

**Chronic diseases and  
hearing loss:  
early detection of adult  
hearing loss**

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**My wake up call**

- Average time to diagnosis and treatment:  
**7 years**
- **Largest unmet medical need:** only 25% of hearing impaired ID and treated
- **Link to chronic diseases and infectious diseases: unknown** to many MDs and health organizations: the invisible handicap

**Hearing Loss: the silent epidemic**

"denial of illness" by patient.

a deficit of self-awareness, a condition in which a person who suffers some disability seems unaware of the existence of his or her disability...Wikipedia

the lack of awareness of the deficits, signs and symptoms of an illness. It is not merely a denial; it is an actual neurological deficit.

**Anosognosia**

**A confounding factor**

- Diabetes
- Chronic Renal Disease
- Cardiovascular Disease
- Hypothyroidism
- Alzheimer's disease
- Infectious diseases

**Diseases affecting hearing**

- Ototoxic and Vestibulotoxic medications
  - Loop inhibiting diuretics
  - Aminoglycoside antibiotics
  - Cancer chemotherapeutics
  - Pain management
  - Hormone replacement therapy
  - ED medications

- **Causes**

- Insulin is a **hormone that acts like a key**. *It unlocks your cells to let in glucose from your blood to make energy.* **Sometimes this lock and key process does not work.** *Then glucose builds up in your blood, even when you are making more insulin.* Chances of becoming insulin resistant go up if you are overweight, smoke, do not exercise, or have high blood pressure

- **Symptoms**

- Hunger and fatigue
- Urinating more often and being thirstier
- Dry mouth and itchy skin
- Blurred vision

**Diabetes: IDDM, NIDDM**

- **Impact on Hearing**

- **Cochlear microangiopathy** Affects the vascular system. Delicate stria vascularis may be implicated
- **Neuronal degeneration** The nervous system of the ear, spiral ganglia is affected
- Up to 30% of adults with diabetes will experience hearing loss

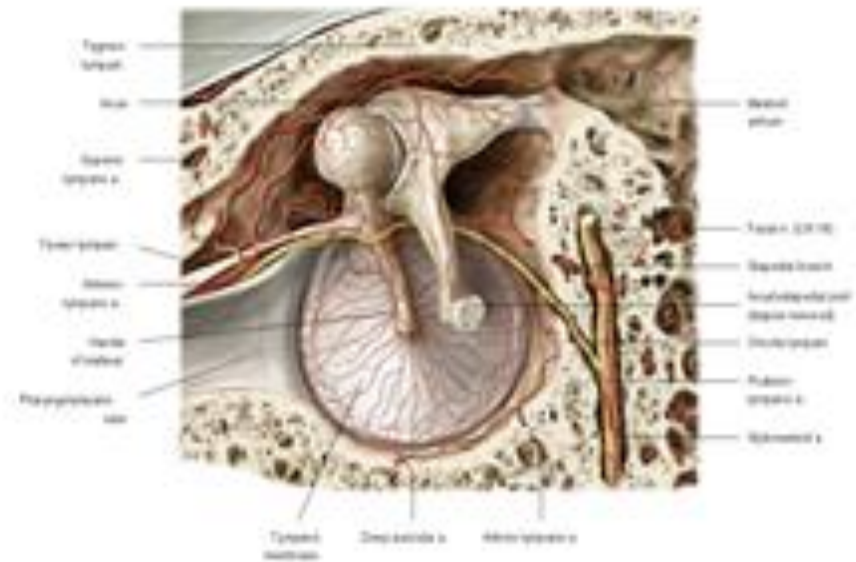
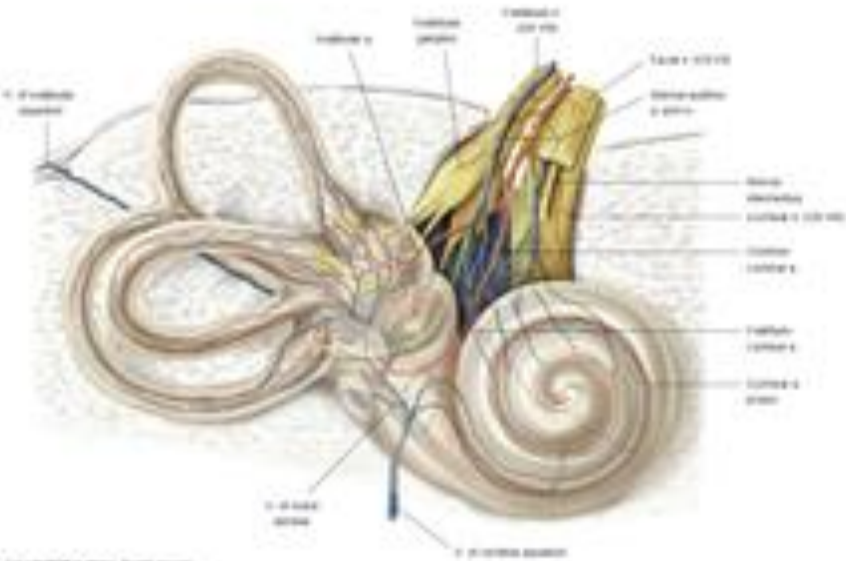
**Diabetic Ear Disease**



# VASCULATURE OF THE EAR

## Blood Vessels of the Inner Ear

## Arteries of the Middle Ear



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Diabetic eye disease refers to a group of eye problems that can occur as a result of diabetes. Without diagnosis and treatment, diabetic eye disease can

# Diabetic Retinopathy

**Hearing loss is higher among individuals with diabetic**  
**Comprehensive Eye Exam**



Vision loss due to diabetes is associated with major depression. <sup>17</sup>

Diabetic retinopathy is associated with periodontal disease. <sup>18</sup>

Worsening diabetic retinopathy is associated with elevated diastolic blood pressure. <sup>19</sup>

65% of individuals with Vision Impairment could achieve normal vision with an eye exam and new glasses, reducing falls leading to fractures. <sup>20</sup>

Retinal plaque signals obstructive vascular disease of the heart or carotid artery. <sup>24</sup>

Diabetic retinopathy is associated with early kidney disease-Albuminuria. <sup>23</sup>

Signs of diabetes detected in the eye are associated with peripheral neuropathies of the foot and foot ulcers. <sup>22</sup>

Reduced corneal sensitivity, dry eye, and ocular muscle palsies are early indicators of diabetes and associated neuropathies. <sup>21</sup>

# Chronic Kidney Disease

## Two Types of Kidney Failure

```
graph TD; A[Two Types of Kidney Failure] --> B["ACUTE"]; A --> C["CHRONIC"]; B --- D["Kidney failure develops within hours or days, includes chance of kidney function recovery"]; C --- E["Kidney failure develops over years, irreversible at the end"]; D --- F["Possible causes, e.g.:"]; E --- G["Possible causes, e.g.:"]; F --- H["- traumatic (e.g. post surgical)"]; F --- I["- acute intoxications"]; F --- J["- part of multiorgan failure"]; F --- K["- various other diseases (e.g. infections)"]; G --- L["- secondary to high blood pressure and / or diabetes"]; G --- M["- chronic bacterial inflammation of the kidneys"]; G --- N["- cystic kidneys"]; G --- O["- various autoimmune diseases"];
```

### **“ACUTE”**

**Kidney failure develops within hours or days, includes chance of kidney function recovery**

#### **Possible causes, e.g.:**

- traumatic (e.g. post surgical)
- acute intoxications
- part of multiorgan failure
- various other diseases (e.g. infections)

### **“CHRONIC”**

**Kidney failure develops over years, irreversible at the end**

#### **Possible causes, e.g.:**

- secondary to high blood pressure and / or diabetes
- chronic bacterial inflammation of the kidneys
- cystic kidneys
- various autoimmune diseases



# CHRONIC KIDNEY DISEASE & HEARING LOSS

- **Association of CKD & Hearing Loss Known for Decades**
- **Kidney & Stria Vascularis of Cochlea Share Physiologic, Ultrastructural and Antigenic Similarities**
- **Diabetes Often Results in Chronic Renal Disease**
- **Therefore, the Link Between Diabetes and Hearing Loss May Be Indirect But Exists**



Coronary heart disease (CHD) begins with damage to the lining and inner layers of the coronary (heart) arteries

- Over time, plaque can harden or rupture (break open). Hardened **plaque narrows the coronary arteries** and reduces the flow of oxygen-rich blood to the heart.
- If the **plaque ruptures, blood cell fragments** called platelets (PLATE-lets) **stick to the site of the injury**. They may clump together to form **blood clots**.
- Blood clots can further narrow the coronary arteries and worsen angina. If a **clot becomes large enough**, it can mostly or completely block a coronary artery and **cause a heart attack**.
- **Low estrogen levels before or after menopause** may play a role in causing coronary microvascular disease (MVD). Coronary MVD is heart disease that affects the heart's tiny arteries.

## Cardiovascular Disease/ Coronary Heart disease

- Heart disease is noted on 68% of diabetes related death certificates among people aged 65 years or older
- Adults with diabetes have heart disease death rates about 2 to 4 times higher than adults without diabetes, and the risk for stroke is 2 to 4 times higher among people with diabetes

**Cardiovascular disease**

## **Impact on Hearing**

- **Arterial hypertension** ...an independent risk factor for hearing loss, besides the male gender and advanced age,
- **Degeneration of the hearing apparatus** ...caused by circulatory problems, most specifically high blood pressure.
- **Pathological findings in the inner ear** and their correlation with cochlear function in research of population-based studies.
- **CVRFs** adversely affect hearing acuity.

**CVRF: Cardiovascular Risk Factors**



## • Risks for Hypothyroidism

- have had a thyroid problem before, such as a **goiter**
- have had **surgery** to correct a thyroid problem
- have received **radiation** to the thyroid, neck, or chest
- have a **family history** of thyroid disease
- have other **autoimmune diseases**, including ◦ Sjögren's syndrome, characterized by dry eyes and mouth
  - **pernicious anemia**, a vitamin B12 deficiency
  - **type 1 diabetes**
  - **rheumatoid arthritis**
  - **lupus**, a chronic inflammatory condition
- ◻ • have **Turner syndrome**, a genetic disorder that affects females
- ◻ • are **older than age 60**
- ◻ • have been **pregnant or delivered a baby** within the past 6 months

# Hypothyroidism

## **Impact on Hearing**

Hypothyroidism (underactive thyroid) is commonly linked with hearing loss. **About half of people with low thyroid function have hearing losses.**

About **3%** of people with Meniere's syndrome have hypothyroidism; and in some, control of the thyroid disease eliminates the symptoms of Meniere's syndrome.

# **Hypothyroidism**

# Risks

Research suggests that a host of factors beyond genetics

- 1) vascular conditions such as **heart disease, stroke, and high blood pressure,**
- 2) metabolic conditions such as **diabetes and obesity.**

GENETIC:

**Early-onset Alzheimer's** occurs in people age 30 to 60 and represents less than 5 percent of all people with Alzheimer's. Most cases are caused by an inherited change in one of three genes

Most people with **Down syndrome** develop Alzheimer's, due to extra copy of chromosome 21, which contains the gene that generates harmful amyloid plaques in the brain.

## Alzheimer's disease

## **Symptoms**

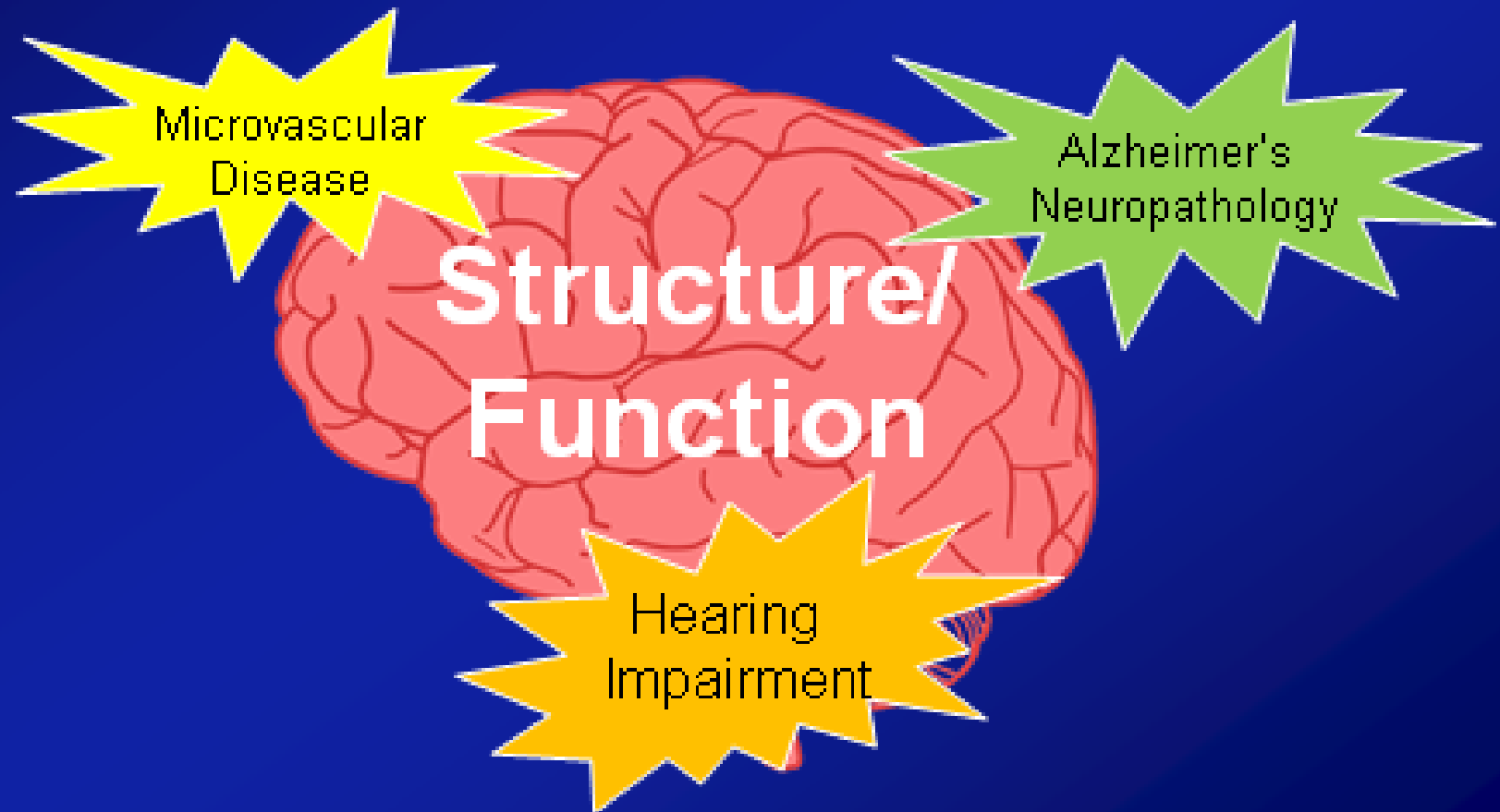
### **Typical warning signs include:**

- Memory loss, especially of recent events, names, placement of objects, and other new information
- Confusion about time and place
- Struggling to complete familiar actions, such as brushing teeth or getting dressed
- Trouble finding the appropriate words, completing sentences, and following directions and conversations
- Poor judgment when making decisions
- Changes in mood and personality, such as increased suspicion, rapid and persistent mood swings, withdrawal, and disinterest in usual activities
- Difficulty with complex mental assignments, such as balancing a checkbook or other tasks involving numbers

# **Alzheimer's Disease**

# Double Hit Theoretical Model

## *Hearing Loss & Brain Structure/Function*



- **Impact on Hearing**

Frank Lin, MD John Hopkins Medical Center:

The **risk of dementia was increased** among those **with at least a mild 25-decibel hearing loss** and went up as hearing problems worsened.

*Those with the most severe hearing loss were most likely to be diagnosed with dementia, including Alzheimer's.*

- Aged 60 and older, **36.4% of the risk of dementia was associated with hearing loss**
- Risk of specifically developing Alzheimer's increased with hearing loss; **the more severe the hearing loss, the more the risk.** For every 10 decibels of hearing loss, the extra risk increased by 20%.

## Alzheimer's disease



# Advocacy issues in early detection of adult hearing loss

**Chronic disease and infectious  
disease are silently destroying  
hearing in adults**

- Who are the players
- How can we accomplish early detection of adult hearing loss

**Advocacy for Adult Hearing  
Detection**



**NAM/IOM**

**PCAST Rx**

**Healthy People 2020 NIH program**

**CDC Communicates standards for chronic disease care; funds programs at state level**

**NCQA sets physician standards of care for diabetes and heart health**

**“What should be the required federal regulatory paradigm for the dispensing of hearing aids?”**

- Are individuals with HL “patients” or “consumers” or “both”?
- Important yet critical distinction in how one may view regulation and marketing

**IOM presentation by Amy Donohue, PhD**

## Recommendations:

- 1) Move to a patient centered care away from a provider centered
- 2) Move to integrated or coordinated care
- 3) Move to population health approach- acknowledgement that factors outside of health care system impact health

Is this provider centered approach appropriate?  
Does this approach work equally well for all individuals regardless of 'degree of loss, communication needs and economic situation

**Amy Donohue IOM presentation**

- NAM June 2, 2016 report:
  - 400 pages
  - 3 findings and 12 recommended actions
  - Causes and Types of Hearing Loss section includes genetics, medical problems (otitis media, meningitis, Menieres, etc), ototoxicity, noise, but mostly a discussion on AGING.
  - ***Chronic diseases as a cause of hearing loss is not considered in report***

## Hearing Health Care for Adults: Priorities for Improving Access and Affordability

- An open door to examine chronic disease:
- Under Goal #1, a recommendation to examine:
  - the risk and natural history of hearing loss;
  - risk factors and co-morbidities of hearing loss;
  - hearing health care needs; and
  - the impact of hearing loss and its treatment on health, function, economic productivity, and quality of life;

## **Hearing Health Care for Adults: Priorities for Improving Access and Affordability**

- **Age Related hearing loss is a substantial national problem**
  - **Major health and social problem** 30 million have difficulty hearing now
  - Hearing loss associated with social isolation, inability to get around safely, dementia, falls, depression, and other issues
  - **Growing importance with aging population** Nearly half of people over age 60 have hearing loss
  - Number of older Americans will rise from 46 to 82 million between 2014 and 2040
  - **Few adults with hearing loss use hearing aids** Only ~15-30% of older adults with hearing loss use hearing aids

**President's Council of Advisors on Science and Technology**

- **Current distribution channels create barriers to access**
  - Difficult for consumers to shop for best value  
Challenges include bundling, complex state regulations, limited distribution agreements, and restrictions on online shopping
- Social stigma
- Lack of engagement by health providers

**President's Council of Advisors on Science and Technology**



**PCAST Recommendations: Open the Market**  
***Modest changes in FDA regulations could dramatically increase access and innovation, without compromising patient safety***

- **Recommendation 1.** FDA should designate as a distinct category (“basic” hearing aids).
- **Recommendation 2.** FDA should withdraw its draft guidance of November 7, 2013 on Personal Sound Amplification Devices (PSAPs).



# PCAST Recommendations Open the Market

- **Recommendation 3.** Analogously to its “Eyeglass Rule,” FTC should require audiologists and hearing-aid dispensers who perform standard diagnostic hearing tests and hearing aid fittings to provide the customer with a copy of their audiogram
- **Recommendation 4.** “Contact Lens Rule,” FTC should define a process by which patients may authorize hearing-aid vendors (in-state or out-of-state) to obtain a copy of their hearing test results and programmable audio profile from any audiologist or hearing-aid dispenser who performs such a test, and it should require that the testers furnish such results at no additional cost.

## **GOAL:**

- Improve the visual and hearing health of the Nation through prevention, early detection, treatment, and rehabilitation.

**Healthy people 2020: vision and hearing HP2010**

## Percent of targeted change achieved:

- Vision impairment due to diabetic retinopathy: **373.05%**
- Hearing exam in the past 5 years:
  - Adults 20-69: **-3%**
  - Older adults +70 years: **100%**

**Progress Toward Target  
attainment for Focus area 28:  
Vision and Hearing HP2010**

<b>28-5</b>	<b>Visual impairment due to diabetic retinopathy (age adjusted, per 1,000 population, 18+ years with diabetes)</b>	<b>National Health Interview Survey (NHIS), CDC, NCHS.</b>
<b>28-6</b>	<b>Visual impairment due to glaucoma (age adjusted, per 1,000 population, 45+ years)</b>	<b>National Health Interview Survey (NHIS), CDC, NCHS.</b>
<b>28-7</b>	<b>Visual impairment due to cataract (age adjusted, per 1,000 population, 65+ years)</b>	<b>National Health Interview Survey (NHIS), CDC, NCHS.</b>

## **Summary of HP2010 objectives for vision**

<b>28-13d</b>	<b>Use of assistive listening devices by older adults with hearing loss (per 1,000 population, 70+ years)</b>	<b>National Health and Nutrition Examination Survey (NHANES), CDC, NCHS.</b>
<b>28-14a</b>	<b>Hearing examination in past 5 years—Adults 20–69 years (age adjusted)</b>	<b>National Health and Nutrition Examination Survey (NHANES), CDC, NCHS.</b>
<b>28-14b</b>	<b>Hearing examination in past 5 years—Older adults 70+ years</b>	<b>National Health and Nutrition Examination Survey (NHANES), CDC, NCHS.</b>
<b>28-14c</b>	<b>Hearing examination in past 5 years—Adolescents 12–19 years</b>	<b>National Health and Nutrition Examination Survey (NHANES), CDC, NCHS.</b>
<b>28-15</b>	<b>Primary care provider referrals for hearing evaluation and treatment</b>	<b>National Health Interview Survey (NHIS), CDC, NCHS.</b>

# Summary of HP2010 Objectives for hearing

- CDC ***instructs and funds programs for state agencies*** on guidelines for chronic diseases and infection control

Take Charge of your diabetes: 4<sup>th</sup> edition 2007.

THIS BOOK IS NOW BEING REPUBLISHED WITH A RECOMMENDATION TO HAVE HEARING CHECKED.

No input by ASHA or AAA or ADA

**What is status of recognizing hearing loss as comorbid to diabetes and other chronic disease?**

**Centers for Disease Control: CDC**

## **Clinician (Physician) Programs**

- **Diabetes Recognition Program (DRP)**
  - Voluntary program is designed to recognize clinicians who use evidence-based measures and provide excellent care to their patients with diabetes
- **Heart/Stroke Recognition Program (HSRP)**
  - Voluntary program is designed to recognize clinicians who use evidence-based measures and provide excellent care to persons with cardiovascular disease (CVD) or who have had a stroke.

## **BUZZ WORDS**

- Medical necessity
  - Link to Chronic diseases, ototoxic medications, noise exposure
- Quality of life
  - Improve communication for reduced confusion, isolation and depression, better job performance
- Unmet medical needs
  - Decrease unmet medical needs by intervening with audiology

**Considerations for coverage of audiology and hearing services**



# Age-Related Hearing Loss (ARHL)

## *Basic Questions*

- What are the consequences of ARHL for older adults?
- **What is the impact of treating ARHL on older adults?**
- How can ARHL be effectively addressed in the community?

**Is adult hearing loss age related or disease related?**

# Barriers to Hearing Health Care (HHC)

**Cost/Affordability**

**Awareness &  
Understanding**

**Access to Services  
& Technology**

**Technology Design  
& Utility**

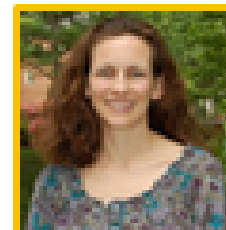
# Innovations in Hearing Health Care

*Affordable & Accessible “Stepping Stones” are Needed for Hearing Health Care*

- **Technology** – **Personal sound amplifiers (PSAP)**
  - Over-the-counter “hearing aids” with in-situ testing & verification
  - Cost < \$100-300
- **Services** - **Community health care workers**
  - Community-based hearing screening
  - Counseling, education, & provision of sound amplifiers & other assistive technologies
  - Referral as needed

# Additional Models of Hearing Health Care are Needed

**Audiologist as the Leader of a Team**



Sara Mamo



Nick Reed

Time/  
Expense/  
Expertise

# **What is the current question about improving access to hearing healthcare?**

- 1) Lower cost/OTC hearing aids? FDA regulations on PSAPs? Hearing loss due to aging?

**OR**

- 2) Identification of hearing loss due to chronic disease and ototoxic medication?

**Are we working with patients or consumers?**

- Set hearing **standards of care** for adults with chronic disease, on ototoxic meds, >age 50 for a baseline.
  - Refer anyone with chronic disease or on ototoxic meds to an audiologist for diagnosis and medical management of hearing loss
- Medical necessity, NOT aging
- ASHA, AAA, ADA action to promote our **allied health** profession of audiology to:

**Physicians, diabetes educators,  
speech therapists**

Forum meeting Fall 2016 Salus University:  
ASHA, ADA, AAA, CDC, NAP, JJDI, AOA,  
AADE, Researchers

**Purpose:**

- 1) Literature/research review
- 2) Audiology standards of care for diabetes
- 3) Educational needs, target populations, implementation ideas
- 4) Research needs

**The Audiology Project**

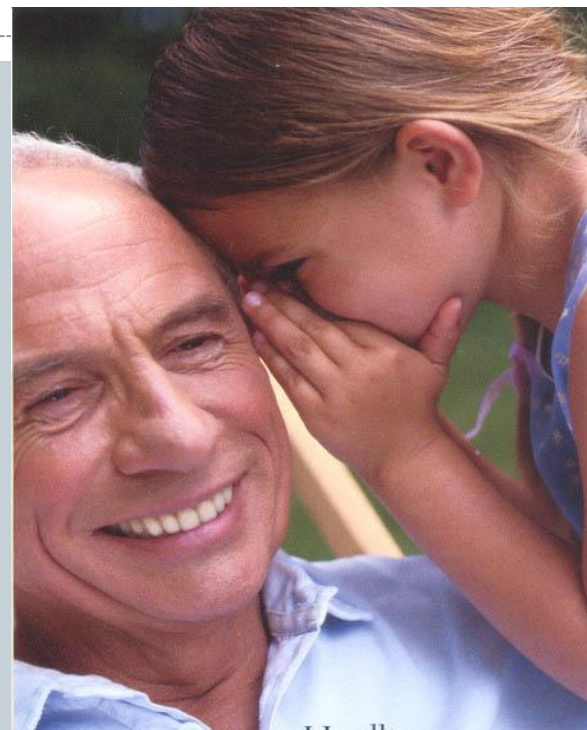


Wow!! Thank you, doctor!  
I can hear better than  
I have for years!!



Next.





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Hearing Solution Center  
Charlotte, NC

[www.hearingsolutioncenter.com](http://www.hearingsolutioncenter.com)