Can You Hear Me Now?
AN INTRODUCTION TO HEARING LOSS AND HEARING AIDS
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Today’s Agenda

- Basics of hearing loss
- Impact of hearing loss, both physically and mentally
- Introduction to Hearing Aids
- Other treatment options
  - Implantable Devices
- Tinnitus
Hearing and Balance Center

• 17 audiologists in 4 locations
• Provide comprehensive hearing and balance testing, as well as treatment options including hearing aids and implantable hearing devices
Why Care About Hearing?
Prevalence of Hearing Loss

- 15% of American adults (~37.5 million) aged 18 years and older report difficulty hearing
- “One in eight people in the United states aged 12 years or older has hearing loss in both ears, based on standard hearing examinations”
- Nearly 25% of Americans ages 65-74 (and 50% over age 75) have hearing loss severe enough to affect daily life
14% of adults aged 20 to 69 in 2011–2012

Prevalence of hearing loss has declined slightly from about 16% in 1999–2004.

Who is most at risk for hearing loss?

Older Age Groups

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGED 40–49</td>
<td>8%</td>
</tr>
<tr>
<td>AGED 50–59</td>
<td>23%</td>
</tr>
<tr>
<td>AGED 60–69</td>
<td>39%</td>
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</tbody>
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Men

Men are about twice as likely as women to have hearing loss.

Prevalence of hearing loss increases with age.
Hearing Loss in the Media

Roger Daltrey  Whoopi Goldberg  Pete Townshend  Jane Lynch

Eric Clapton  Jodie Foster  William Shatner  Halle Berry
Hearing Health Care

• Why is hearing health important?
  — Physical impact
  — Mental/psychological impact
  — Impact on overall quality of life
Physical Impact of Hearing Loss

- Increased risk of falls
  - A mild degree of hearing loss triples the risk of accidental falls
  - 10 dB of additional hearing loss increases risk by 140%
- Theories about falls
  - Less awareness of environment and decreased spatial awareness due to fatigue
  - Hearing loss causes the brain to work harder, in turn taking away resources for gait and balance
Mental Impact of Hearing Loss

- *Is There an Association Between Untreated Hearing Loss and Psychosocial Outcomes?* Jayakody et al 2022
  - Cognitive impairment (Jayakody et al., 2017)
  - Dementia (Dalton et al., 2003; Lin et al., 2011)
  - Alzheimer's disease (Lin et al., 2011)
  - Social isolation (Strawbridge et al., 2000)
  - Depression, anxiety and stress (Jayakody et al., 2018)
  - Poor quality of life (Dalton et al., 2003)
  - Physical inactivity (Gispen et al., 2014)
Adults with untreated hearing loss are more likely to develop dementia.

Source: Johns Hopkins Medicine
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Hearing loss can impact every aspect of our lives
Hearing Loss 101
Hearing Loss Types

• Conductive
• Sensorineural
• Mixed
CONDUCTIVE HEARING LOSS

[Diagram showing the parts of the ear: Outer Ear, Middle Ear, Inner Ear]
SENSORINEURAL HEARING LOSS

Outer Ear

Middle Ear

Inner Ear
Sensorineural Hearing Loss

- Most common type of age-related hearing loss, called presbycusis
- Involves damaged or destroyed hair cells in the cochlea (sensory hearing organ) which cannot be regrown
MIXED HEARING LOSS

Outer Ear

Middle Ear

Inner Ear
How is Hearing Assessed?

• Audiologic evaluation uses a series of tests to assess multiple parts of the hearing system to determine type, degree, and configuration of hearing loss.

• Plotted on an audiogram—Visual display of the softest sounds a person can hear at different pitches.
Low (Bass)  FREQUENCY/PITCH  High (Treble)

Soft

VOLUME

Loud

Red O’s  = Right ear  Blue X’s  = Left ear
The greater the degree of hearing loss, the greater the amount of hair cell damage/loss.
Speech and hearing science help us estimate the impact of hearing loss on one’s ability to understand speech.
Hearing Aids
Prescriptive Hearing Aids

- Electronic medical device that amplifies sound based on an individual’s hearing loss and communication needs
- Recommended and programmed by a hearing care professional
- Provide improved speech clarity and better hearing in noise
Hearing Aid Styles

- **IIC** (invisible-in-the-canal)
- **CIC** (completely-in-the-canal)
- **ITC** (in-the-canal)
- **ITE** (in-the-ear)
- **OPEN** (open fit, behind-the-ear)
- **RITE** (behind-the-ear)
- **BTE** (behind-the-ear with ear mould)
- **POWER** (behind-the-ear with high amplification)
Hearing Aid Technology

• **Left picture** - what speech in noise may look like to our brain

• **Right picture** - what speech in noise with hearing aid technology/resolution can do

• The better the hearing aid technology, the better the resolution of speech
Hearing Aid Technology

• Main goal – improve speech intelligibility

• Algorithms created using speech and hearing science to try to compensate for hair cell damage and improve speech clarity in all listening environments
Hearing Aid Technology in Quiet

• Main goal is to make speech and sound audible and recognizable to the brain based on the individual's hearing loss.
• Maintain fidelity of sound and relationship between soft, medium and loud sound to improve speech recognition.
Hearing Aid Technology in Noise

• Waveform of speech and background noise are different
• Hearing aid makes comparative calculation to favor speech signal and filter noise to extent possible without degrading speech
Waveforms of Speech and Noise

Speech Signal in Quiet

Speech Signal in Noise (pink speech, white noise)
Directional Microphones

• Hearing aid microphones can automatically or manually focus where speech is detected
• Can give the perception of increased volume similar to cupping back of your ear
Hearing Aid Technology

• Some manufacturers can cancel out reverberating sound
  —Recognition of same signal within milliseconds and mathematically cancelling it out
Levels of Hearing Technology

• **Simple amplifiers** (average range ~ $40-$400 per ear)
  — Make everything louder regardless type of signal and direction

• **Basic technology** (average range ~ $800-$1600 per ear)
  — Automatic processing, but best for those needing help in more controlled (less variable) listening environments (1:1, places of worship, television).

• **Mid-level technology** (average range ~ $1600-$2800 per ear)
  — Automatic and designed for a wider variety of average social environments

• **Premium technology** (average range ~ $2800-$3800 per ear)
  — Incorporating the highest number of features and formulas to accommodate the widest variety and most demanding listening environments.
Newer Technology

91% satisfaction rate
in the US for hearing aids obtained within past few years
shows effectiveness and improvements with newer technology

yet...

Only about 30% of people
in the U.S. who need hearing aids get them (this % is higher than most countries)

Marketrak 9:
http://www.hearingreview.com/2015/05/introduction-marketrak-ix-new-baseline-hearing-aid-market/
Other Considerations

• Individual communication needs
  — Remote microphone systems and other accessories
• Other physical concerns (dexterity, vision)
  — Rechargeable devices
• Convenience
  — Compatibility with phone and other Bluetooth device
• Cosmetics
Over-the-Counter (OTC) Hearing Aids

- Direct-to-consumer devices for individuals with *perceived mild to moderate hearing loss*
- FDA approved since October 2022
Prescription Hearing Aids
- Purchased from/under care of an audiologist or hearing aid technician
- Devices recommended by provider
- Programmed based on patient’s hearing test
- Objectively assessed to confirm appropriate programming

OTC Hearing Aids
- Direct-to-consumer
- No hearing test required
- User alone decides what device to purchase
- Programmed by patient via smart phone
- User determines appropriate settings

Amplify sound to improve audibility of speech
Implantable Hearing Devices
Bone Conduction Hearing Aids

- Surgically implanted device
- Translates sound into vibration to access the inner ear
  - Don’t need anything in the ear
  - For people with conductive/mixed hearing loss and single sided deafness (SSD)
Cochlear Implants

• Electronic medical device for people with moderate to profound hearing loss who no longer benefit from hearing aids
• Extensive evaluation process that includes an audiologist and otologist
• Two parts
  — Surgical implant in the cochlea (hearing organ)
  — External processor (picture)
Reasonable accommodations for instructors/effects of hearing loss at work

Are we eligible for assistance in the classroom?
Reasonable Accommodations

The ADA requires reasonable accommodations as they relate to three aspects of employment:

1. Ensuring equal opportunity in the application process;

2. Enabling a qualified individual with a disability to perform the essential functions of a job;

3. Making it possible for an employee with a disability to enjoy equal benefits & privileges of employment.
Roger system

• Roger is just one of the hearing aid technology systems we dispense
  o It is a wireless microphone system that transmits speech to hearing aids and cochlear implants
• Considered a reasonable accommodation for hearing loss by the FDA
Americans with Disabilities act of 1990 (ADA) allows employees with a disability (hearing loss) to request the reasonable accommodations (Roger system) to help them perform their job better.

**Needs Assessment**
Determine which Roger microphone they need
easyguide.phonakpro.com

**Demo**
Lend patients your Roger Demos so they can experience the benefits

**Request**
Patients download a templated Roger request for their HR department
morethanahearingaid.com/ada

**Invoice**
You invoice the employer
Different jobs: Different dynamics
Tinnitus
Tinnitus

- Ringing sound in the ear(s) in the absence of an external source
  - Ringing, buzzing, hissing, roaring, whistling, static, clicking, pulsing, etc.
  - Constant or intermittent, can be fluctuating
- Can be in the presence or absence of hearing loss
- Possible causes
  - Excessive loud noise, certain medications, blood/heart issues, ear/sinus infections, etc.
Tinnitus Management

- Sound masking
- Hearing aids/cochlear implants to increase access to sound
- Cognitive Behavioral Therapy (CBT)
- Tinnitus Retraining Therapy (TRT)
Cognitive Behavioral Therapy (CBT)

- Goal is to help promote habituation
  - Reduce or eliminate negative emotion response/reaction to tinnitus
  - Slowed by high levels of stress, arousal, general emotion around the tinnitus
- Robust evidence that CBT is effective in helping manage tinnitus and making bothersome tinnitus less bothersome
- Does not necessarily make tinnitus less loud
Tinnitus Retraining Therapy (TRT)

- Combination of CBT and sound masking
  - Both aid in habituation and work in tandem
- Unfortunately lacking substantial amounts of research
- CBT alone and TRT are effective, so treatment can be personalized
I Think I Need a Hearing Aid…
The Hearing Aid Assessment at Penn: What can I expect?

• Additional testing beyond the hearing test
• Majority of appointment is discussion of benefits and limitations of hearing aids and current available features
  —Style, technology, optional circuitry available, impact of tinnitus, cost of devices
• $250 out of pocket cost for appointment (not billable to insurance)
University of Pennsylvania Benefit

• UPenn (current and retired) and UPHS (current) employees and faculty are given 15% off the cost of the hearing aids

• In addition:
  – **UPenn employees and faculty**: $4000 toward hearing aids every 3 years for the following plans:
    o Aetna HD plan, Aetna POSII, Aetna POS Standard, Keystone HMO, PennCare/Personal Choice
    o For questions, contact Benefit Solutions Center at 866-799-2329 or email HRbenefits@hr.upenn.edu
  – **UPHS employees and faculty**: $2500 toward hearing aids every 3 years
    o Independence Blue Cross/BS Penn Care/Personal Choice PPO Plan
    o For questions contact BenefitQuestions@pennmedicine.upenn.edu
Next Step

• Hearing Aid Fitting
  — Programming and orientation
    o Real ear measures to verify settings
  — 45 trial period with devices
    o Devices are purchased at the fitting but can be returned for a full refund minus a ~$250 restocking fee
    o Typically scheduled for 1-2 follow up appointments during the trial period for adjustments, reviewing care/use, etc.
Audiology
Department of Otorhinolaryngology
Perelman Center for Advanced Medicine
3400 Civic Center Blvd, South Pavilion 3rd Floor
215-662-2784
PennMedicine.org

Other locations:
Penn Medicine Radnor – 610-902-5500
Penn Medicine University City – 215-316-5151
Penn Medicine Washington Square – 215-829-5180
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