearing loss in comparison with their normal hearing peers. They found, "to compensate for the decreased auditory input that is caused by hearing loss, more listening effort is required through the additional recruitment of frontal areas" (Campbell, Sharma 2013). The increased listening effort is creating more work on other areas of the brain.

Research which indicated a neural change in patients with hearing impairment was conducted by Martini, et al. (2014). The researchers wanted to determine if restoring sensory function in cognitively impaired adults would improve cognitive status. The researchers indicated, when an activity becomes more demanding on adults with a sensory impairment, the brain recruits different neural populations to achieve the same performance. When hearing loss is present, it creates more work for the brain to attempt to understand the auditory stimuli. These researchers stated "People with hearing loss have various neuronal changes. Hearing loss in older adults may result in an acceleration of aging because the nervous system can alter synapses and neural anatomy". Overall, the researchers found that restoring an individual's hearing ability can reduce the neural activity needed to understand the auditory stimuli.

Hearing impairment causes the brain to compensate the way it processes sounds. Boyle and colleagues (2008) determined there was a change in neural processing with the presence of a hearing impairment. Campbell and Sharma (2018) further investigated the involvement of the

frontal lobe and its role in processing when hearing loss is present. Martini et al. (2014) indicated the brain can also adapt by lessening the cognitive load when the auditory stimulation is restored.

Identification and Hearing Aids

Audiologists play a key role in the identification and treatment of hearing loss, especially those with dementia (Hubbard et al., 2018). According to Hopper and colleagues (2016), there tends to be a great deal of misclassification of hearing loss in older individuals. Individuals tend to have a more severe hearing loss than caregivers suspect which can make identification harder and delay treatment. A major tool for treatment of hearing loss is hearing aids. Maharani and colleagues (2018) found that hearing aids could potentially slow cognitive decline. Dawes and colleagues (2015) discovered that hearing aids provided adult users with better outcomes in mental health, social engagement, cognitive function, and physical health. Shen and colleagues (2016) suggested that audiologists should provide cognitive screeners. Cognitive screeners would allow for diagnosis and treatment to take place quicker. The importance of care in a timely manner is important because it can help delay the negative behaviors associated with cognitive decline. Findings from a study done by Palmer et al. (1999) found hearing aids assisted in controlling behaviors in people with mild to moderate dementia.

Hubbard and colleagues (2018) emphasized the idea that there is little focus on treatment of hearing loss among people who have dementia. The article reviewed research for hearing interventions and found that, overall, poor hearing ability is associated with poorer cognitive ability. Therefore, it is likely that if audiologists can treat the hearing loss, it will help keep individuals cognitively engaged in communication which can help slow the process of cognitive decline.

There is some evidence that indicates treatment of hearing loss influences cognitive decline. Early identification of cognitive decline is an important factor in potentially delaying the onset. Maharani and colleagues (2018) wanted to determine if hearing aid use could change cognitive trajectories in older adults. This study collected data from the Health and Retirement Study, which calculated cognitive performance every 2 years for over 18 years. The findings of this study included a slower decline in episodic memory performance after the participant started using hearing aids. The researchers stated, "that early recognition and treatment of hearing loss could have the potential to slow down cognitive decline and potentially delay the onset of dementia, and should, therefore, be a focus of healthcare providers and care management models". This study is important because it also provides evidence that treating hearing loss could ultimately slow down cognitive decline.

Hopper et al. (2016) wanted to explore the effects of amplification on individuals with dementia and determine if hearing loss could accurately be identified by staff in long-term care facilities. They found that in a long-term care facility, the staff misclassified hearing loss for 44% of the 31 participants. The same study found that 7 participants had hearing loss that was not identified, and four participants had a more severe hearing loss than estimated. This shows that there are cracks in the foundation for identifying and treating hearing loss. Often, detecting hearing loss in the geriatric population can be challenging due to inability to respond or inability to understand directions. However, this is a very important population in which to find and treat hearing loss due to the complications associated with cognitive decline. The researchers in this study also found that speech intelligibility scores improved with amplification. This demonstrates that hearing aids can be an effective tool in helping those individuals with

dementia. An audiologist should educate health care workers on the effects of hearing loss, and the importance of hearing aid use.

Dawes and colleagues (2015b) investigated whether the use of hearing aids was associated with better cognitive outcomes. They used the UK Biobank data set of 164,770 UK adults aged 40 to 69 years. These participants completed a hearing test as well as a cognitive test and answered questions regarding hearing aid use, social isolation, and depression. The goal of this study was to determine if there is a relationship between hearing loss, social isolation and/or depression (Figure 1). The researchers found that social isolation is associated with poorer cognition and poorer hearing. These findings highlight the relationship between cognitive decline, hearing loss and social isolation.

To clarify the impact of hearing aids on mental health, social engagement, cognitive function, and physical health outcomes in older adults with hearing impairment, Dawes and colleagues (2015a) conducted a longitudinal study. The researchers found, in a sample of 666 older adults with hearing impairment, 11 years after baseline, hearing aid users had lower scores of hearing handicap and better physical health. This is an important finding because often we do not associate hearing health with physical health. However, if someone is active, engaging in activities, they are more likely to have better overall health than someone who has socially withdrawn.

Treating hearing loss may make a significant contribution to reducing the burden associated with cognitive decline and reduced quality of life. Audiologists need to take an active approach in combating social isolation by treating the hearing loss. Shen and colleagues (2016) indicated, “As health care professionals who serve the aging population, audiologists are likely to encounter cases of undiagnosed cognitive impairment”. With the help of early identification,

a treatment plan, and allowing the brain to adjust with hearing aids, social isolation is less likely to occur. An audiologist needs to extensively counsel people with hearing loss and their communicative partners. This is allowing the person with hearing loss to continue to connect with other people and stay in the conversation instead of withdrawing from the conversation. Caregivers play a key role in the treatment of hearing loss. When an individual relies on a caregiver to help them with daily activities, the caregiver becomes a crucial person to help assist the individual with hearing loss and their hearing health care. If the caregiver is not properly trained in how to use amplification, or does not consistently put the hearing aids in, it is detrimental to the person needing the amplification.

Palmer and colleagues (1999) identified 30 behaviors commonly associated with dementia and asked caregivers to pick the four most upsetting behaviors, pre-amplification. Post-amplification results showed reduction of several problem behaviors. This study was only performed on individuals with mild to moderate Alzheimer's Disease. The technology has advanced tremendously which may impact the results of this study if done on an individual with slight to mild Alzheimer's Disease today. This study revealed the importance of amplification for individuals diagnosed with Alzheimer's Disease. Amplification is not able to cure the disease, but it improves the problematic communicative behaviors of this disease.

The importance of treating hearing loss was emphasized by Hubbard and colleagues (2018). However, Hopper and colleagues (2016) proved that receiving treatment may be harder because of the misclassification of hearing loss. Hearing loss tends to be worse than expected which could lead to delayed diagnostic evaluations and treatment. Treatment includes hearing aids which, according to Maharani and colleagues (2018), have been shown to delay or slow cognitive decline. Dawes et al. (2015) found that a relationship between hearing loss, depression

and social isolation could impact a person's cognitive state. Another study completed by Dawes and colleagues (2015) discussed that treatment of hearing loss could impact not only better cognition but better physical health. Treatment of hearing loss has shown to improve the quality of life of people who have already been identified with dementia. Palmer et al. (1999) found that management of hearing loss with hearing aids could also help some problem behaviors. Shen et al. (2016) further discusses the importance of early identification of hearing loss so the treatment process can start as soon as possible.

Methods

Database searches (Figure 2) using key terms yielded approximately 163 articles and books associated to our topic. Approximately 95 literature sources were selected for review. Of the 95 texts, 40 were chosen as appropriate resources for the purpose of this literature review. We assessed each resource to conclude if it fit criteria for our literature review. Figure 2: Database search including search terms that were used.

Database Used	Search Terms
PubMed	Hearing impairment; hearing loss; Audiologist; dementia; cognitive decline; Alzheimer's; hearing aids
Milner Library Database	Hearing loss; cognitive decline; Audiologist; dementia; hearing aids
Google Scholar	Hearing loss; cognitive decline; Audiologist; dementia; hearing aids; Cognitive Screener;

Discussion

While the exact correlation between hearing loss and cognitive decline is unknown, there is a broad association between the two. There is no research study that proves that hearing loss causes cognitive decline; however, there are many studies that point to a strong relationship between the two. More studies are needed to better understand the exact relationship between the two factors. Until then, we have a broad understanding of hearing loss affecting communication which can lead to social isolation leading to negative cognitive outcomes.

The social and emotional effects associated with hearing loss can lead to cognitive decline. When a person with hearing loss is in a conversation, they must put in more effort to keep up with the conversation. This is because the brain attempts to compensate, when it is not being fully stimulated, to try to understand what is being heard. If the individual with hearing loss does not know the context of the conversation, they require more effort to listen and decode the conversation. This can be taxing on the brain as it tries to process what is being heard. Often, people with hearing loss withdraw from conversations because it is hard to understand a conversation when one cannot hear. This repeated pattern of communication breakdown can lead to social isolation and depression. Loughrey et al. found evidence that hearing loss changes the way the brain operates (2017). It is possible these changes are correlated with cognitive decline as communication allows connection with others and brain stimulation.

When communication cannot occur due to hearing loss and the effort it takes to maintain the conversation, it is very common for people with hearing loss and their communicative partners to struggle. Even if there is no cure for dementia, there is plenty of evidence that suggests the important role that amplification can play in slowing the progression of dementia.

When someone has hearing loss, the entire listening and understanding process is negatively impacted. Audiologists should consider providing counseling and listening strategies to accompany hearing devices to help ease communication. Aiding in the brain's understanding of speech and noise amplification can be a helpful tool to assist in restoring some of one's hearing ability.

Hearing loss is taxing on the brain because it takes more neural energy to deconstruct the auditory stimuli for understanding in noise. Other processes of the brain are negatively impacted because the brain is using other methods to attempt to understand what is being heard. Individuals with hearing loss often struggle with conversation in groups or when background noise is present because the brain is working harder to decode what is being heard. There is more stress on the cognitive load because the brain must do more work to understand the auditory stimuli. This tiresome strategy can eventually fade, and commonly, the person with hearing loss will not maintain the focus needed to continue the conversation. The effort that is needed to maintain engagement in the conservation is draining so people with hearing loss are more likely to withdraw from putting forth this energy. When a person is not engaging in conversation it can lead to social isolation and, ultimately, cause depression. Another common communicative pattern with people who have hearing loss is to dictate the conversation. If the person with hearing loss dictates the conversation, they know the context of the conversation. Dictating the conversation or not participating in the conversation takes an emotional toll on a person with hearing loss and their communicative partners. The repeated pattern of experiencing great difficulty understanding the conversation leads individuals with hearing loss to withdraw from the conversation. The continued action of withdrawing from the conversation can result in social isolation.

Audiologists play a role on the multidisciplinary team responsible for caring for persons with dementia. Audiologists know the effects of hearing loss on cognitive function and can add the value of audiologic services in the management plan of persons with dementia (Weinstein, B. E., 2018). Therefore, audiologists play an important role in fitting the hearing aid properly which will help reduce the cognitive load, making it easier to hear. Audiologists can educate caregivers and other health care workers on the importance of amplification. They can advocate for people with cognitive decline and hearing loss. According to the American Speech-Language-Hearing Association (ASHA) and the American Academy of Audiology (AAA), cognitive screening is in the scope of practice of audiologists. Audiologists can start to use cognitive screeners and refer an individual when cognitive decline is suspected.

Cognitive screeners play a crucial role in identifying people who may be at the beginning stages of cognitive decline. Due to the fast-paced nature and limited time many audiologist have with their patients for each visit, it is important to consider the value that a cognitive screening measure can add to the assessment and treatment of a patient given the relatively little amount of time required for the screener. Bogardus et al. (2003) suggests screening for cognitive decline by having patients complete a questionnaire in the waiting room. A questionnaire in the waiting room would not take away from the overall appointment but would add value to the appointment. An audiologist could easily provide a screener and then refer to it if they suspect cognitive decline.

Audiologic rehabilitation is another strategy to combat cognitive decline. An audiologist is a communicative expert who can not only treat the hearing loss but also educate people on communication strategies. It is key that the person who needs amplification knows how to properly use their devices. Hearing aids will help keep the person engaged in conversation and

prevent social isolation. Audiologic rehabilitation courses can even bring together people with hearing loss and create a supportive community.

Conclusion

The relationship between hearing loss and cognitive decline should be of utmost importance for audiologists. The role an audiologist plays is crucial to better serving patients with cognitive decline or dementia. Hearing loss is a modifiable risk factor associated with dementia. By assisting a person with hearing loss, audiologists can help lower the risk of dementia and cognitive decline in their older patients. As the rate of dementia is increasing, treating hearing loss is a key factor in the management of the disease. Research has shown the importance of treating hearing loss to support a patient's cognitive functioning, socialization, and overall health.

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