

**An Analysis of Treatment Options and Overcoming Stigma Associated with Age-Related
Hearing Loss**

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On my honor as a University student, I have neither given nor received unauthorized aid
on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

Presbycusis is one of the leading factors of disability among the geriatric population. This condition is characterized as the deterioration of the ability to normally process sound and speech as one ages. To be able to understand the importance of correct treatment options, it is imperative to acknowledge the consequences that untreated hearing loss has on an individual. Hearing loss is associated with feelings of social and emotional isolation, as well as psychological discomfort (Jayakody et al., 2022). Several studies have also shown that one's quality of life is adversely affected by auditory impairment and how it leads to depression, cognitive decline, and even dementia (Cominetti et al., 2023). Additionally, it has also been proven that the longer one waits to seek treatment the more likely it is one's brain will go into auditory deprivation, a condition where the brain is insufficiently stimulated for an extended period, so it loses a portion of its ability to process information (Beyer, 2009). Because of all these issues that arise from untreated cases of hearing loss in adults, it seems evident how important it is to have corrective action. However, many adults refuse to seek treatment because of social stigmas that are associated with loss of hearing and aging. In a 2023 study on disclosing hearing loss, 8 out of 11 participants initially kept their condition hidden due to factors like embarrassment, pride, and fear of being seen as weak or disabled (Katsuya & Sano, 2023). These social norms, driven by a desire not to appear "old" or vulnerable, discourage individuals from seeking help with hearing issues.

Because this condition is so closely interconnected with societal standards, it is important to understand how the treatment options work in a sociotechnical environment. Additionally, since there is technically no cure for presbycusis, there is no perfect fix. Therefore, any treatment option will have its own societal perceptions, which will steer individuals' decisions. The way

that these perceptions not only affect the market but also affect the amount of time individuals generally wait to seek treatment must also be considered when approaching healthcare solutions. The main tenants to explore when searching for ways to better help people with auditory impairment integrate into society are assistive technology, prevention, inclusive infrastructure, and evolving societal norms.

This analysis is done through a Social Construction of Technology (SCOT) framework. The SCOT framework emphasizes the significance of examining the wider social and cultural environment surrounding the creation and utilization of technology. Because presbycusis is extremely common and so many people refuse to seek treatment, it is important to consider the perceptions of the disease when creating treatment options. This plays into the idea of social construction of technology as the best treatment options will be the ones to appeal most to society or that society is ready to adopt, rather than the most technologically advanced. This is shown especially through hearing aid technology. Additionally, this topic can be addressed through the concept of cultural lag. This is the idea that social norms may move slower than technological advancements. This is especially shown within the realm of presbycusis as individuals with hearing impairments may face challenges in accessing appropriate support or accommodations due to societal attitudes or infrastructural limitations that have not yet adapted to the capabilities of modern technology.

Assistive Technology

Presbycusis is an irreversible condition. Once an individual begins to lose their hearing ability, it cannot be recovered. This is because there is usually damage to cells or nerve fibers due to lifelong exposure (Cheslock & Jesus, 2023). The best way to manage this disease is to alleviate symptoms, which is generally done by amplifying the sound going into one's ear,

typically done through hearing aids. Hearing aids are by far the most popular and well-known treatment option for hearing loss, but that does not mean it comes without its own set of disadvantages. The main drawbacks that hearing aid users report are high costs, inappropriate fitting, and lack of information ("Hear well in a noisy world," 2009).

It is widely recognized that experiencing hearing loss can pose challenges not only in perceiving one's surroundings but also on one's financial well-being. Hearing loss is extremely common, as 50% of individuals who are 75 or older have disabling hearing loss (Quick Statistics About Hearing | NIDCD, n.d.). However, consumers buying hearing aids from an audiologist or other hearing aid professional on average cost \$2,363 per ear (Robers, 2021). Additionally, hearing loss deterioration can be impacted by the amount of sustained high levels of sound throughout one's lifetime. This kind of effect can occur during careers that take place at construction sites, military service, manufacturing, etc. Some of these jobs that disproportionately accelerate hearing loss effects are ones that have employees who may make a smaller income and in turn have less financial flexibility. Therefore, when these individuals find themselves needing hearing aid devices later in life, they will have more financial constraints and be less inclined to seek treatment for their condition. In turn, the most expensive hearing aids include the most advanced features.

Another major obstacle is that hearing aids tend to be fitted incorrectly, leading to discomfort and improper use of the device. This is an unfavorable cycle as many users will be inclined not to wear their hearing aid because of the discomfort that it causes and continue to put themselves in a situation of auditory deprivation. The responsibility for hearing aid misfitting is generally put on the sellers or the auditory specialists. However, the underlying issue associated with this is that there is a lack of knowledge on the subject. Individuals themselves may not

realize that a hearing device fits incorrectly and so they are unable to communicate this discomfort. Additionally, with recently passed legislation that allows for over-the-counter hearing devices, although these devices are more affordable, there is an increased risk of improper fittings and other safety risks that stem from widespread accessibility.

Additionally, even the most lucrative hearing aids are still a work-in-progress technology. Many users report experiencing the least effective treatment when they are in a noisy room or environment. Since a hearing aid amplifies all sound coming into the ear, it makes it harder for the user to decipher between the sound they want to listen to and the background noise coming in. Furthermore, users are constantly put in a position where they must adjust the volume of their device while their surrounding conditions change. This also puts them at risk of setting the volume too high to hear a softer noise, and accidentally further damaging their ear canal if a louder noise unexpectedly occurs.

Focusing solely on the disadvantages of hearing aids without acknowledging their advantages and delving into their impactful history would be an incomplete portrayal. Hearing aids have progressed extensively in the last decade and offer many different forms of assistance. The latest and greatest hearing technology allows one to Bluetooth connect their device to their phone so they can use their phone to change the sound levels that are coming in. Moreover, hearing aids are the most widespread and popular form of symptom alleviation for presbycusis. Although far from perfect, they do allow sound to be amplified for users to understand speech and sounds that they are no longer able to hear without some type of assistive device. They have also been found to increase the quality of life for users, and it allows users to escape the entrapment of emotional isolation that hearing loss can cause. Furthermore, as these technologies advance in discretion, becoming less noticeable to the public eye, they attract more users. Many

individuals refrain from acquiring hearing aids due to concerns about visibility, as society often stigmatizes disabilities. Addressing these perceptions is crucial in encouraging wider acceptance and adoption of hearing aids.

Aside from hearing aids, other assistive technologies exist that, while they do not amplify sound directly into the ear, they improve the experience of the user. Such assistant devices can include speech to text algorithms and training in speechreading. A more severe route for treating presbycusis symptoms is cochlear implantation. Although cochlear implantation is not perfected and does not necessarily return hearing to its original level prior to loss, it can be the preferred option when all or most hearing has been lost. Most cochlear implants used for presbycusis are a hybrid implant that utilize electrical stimulation for addressing high-frequency hearing loss and acoustic hearing-aid technology to stimulate any remaining low-frequency hearing (Goransson, Hakansson, & Rosenhall, 2020). The main drawback to cochlear implants is the rapid loss of the patient's residual hearing within months of implantation. There are mainly research based efforts being undertaken to work to preserve the patient's hearing during this process, but none have become mainstream yet. This leaves this technology to be considered in most cases as a last resort, because so many patients fear losing all residual hearing.

Prevention

When considering the different sociotechnical structures in our society associated with presbycusis, it is important to explore prevention methods and how they can be built into our societal expectations. The World Health Organization estimated that over 50% of hearing loss cases in adults can be prevented through certain prevention methods and interventions prior to the onset of symptoms, with the most significant measure being reduced noise exposure (World Health Organization, 2021). One type of age-related hearing loss is primarily caused by the loss

of outer hair cells. A study was done in 1962 where a group of scientists lived with the Mabaan people of Sudan. The Mabaan people showed improved hearing with aging as opposed to people in the United States, specifically hearing at higher frequencies (Rosen et al., 1962). One main reason for this was that the Mabaans were generally a quieter community. Part of this can be attributed to the lack of hard reverberating surfaces such as walls, ceilings, and hard furniture. It was also suggested that high blood pressure and the thickening of small blood vessels may deteriorate the structural integrity of the cochlea, leading to presbycusis (Rosen et al., 1962). From their findings, Rosen and his team concluded that noise exposure and diet have associations with age progressive hearing loss.

Though age-related hearing loss cannot be prevented as the factors are mainly genetic, noise-induced hearing loss that generally goes hand in hand with age is what one can act about. From this, it is imperative to note that in our society sometimes these things are unavoidable. Loud noises are everywhere, and our diets can be mostly solidified based on the region where we live. However, being aware of this phenomenon allows us to tweak certain parts of our own lifestyles and advocate further so these practices reach the most amount of people to allow for prevention to become a more normalized statute of society. The recommended prevention techniques are avoiding loud noises, avoiding prolonged exposure to loud noises, and wearing ear plugs or earmuffs during exposure (Age-Related Hearing Loss (Presbycusis), 2023). This is especially useful for individuals who work in careers that have general high noise levels or individuals with particularly loud hobbies. Although it is not completely societally acceptable to wear ear plugs on many occasions, there are some safety regulation administrations, such as Occupational Safety and Health Administration (OSHA), that require workers to wear ear plugs during loud sustained environments. Additionally, drawing from Rosen's team's conclusions,

adjusting one's diet to reduce risk of high blood pressure has the possible effect of preserving the durability of the cochlea, therefore retaining hearing.

Inclusive Infrastructure

As discussed previously, most hearing assistive devices are not particularly effective when there is background noise present. A "listening bubble" is used to describe the distance from oneself that noise can be heard. For people with non-impaired hearing, the listening bubble is quite large. When there is some form of hearing loss, the listening bubble distance significantly decreases, and general hearing aids and assistive devices cannot make up for this distance before the user experienced hearing loss. One solution that has been found to be most useful is to implement hearing loops in infrastructure. A hearing loop transmits sound to a telecoil in one's hearing device, usually either a hearing aid or a cochlear implant, using magnetic energy. The telecoil is able to receive the audio with no background noise, reverberation, or distortion (Sterkens, 2014). Most hearing devices have a telecoil option, which can be activated whenever a hearing loop is present. This makes this technology especially useful in large auditorium or speaker settings, like in a church or theater.

The way that the telecoil, or T-coil, operates is by receiving electromagnetic signals from an external hearing loop and converting them into audible sound. The electromagnetic field is created when an induction loop system is present, and electric current flows through the loop. The telecoil receiver must either be built into the hearing aid, cochlear implant, or handheld portable loop receiver. Because the sound is going directly from the hearing loop to the receiver, background noise is completely avoided, making this device particularly efficient in larger audiences.

Another type of group-based hearing assistive technology is FM sound systems. Similar to the way that induction loop systems use electromagnetic signals, FM sound systems transmit audio using FM radio waves from a speaker to a receiver. The way this system is used is by having a speaker use a microphone that is connected to a transmitter and an audience member wears a hearing aid or cochlear implant with a compatible receiver. The main difference between the quality of the FM sound system versus the induction loop is that the induction loop will transmit electromagnetic signal to the signal within the loop, whereas the FM sound system will transmit signals up to 300 feet surrounding the transmitter and the signal can penetrate walls (Kim & Kim, 2014).

Another popular alternative to an induction loop system is an infrared hearing system. This technology works similar to the induction loop system and FM sound system, except it converts sound to infrared light using a modulator and infrared radiator installed in a room. One of the advantages of this system is that infrared light cannot penetrate walls, so it is better for more confidential or private conversations. Additionally, magnetic interference from steel beams or the general construction of the room does not interfere with infrared light that carries the signal. The system is also easier to install as a loop wire does not have to be run through the perimeter of the room.

Societal Norms

What do we as a society constitute as the best hearing aid device? Generally, most people will agree that the “best” hearing aid device is the one that is smallest, most discreet, and amplifies sound that most accurately reflects one’s hearing prior to the onset of hearing loss. The attribute that may be most important to focus on is the discrete part. For centuries, individuals have created technology that alleviated hearing loss symptoms with trumpet like devices that

maximized sound entering one's ear. At this point, the real downside of this technology was the dexterity constraint where one would physically have to hold up this device. In the late 19th century, a movement toward concealing individual disability began to gain momentum which led to creating more discreet hearing technology. This was when the market demonstrated a switch, where the devices being bought were the ones that were most discreet. Our society then deemed this aspect of hearing aids as one of the most important, which is still prevalent in our society today. This discreet hearing technology initially manifested in headband type gear that, although aesthetically concealing, did not amplify anymore sound. After the telephone was invented, technologies began to gear more towards improving the amplification process of a device. This was facilitated by Thomas Edison's creation of the carbon transmitter that amplified electrical signals and decibels levels. Some believe that this was the most significant invention in hearing aid history, as it allowed for control of current, which translated to the ability to have multiple settings on one device. Fast forwarding to the 21st century, the ability to program hearing aids forever changed the way these devices would be improved. By 2005, digital hearing aids accounted for approximately 80% of the market (Valentinuzzi, 2020). This demonstrates how hearing aid technology has changed in the last century, but consistently dictated by a movement for the device to be invisible.

One aspect that cannot be overlooked when using the SCOT framework as a basis for research is how this affects the other treatment/alleviation techniques that are discussed. Although Social Construction of Technology most directly applies to hearing aids as they are generally considered the best solution to age-related hearing loss, this shows how other alleviation techniques are overlooked by society. If certain standards and mannerisms of speech were more acceptable or built into our society, age-related hearing loss would not be seen as

such a restricting condition. For instance, many individuals with presbycusis report that they have minimized participation in outside events which leads to “withdrawal and isolation from social situations” (Midha, P., & Malik, S., 2015). If it was slightly more normalized in our society or if awareness was spread about the prevalence of this condition, then this social isolation could potentially be minimized. Certain conversational techniques when speaking to someone experiencing hearing loss would be getting someone's attention before speaking, speaking clearly with a moderate pace, using facial expressions and gestures, avoiding noisy backgrounds, practicing patience, and giving clues when changing a subject (Midha, P., & Malik, S., 2015). However, it has been proven time and time again that social norms move slower than technological advancements, which plays into the concept of cultural lag. In this specific context, it is easier to adopt technology that caters towards general social standards (e.g. discreteness of hearing aids) than adjusting individual behavior when interacting with someone with hearing loss. This is not generally a specific individual's fault; the problem lies with lack of awareness of the popularity of this condition as well as the societal norms surrounding disclosing disabilities leading to people with hearing loss wanting to hide their disease.

To apply this framework to future work, as more light is shed on this condition, it could be expected that technology would reflect this change in society. Due to the ability to make more niche or previously taboo information widespread using the internet and social media, one can assume that a higher level of awareness will be spread on this type of disease. This could be especially true for when the generations that use social media enter an age range where hearing loss becomes more prevalent. It can be predicted that when this occurs there will be more information spread advocating for awareness and changes in law and hearing assistive technologies. When this switch occurs, it could be expected that bringing awareness to this

disease would change the way that technology is created. There may be more of an emphasis on creating assistive devices that may amplify sound more closely related to one's hearing before any loss rather than focusing on the discreteness of the device. We have already seen trends of hearing devices adapting to the newest available technologies, such as Bluetooth connectivity, telehealth appointments to meet with audiologists, and AI powered sound processing. This demonstrates how hearing assistive technologies are changing as other technological advances in unrelated fields are made and adopted by society.

Conclusion

Because presbycusis is so common, it is heavily researched and discussed in the medical community. Although this is not a treatable condition, the awareness of this disease in the scientific field means major breakthroughs in the future are possible. However, culturally, many societies do not talk about the prevalence of this condition. This is a condition that is popularly hidden and that patients may refuse to admit that they suffer from. The underlying cause of this masking that occurs is one's own perceived embarrassment or fear of being seen differently or more vulnerable. Our society has a strong correlation with wanting to seem strong and unstoppable, so admitting to having an impairment that affects everyday life is not so easy. This is why it is essential to explore different options, rather than just saying that one specific device is a "one size fits all" solution. For many people that may not be as well-informed on the topic, the easy answer would be using hearing aids. In a perfect world, the best solution would be some non-invasive treatment that restored one's hearing to the level it was prior to any loss. Realistically, the answer is tailored to each person individually, and the best solution may change depending on the severity of the loss as well as one's age and the number of years they have been experiencing this condition.

Because of the negative effects of auditory deprivation, the priority is ensuring that people have access to different treatments and are willing to seek help. In the first few months or years where a small amount of hearing loss may not necessarily affect day to day life, but can occasionally cause confusion, the best route may be to use assistive and widely available technologies such as speech-to-text algorithms, captioning services, vibrating alarm clocks, alert systems, smartphones applications, and some training in speech reading. Once the condition begins to affect daily life, this is where more options involving healthcare professionals are recommended. This could involve a trip to the audiologist and a deeper look into hearing aid technology. As previously discussed, there are many different kinds of hearing aids so, if one has the financial flexibility to visit a hearing professional, the best hearing aid to fit a user's individual priorities is best. If financial restraint is a higher priority, over-the-counter options along with extensive personal research can be appropriate. This is the main stage where an individual must come to terms with their affliction and realize that, even if it involves putting oneself in a vulnerable situation, these technologies are proven to improve the quality of life of the user. Additionally, attending large halls or auditoriums that have some type of built-in hearing loop technology is known to be helpful. If one's hearing loss gets to the stage where one's hearing is extremely minimal and hearing aids no longer serve as an effective treatment, this is when more severe treatments such as cochlear implants can be explored with the individual and their audiologist.

Solutions that could have a significantly greater impact if more integrated into society or widely known include expanding the prevalence of prevention methods and incorporating clearer conversation techniques into everyday life. However, these solutions are more long-term and are not necessarily discrete events. Moving towards integrating these strategies into our society can

be an overall goal to work towards and may in the future lead to decreasing presbycusis cases or generally less stigma associated with this affliction. By spreading awareness of the prevalence of age-related hearing loss and different treatment options, we can collectively work towards a future where presbycusis is better understood, managed, and accepted within our communities.

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