

# Diabetes & Hearing Loss: A Connection

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# Prevalence and Research

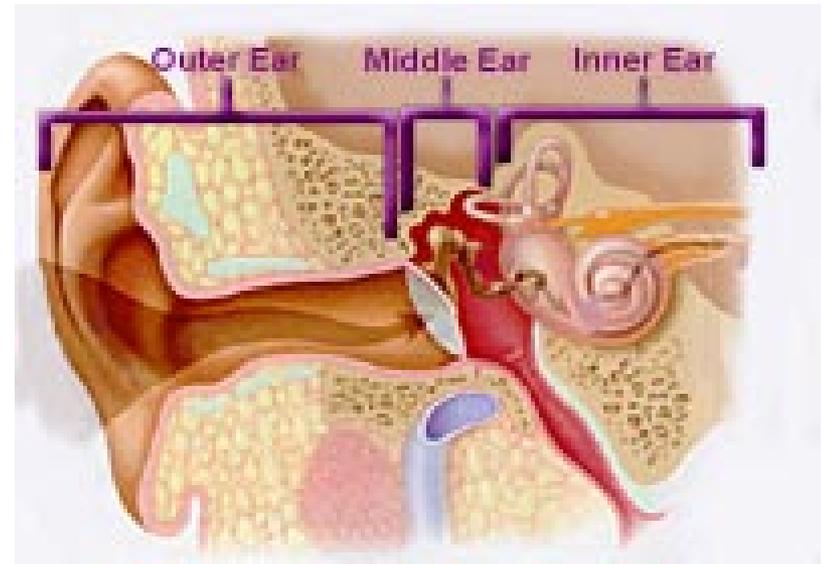
- Diabetes affects just over 26 million Americans, while another 79 million are pre-diabetic.
- Even with the substantial media coverage that diabetes receives, there is little information available about the relationship between diabetes and hearing loss.
- A possible connection between hearing loss and diabetes has been studied since the late-1800s but is not as well-documented as the connection with vision.
- Although the diabetic mechanisms that affect hearing sensitivity remain obscure, a study by the Department of Veterans Affairs in 2004 demonstrates a clearly higher prevalence of hearing loss in diabetics when compared to non-diabetics.

# Prevalence and Research

- People aged 65 years or older account for almost 45% of the diabetic population (CDC). It is commonly understood that many more cases go unreported or undiagnosed.
- Numerous studies show an inordinately high incidence of hearing loss among diabetics, roughly 80% for those over age 65, particularly with sensorineural (nerve) hearing loss. Hearing loss was 60% more prevalent in persons *under* age 65 with diabetes.
- While the connection between Type II Diabetes and hearing loss has been established, because of aging and other health factors, the connection can sometimes be obscured in routine medical diagnosis.

# How We Hear

- Sound enters the ear canal
- It strikes the eardrum, causing it to vibrate
- These vibrations are carried by tiny bones, called ossicles, to the inner ear
- Fluid in the inner ear is then vibrated, causing hydraulic motion over the “inner ear hair cells”—nerve endings which convert the vibrations into chemical energy
- This energy is then carried by the auditory nerve to the brain.



# How Does Diabetes Affect Hearing?

- Since vascular and nerve tissues play prominent roles in hearing, any disease that has the capacity to damage their cells has potential to damage the various hearing organs.
- A link between hearing and diabetes seems likely if the blood supply to the cochlea and/or the nerve centers in the hearing pathways are affected.

# How Does Diabetes Affect Hearing?

- Diabetes-related damage to blood vessels in the cochlea has been documented in recent animal studies.
  - Through surgery, researchers observed microvascular changes in the inner ear, including differences in circulation flow, narrowing capillaries, and loss of outer hair cells that amplify the sounds that enter the cochlea.
  - Such changes would be nearly impossible to observe directly in human ears.
  - The human auditory system is obscured because the cochlea is embedded in the temporal bone and the neural pathways are complex and distributed through the brainstem and cortex.

# How Does Diabetes Affect Hearing?

- We know that similar degenerative processes related to diabetes take place in human eyes, kidneys, and peripheral nervous systems. It is logical to suspect, therefore, that these changes would also take place in the highly vascularized inner ear.
- Results of otoacoustic emissions tests to indirectly examine outer hair cell function show fundamental differences between diabetic and non-diabetic patients even when hearing loss is *not* present.
- This suggests that certain hearing structures may be damaged in diabetic patients before the impact can be diagnosed by clinical tests of hearing sensitivity.

# How Does Diabetes Affect Hearing?

- Nerve cell damage related to diabetes may affect structures farther along the hearing pathway as well.
  - Results from a study using another audiometric test, auditory brainstem response, show that the electrical signals from the cochlea may travel more slowly along the auditory nerve and in the brainstem pathways in diabetics than in non-diabetic people.
  - Alterations in the brain cells in some diabetics also may result in slower processing of complex sounds such as speech.
- Simply put, certain individuals with diabetes could have difficulty understanding speech even if they have little or no hearing loss.
- In addition, if a person loses vision, the problem could be exacerbated since visual cues (e.g., gestures, lip movements, etc.) that are normally helpful in communication situations are unavailable.

# Recommendations

- At the present time, experts recommend that people with diabetes undergo regular examinations to monitor changes in vision, kidney function, tactile and thermal sensitivity and cardiovascular health, but there is no formal inclusion for hearing examinations.
- Considering the drastic effects diabetes has on vital organs, the addition of hearing loss to the list of potential complications might not make health news headlines.
- If preventing stroke, heart disease, kidney failure, and blindness are not sufficient motivation to change one's lifestyle to prevent diabetes, hearing loss is not likely to tip the scales.

# Recommendations

- Evidence of the connection between hearing loss and diabetes would be cause for a change in the standard of care for diabetics, ensuring that physicians address the potential relationship of diabetes and hearing loss.
- By adding monitoring of hearing abilities to physicians' preventative care protocols, and by referring *all* patients with a hearing loss to a hearing healthcare professional, physicians can help patients have access to the tools needed to manage and make the most of their hearing abilities.

# How Does Hearing Loss Affect Diabetes?

- Over 17% of *all* Americans, regardless of age, have some degree of hearing loss—nearly 54 million people.
- After hypertension and arthritis, it is the 3<sup>rd</sup> most prevalent chronic disorder affecting Americans over age 65
  - 25% of people over age 65 have hearing loss
  - 35% over age 75
  - 50% over age 85
- 85% of all hearing losses are sensorineural in nature, and non-correctable by medication or surgery.

# How Does Hearing Loss Affect Diabetes?

- Hearing loss is considered to be tied to the leading causes of depression
- Studies show that when individuals with hearing loss use hearing aids, they experience significant improvements in quality of life and decreased depressive symptoms, have significantly higher self-images compared to individuals with hearing loss who do not wear hearing aids, and experience significant improvement in their functional health status.

# How Does Hearing Loss Affect Diabetes?

- In a 1999 study, the Better Hearing Institute interviewed over 2,000 family members of those who had hearing loss, and the differences were even more exaggerated; family members felt that the hearing impaired person's quality of life had been improved since obtaining treatment, even more than the hearing impaired person himself.
- Areas of improvement included relations at home, self-esteem, mental status, relations with young children, sense of safety, social life, work relations, and—most importantly—overall health and quality of life.

# How Does Hearing Loss Affect Diabetes?

- It therefore stands to reason that because the effects of hearing loss can potentially degrade mental and emotional health, it can exacerbate the problems related to diabetes due to lack of communication, depression, etc.

# Treatments for Hearing Loss

- Surgical treatments (3%): restructures the ear.
- Medical treatments (12%): combats infections—viral, bacterial, fungal
- Amplification (85%): hearing aids and other devices

# Steps for Obtaining Amplification

- Consult with your physician
- Obtain a diagnosis from an audiologist
- If a candidate, have a consultation discussing styles, costs, options, and technology. If possible, have a demonstration.
- Have a trial period with the amplification
  - Opportunity for you to evaluate the products
  - Opportunity for the audiologist to address issues that may arise
- Return for long-term follow-up as needed
- Re-evaluation every 12-24 months or with any perceived change in auditory status.

# Considerations for Amplification

- Diabetics tend to be missing or have abnormal keratin protein, which comprises the protective layer over the ear canal tissue and helps the ear maintain proper pH flora. Additionally, keratin protein allows earwax to travel outward.
  - Skin in the ear canal is more easily damaged
  - Wax tends to build up more
  - Hypersensitivity of the ear canal skin to plastics (necessitating hypoallergenic materials).
  - Greater chances for chronic irritation, fungal and yeast infections, bacteriological infections (“otitis externa”) if the ear canal becomes closed off.

# Considerations for Amplification

- Hypertension, microvascular constriction, and other fluid abnormalities may have a direct effect upon the inner ear, and are sometimes worsened by overly aggressive medical regimens such as some designed to control blood pressure.
- When the body's pH balance is abnormal (either too much acidity or alkalinity) or proper fluid level and circulation is affected as a result of the diabetic condition, changes in sound volume perception and auditory function occur.
- For this reason, the diabetic hearing aid user's inability to sustain normal sound volume tolerance usually requires the use of non-linear amplification in their hearing instruments. A manual volume control would also be recommended.

# Considerations for Amplification

- Due to the progressive nature of hearing loss in diabetics and physical conditions of the ear canal, behind-the-ear models are recommended in almost every case (but there are exceptions):
  - The hearing loss will progress more rapidly in diabetics, so the hearing aid should have a good, long-term power range.
  - Hypoallergenic materials are almost always used in the BTE earmold.
  - Broader spacing between the microphone and the receiver on a behind-the-ear hearing aids allows for larger venting, which creates better ventilation of the ear canal, thereby reducing the chances for infection.

# Know Your Consumer Rights

- Know what you are paying for—and what you are getting.
- 30 day trial period (minimum)
- Right to return
- Medical clearance from the physician
- Reasonable guarantee for follow-up services.

# Sources

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