Why Diabetes and Hearing Loss? (2011 Survey)

- Unknown complication (49% aware of the relationship between diabetes and hearing loss)
- 95% rarely or never refer patients for hearing screening
- 98% do not use any hearing screening tools
- Referral networks: 28% indicated good network; 10% indicated excellent

Why Diabetes and Hearing Loss? (2017 Survey)

- Known complication: 95% are aware
- 76% rarely or never refer patients for hearing screening
- 96% do not use any hearing screening tools
- Referral networks are improving: 35% indicated good network; 7% indicated excellent
Weakened immunity with advancing age...

- Increased prevalence of chronic disease
- Ototoxic medications more common
- Increased prevalence of hearing loss?

Hearing Loss: A Silent Epidemic

- 7 years
  - Average time to diagnose and treat
- Unmet medical need
  - Only 20% identified and treated
- The Invisible Handicap
  - MDs and health organizations not informed about links between chronic and infectious disease

A Confounding Factor

- Anosognosia: inability to know you are sick or have a sensory impairment
- Patient “denies” illness
- Lack of self-awareness
  - Spouse and family notice first
- Not denial but true neurological deficit
Diseases Affecting Hearing & Balance

- Diabetes
- Chronic renal disease
- Cardiovascular disease
- Hypothyroidism
- Alzheimer's disease
- Paget's disease
- Chron's disease

Diabetes Ear Disease

**Cochlear Microangiopathy**

- Micro vascular effects of diabetes may damage stria vascularis and cochlear blood supply

**Neural Degeneration**

- Affects 8th nerve and spiral ganglion

Vasculature of the Ear
Hearing loss is higher among those with diabetic retinopathy.

Diabetic eye disease refers to a group of eye problems that can occur as a result of diabetes. Although diagnosis and treatment, diabetic eye disease can:

- Vision impairment could achieve normal vision with an eye exam and new glasses, reducing falls leading to fractures.
- Reduced corneal sensitivity, dry eye, and ocular muscle palsies are early indicators of diabetes and associated neuropathies.
- Diabetic retinopathy is associated with periodontal disease.
- Worsening diabetic retinopathy is associated with elevated diastolic blood pressure.
- Vision loss due to diabetes is associated with major depression.
- Signs of diabetes detected in the eye are associated with peripheral neuropathies of the foot and foot ulcers.
- Diabetic retinopathy is associated with early kidney disease – albuminuria.
- Retinal plaque signals obstructive vascular disease of the heart or carotid artery.

Diabetic Pain & Infection Control:
- Ototoxicity
- Vestibulotoxicity

Audiological Concerns: Diabetes

- Hearing Loss
  - Cochlear microangiopathy
  - Neural degeneration
- Balance & Fall Risk
  - Foot neuropathy and vision effects
  - Vestibular effects of diabetes
- Diabetic Pain & Infection Control
  - Ototoxicity
  - Vestibulotoxicity
Audiological Concerns: Cardiovascular Disease

- Hearing Loss
- Strokes: CVA
- DVT, PE, HBP

- Balance & Fall Risk
- Fluid build up in extremities: loss of feeling
- Hypertension related (44% in NHANES)

- Medication
- Loop inhibiting diuretics
- Pain Rx

Diabetes Ear Disease

- Medical management
- Audibility
- Clarity
- Impact
- Social life
- Communication
- Employment

Consequences of Hearing Loss

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Medical Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asks for repetition</td>
<td>Misses verbal instructions</td>
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<tr>
<td>Brings 3rd-party interpreter</td>
<td>Noncompliance</td>
</tr>
<tr>
<td>Associated with cognitive decline and depression</td>
<td>Worse patient outcomes</td>
</tr>
<tr>
<td>Social isolation</td>
<td></td>
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<tr>
<td>Stress</td>
<td></td>
</tr>
<tr>
<td>Confusion</td>
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</tbody>
</table>
Diabetes & Vestibular Disorders

**Causes & Treatment**
- Problems in inner ear and central vestibular system → vestibular impairment
- Pathophysiology linked to diabetes
- May be resolved with physical therapy or symptoms treated with medication

**Symptoms**
- Reduced mobility and need of assistance
- Worsened by vision and proprioceptive deficits linked to diabetes
- Increased fall risk can lead to serious injuries

Vestibular Symptoms

- Diabetic retinopathy and vision
- Diabetic ear disease and vestibular input
- Neuropathy and proprioception
- Refer patients with diabetes who cannot stand or walk unsupported with eyes open or eyes closed
**Vestibular Symptoms**

- Nystagmus - involuntary, rapid and repetitive eye movements
- Usually side-to-side but can be vertical or circular
- Reason to refer patients with diabetes

---

**Vestibulo-Ocular Reflex (VOR)**

- Nystagmus - involuntary, rapid and repetitive eye movements
- Usually side-to-side but can be vertical or circular
- Reason to refer patients with diabetes

**Ears and eyes are connected!**

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**Auditory**  
30% hearing loss prevalence (NHANES)

86% among skilled nursing facility residents

**Vestibular**  
39% balance disorders

Fall risk higher with retinopathy and neuropathy

**Cognitive**  
Comorbid with auditory and vestibular disorders

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**Complications of Diabetes**
who evaluates hearing loss and balance?

- audiologists are the experts
  - perform audiological & vestibular evaluations
  - refer when medical or surgical need

degrees
- masters, auD, PhD

certifications
- aba, CCC-A

complications of diabetes:
- insulin medications

auditory
- 27% have risk of hearing loss

vestibular
- 81% show vestibular risk

Cognitive
- 61% list potential cognitive risk

audiology scope of practice
- audiology evaluation & management of hearing
- balance screening and evaluation
- treatment of hearing loss and balance problems
- counseling for social, job and personal
- tinnitus, cochlear implants, pediatric specialties

www.theaudiologyproject.com
### Vestibular: Falls Risk Management

**Screening Protocols**
- Interview: fall history or increased fear of falling
- Timed up-and-go test
- Functional reach test
- Dynamic gain index
- Clinical test of sensory integration of balance
- Modified Hallpike (BPPV)

**Advanced Assessments**
- Computerized dynamic posturography (CDP)
- Videonystagmography (VNG)
- Cervical vestibular evoked myogenic potential (cVEMP)
- Rotary chair

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### Auditory: Hearing Management

**Screening Protocols**
- Interview: Patient & Family Members
- Standardized Questionnaires (HHIE)
- Otoscopy
- Pure-tone screening
- Otoacoustic Emissions (OAE) screen

**Advanced Assessments**
- Audiometry
- Tympanometry
- Acoustic Reflexes
- OAE (full battery)
- Speech Intelligibility
- Auditory Brainstem Response (ABR)

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### Insurance Coverage

- Adult Medicaid hearing aid coverage varies by state
  - Find yours at [www.hearingloss.org/content/medicaid-regulations](http://www.hearingloss.org/content/medicaid-regulations)
  - Children always covered by Medicaid/insurance

- Most Insurances cover audiological & vestibular diagnostic testing.
- Some Employer insurance plans have hearing aid coverage.
- None Medicare has no hearing aid coverage. Advantage plans may have some coverage.
Cost for Uninsured

- Children always covered for services and devices
- Vocational Rehabilitation option for adults without coverage
- Adult out-of-pocket

Summary of Presentation

Diabetic Patient Pathophysiology

Ototoxic & Vestibulotoxic Medications

Improved Patient Compliance

Audiological Evaluation

Hearing, Vestibular, Cognitive, Social Consequences

Your Observation & Referral

Audiology and PPOD Professions

- Align with Pharmacy for otosthebototoxic monitoring
- Collaborate with Podiatry for better balance and foot care
- Ensure Optometry Evaluation to help lower risk of falls
- Counsel patients to see Dentist several times a year
- Ongoing IPE and IPC/IPP with the other professions