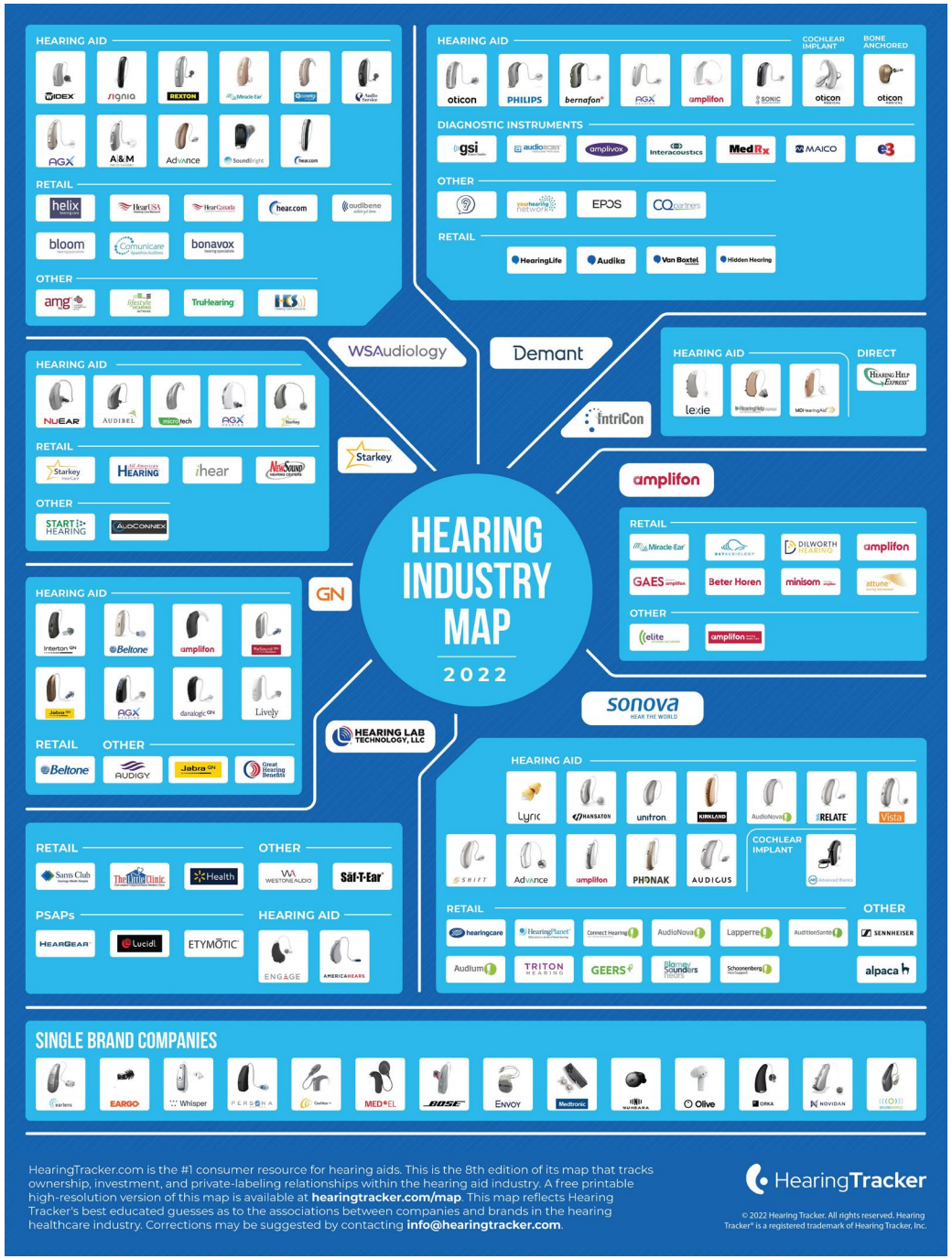
Where are we in 2022? Hearing Industry Landscape and Emerging Technologies

Laurel A. Christensen, Ph.D.

Chief Audiology Officer, GN Hearing

Hearing Industry

What are you hoping to hear about today?



A Very Dynamic Marketplace.

II

115TH CONGRESS
1ST SESSION

S. 670

To provide for the regulation of over-the-counter hearing aids.

IN THE SENATE OF THE UNITED STATES

MARCH 21, 2017

Ms. WARREN (for herself, Mr. GRASSLEY, Ms. HASSAN, and Mr. ISAKSON) introduced the following bill; which was read twice and referred to the Committee on Health, Education, Labor, and Pensions

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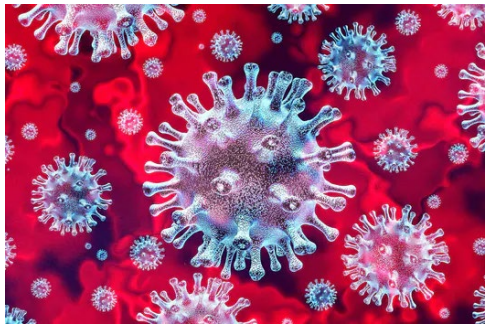
A BILL

To provide for the regulation of over-the-counter hearing aids.

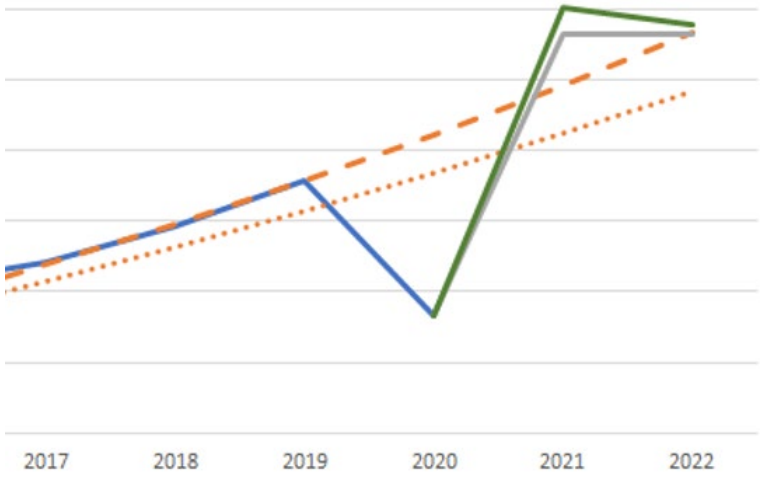
Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

OTC

Covid - 19



Market Rebound



hear.com

AUDICUS
A new Approach to Hearing Aids.

Omni-Channel

Market Growth Drivers – US Commercial Market

- Aging Population: Baby Boomers will continue to grow the market
- Patient Satisfaction: Remains at record levels.
- Repeat Purchases: Increases in existing wearers, will increase re-purchases over time.
- Healthcare Benefits: Delivering new patients to market.
- Omni-channel: Driving additional demand through telehealth and self-fitting capability, which is expected to attract a younger end user.

	2014	2018	2025
US Population (millions)	318.6	327.2	347.3
Hearing Loss Incidence	10.6%	10.8%	10.8%
Adoption Rate	30.2%	34.1%	38.8%
Active Wearer Population (millions)	10.2	12.1	14.6

Data synthesis utilizing MT2019 and MT2022 data
Excludes OTC, which could ultimately account for an additional 3.0 to 5.0 million wearers within 3-5 Years

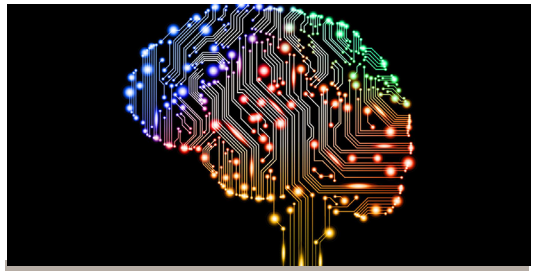
4.7M units from repeat purchases alone

Topics

1 OTC

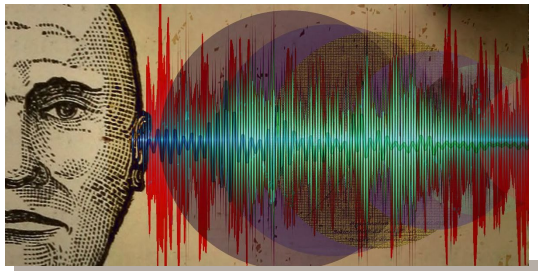
2 Convergence of CE and Hearing Aids

3 Connectivity

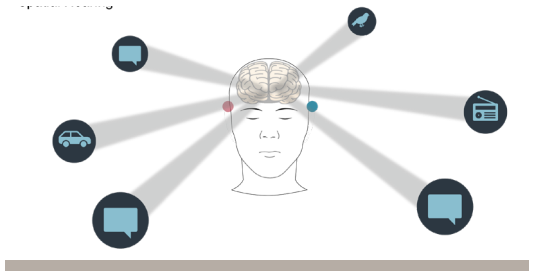


4 AI

5 Environmental Classification



6 Hearing in Noise



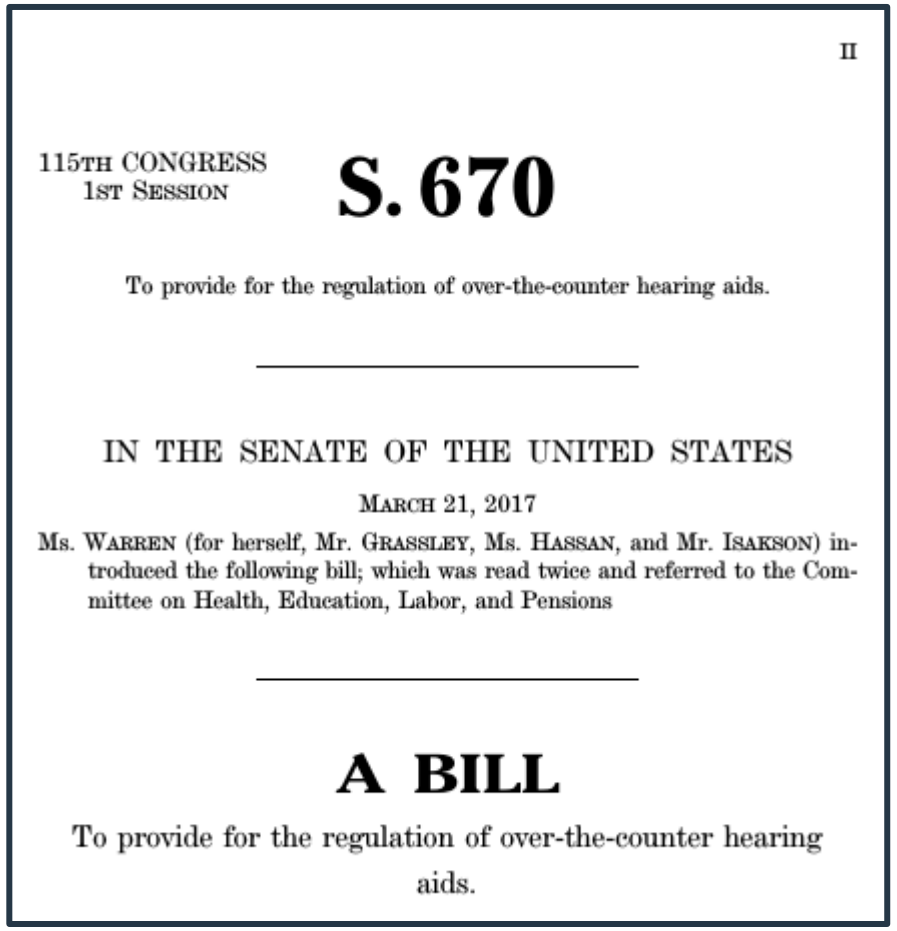
7 Spatial Perception

8 Health

OTC

The starting point…

The OTC Act?



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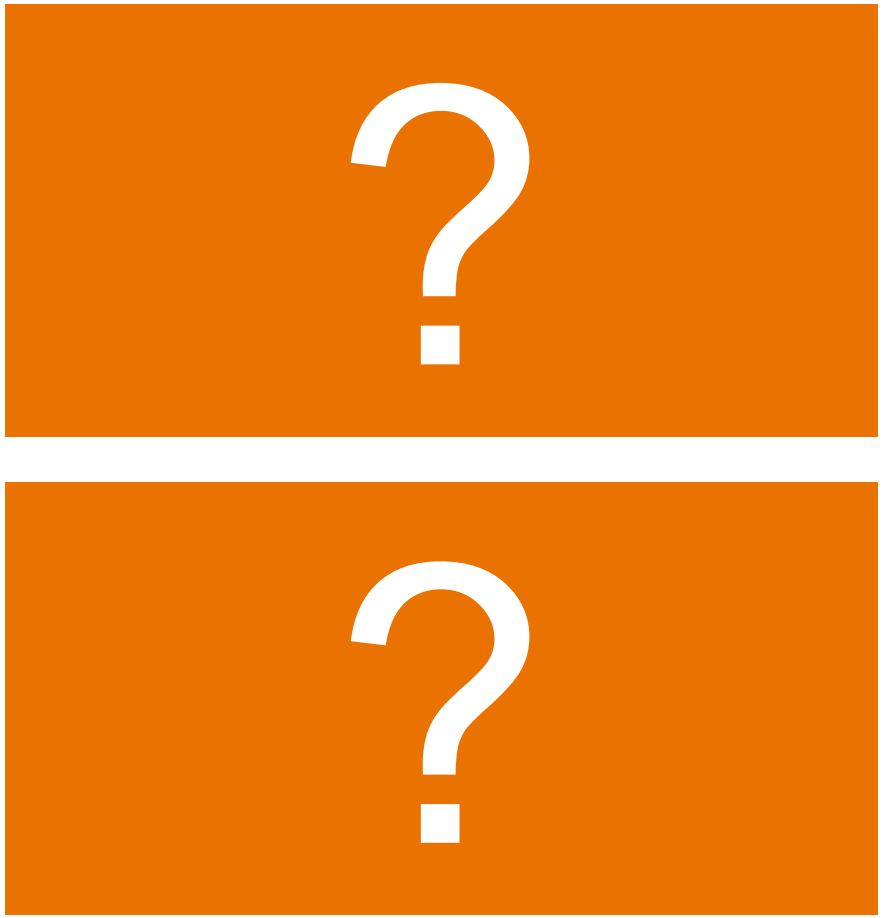


OTC Draft Overall Summary

The OTC draft defined the new **OTC category** as expected, but it also re-defined all today's classic HI's into a **Prescription category**:

OTC	Prescription
For mild-to-moderate HL & adults only	For all HL & ages
OTC (Direct-to-Consumer) or Self-Fitting with HCP – State Laws are pre-empted	As today: State laws apply, e.g. some states require a state licensed HCP
New & specific technical requirements such as max 120 dB SPL, no gain limitation, insertion depth limitations, etc.	As today
New labeling requirements unique for OTC	New labeling requirements (from 20??)
Required for market claims like "Intended to treat Hearing Loss"	
Medical grade quality system (CAPA, NPD R&D process, manufacturing…)	

Note:

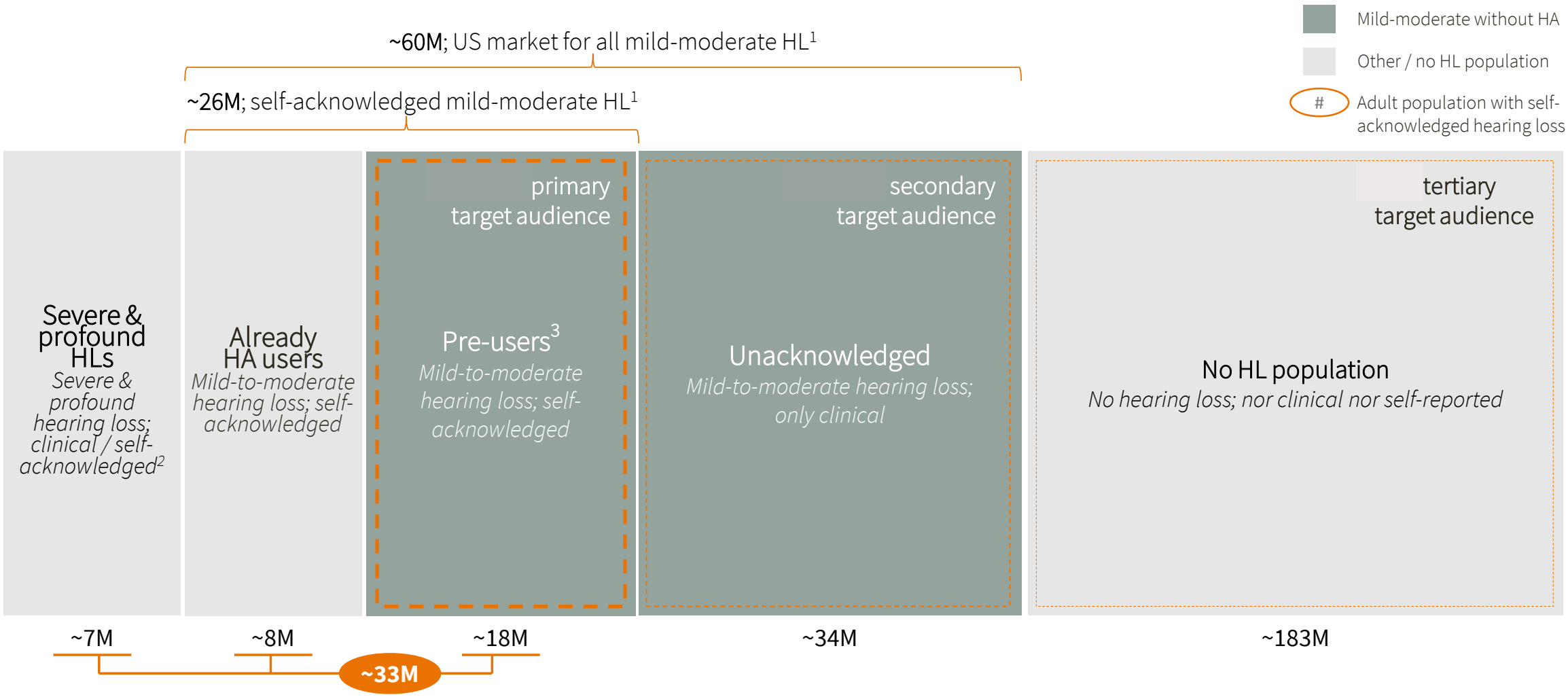
- FDA has stated they will enforce new regulation

OTC Regulation

- Comments to the OTC Rule from HIA
  - Limit the Maximum Output for OTCs to 110 dB SPL instead of the 115/120 dB SPL that is proposed
  - Apply a gain limitation of 25 dB
  - Require 510Ks for all OTC devices
  - Require Class II Quality Practices

The opportunity…

18M with acknowledged mild-to-moderate hearing loss and no solution



Note(s): 1) Adults only; 2) Clinical and self-reported almost identical due to severity; 3) Includes PSAP

The research…

What did we learn from these pre-users?

Over **10 studies** completed

Simplified hearing aid

Cheap and accessible alternative to hearing instruments with hearing as main / only use case

Key consumer driver: **PRICE**

Lifestyle hearing

Hearing assistance as part of a CE experience, e.g., consumerized form factor and features

Key consumer driver: **STIGMA**

They mentioned three occasions to be the most problematic

At work
Both in open plan offices, meetings, and informal chat

In noisy locations

At restaurants, cafés and bars

	At work	In noisy locations	At restaurants, cafés and bars
Recipients perceives hearing issues to be a moderate to serious problem	44%-37%[1]	55%	37%
Across all recipients	19-16% [1]	26%	15%

1 depending on situation at work

Lifestyle Hearing

6 key drivers:

- Acknowledge loss but looking for support in certain situations only
- Want a “miniature” discreet but visible product in non-traditional form factor
- Don’t want a traditional hearing aid but do want comfort of medical technology & back-up support
- Want a multi-functional easy to use device
- Tend to be younger than today’s first-time user.
- Plan to research purchase on-line

Ideal scene for individuals with hearing loss

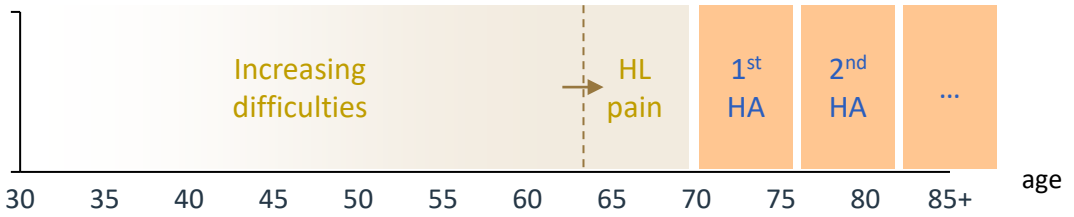
Illustrative

Because of the situation we have discussed today…

1. Large population with untreated hearing difficulties
2. Long wait time before embarking on hearing journey
3. High(er) purchase intent for this product with younger segments

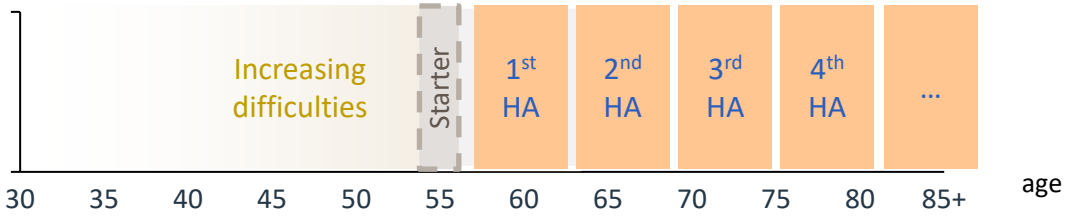
We can together move towards the ideal scene…

From



Age of individual. 1st HA ~ 70, aware of difficulties due to loss since ~64

To



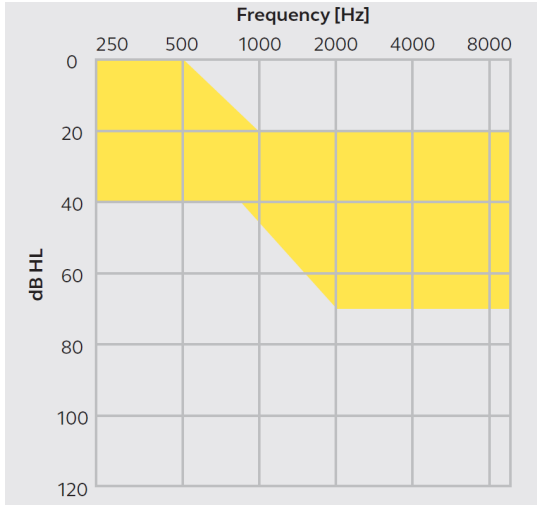
How to serve your patients

Evaluate patients to determine the best solution for their hearing loss.

As hearing care professionals, our mission is to evaluate patients' hearing challenges and abilities in order to apply those findings to the most appropriate hearing care recommendation.

- Share with each patient that you strive to fit based on his/her hearing loss, lifestyle and budget.
- Utilize comparative tools to share the differences between technology options and the impact on his/her hearing solution. This may include items like audiogram overlays representing product fitting range and technology features/benefits handouts.
- Recommend OTCs when appropriate and serve you patients' with a customized offering package to meet their needs.

Jabra Enhance Plus fitting range



Care/Support packages

Create 2 to 3 customized offering packages to meet a variety of patients' needs.

Assess and Go

Office Visit + Testing + Devices

- Diagnostic and assessment services are billed to the patient and/or insurance.
- Device cost
- Any additional EarGels or visits would be charged.

Assess and Fit

Office Visit + Testing + Devices + Fitting/Orientation Fee

- Diagnostic and assessment services are billed to the patient and/or insurance.
- Device cost
- Personalize the devices (set up app, pair, instruct them through set up process and answer any questions)
- Any additional EarGels or visits would be charged.

Assess, Fit and Follow

Office Visit + Testing + Devices + Care/Support package

- Diagnostic and assessment services are billed to the patient and/or insurance.
- Device cost
- Care/Support package:
  - Personalize the devices (set up app, pair, instruct them through set up process and answer any questions) if needed
  - Clean & check visits (quarterly)
  - Replacement EarGels
  - Loaner if devices go in for repair

Disclaimer: These packages are suggested guidelines to consider as you think about what solution best meets your practice needs.

Who is playing in this segment?

Eargo

Lexie Lumen

Sound World Solutions

Etymotic Research

Whisper AI

Nuheara

Jabra

Convergence of CE and Hearing Aids

In-The-Ear Convergence

‘Medical’ Customs today

Modern Custom Products

Self-fitting Lifestyle Hearing

Advanced Hearing Amplification

Design is moving away from the tradition “medical” in-the-ear product to modern, ear bud styles due to the convergence of consumer electronics products for hearing loss.

Custom Hearing Aids taking on a non-medical look

Starkey Livio

Insio Charge and Go AX

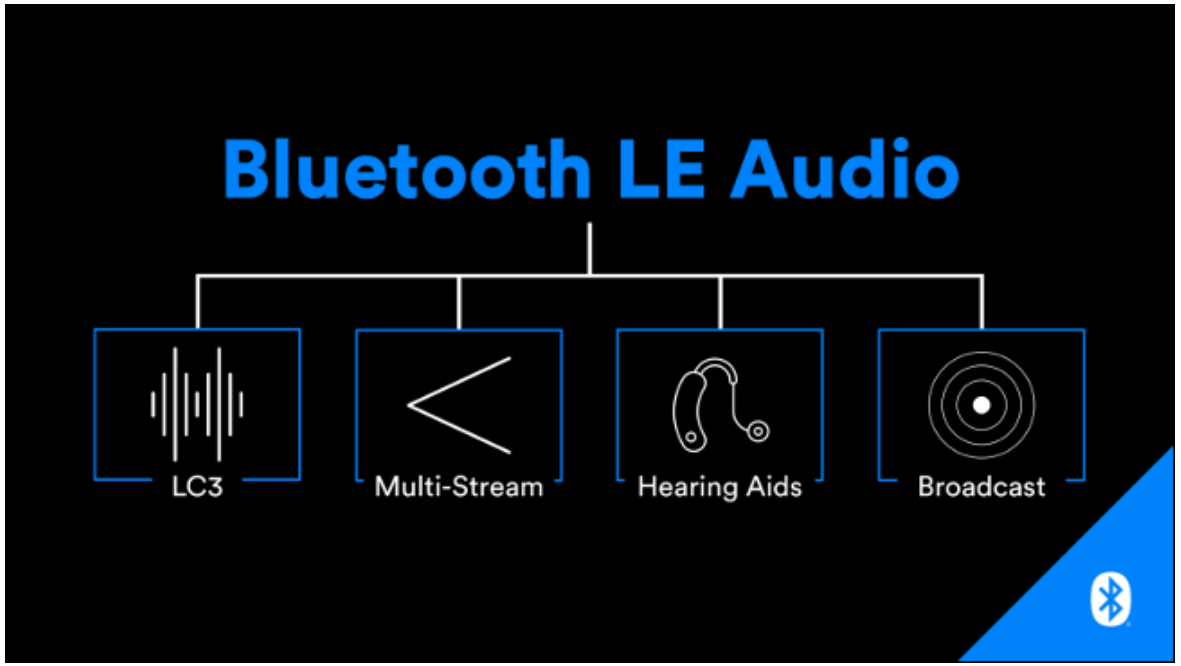
Earbuds with Hearing Enhancement

AirPod Pro

Olive

Connectivity

Bluetooth



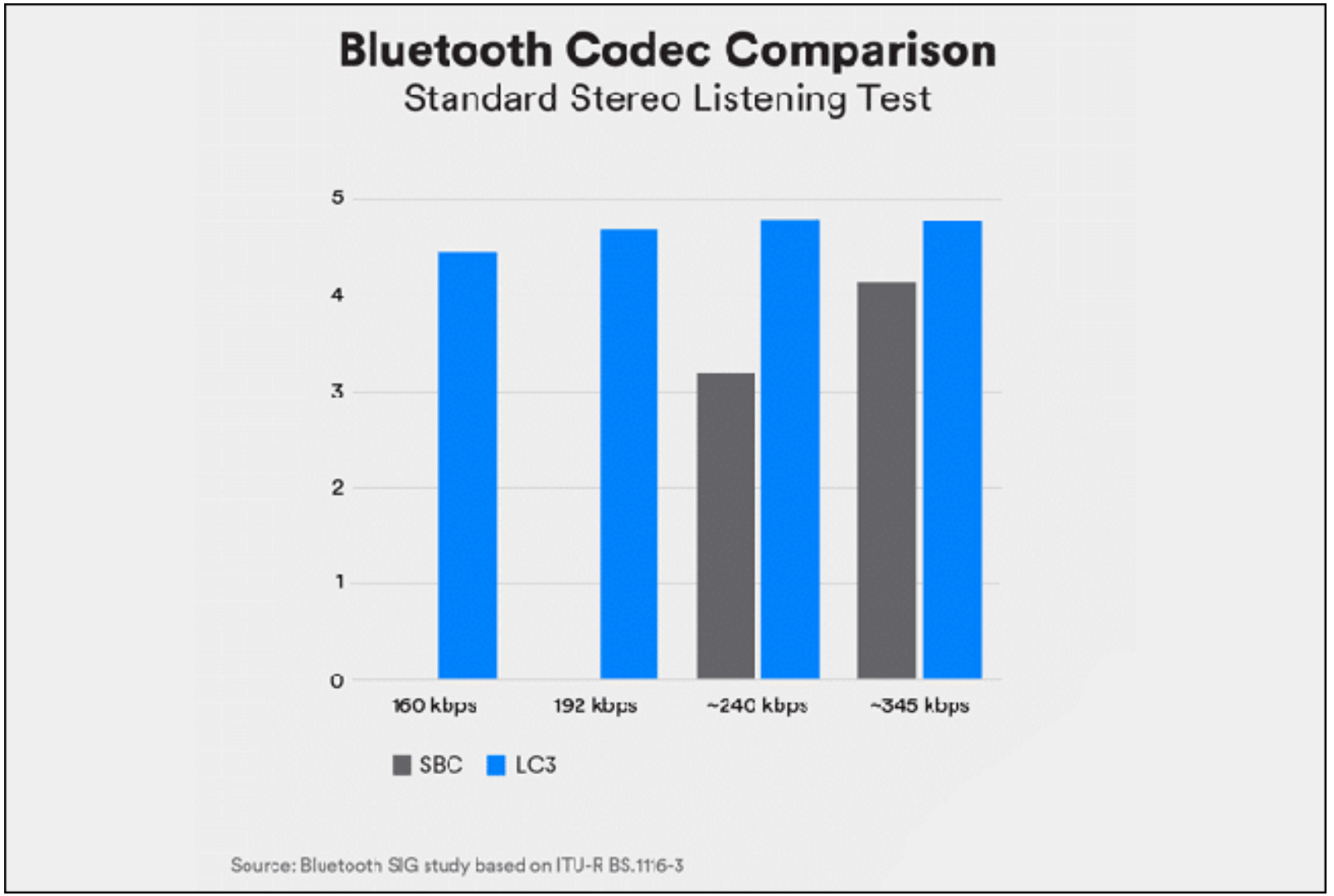
Bluetooth Classic

- Streams to One Device
- High Power Consumption
- Compression of the signal causes distortion

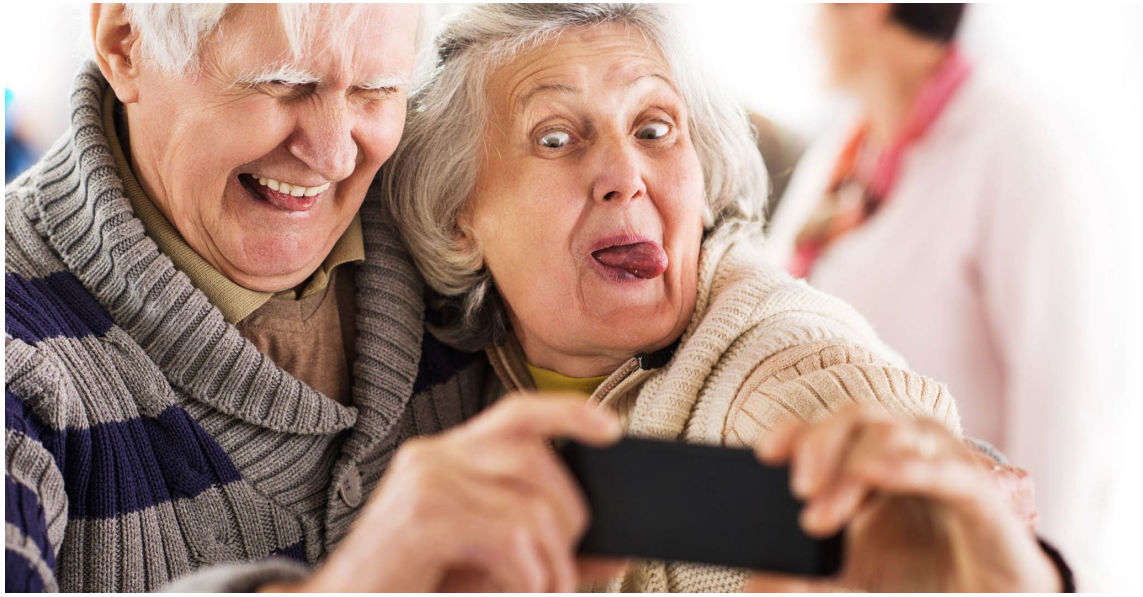
Low Energy Audio (LC3) – Low Complexity Communication Codec

- Steams to Multiple Devices
- Lower Power Consumption
- Broadcast Audio
  - From Single Device to Multiple Devices
  - Public Venues
    - Replacing the Loop and TC Eventually

Sound Quality of Bluetooth Classic vs. LC3 Bluetooth

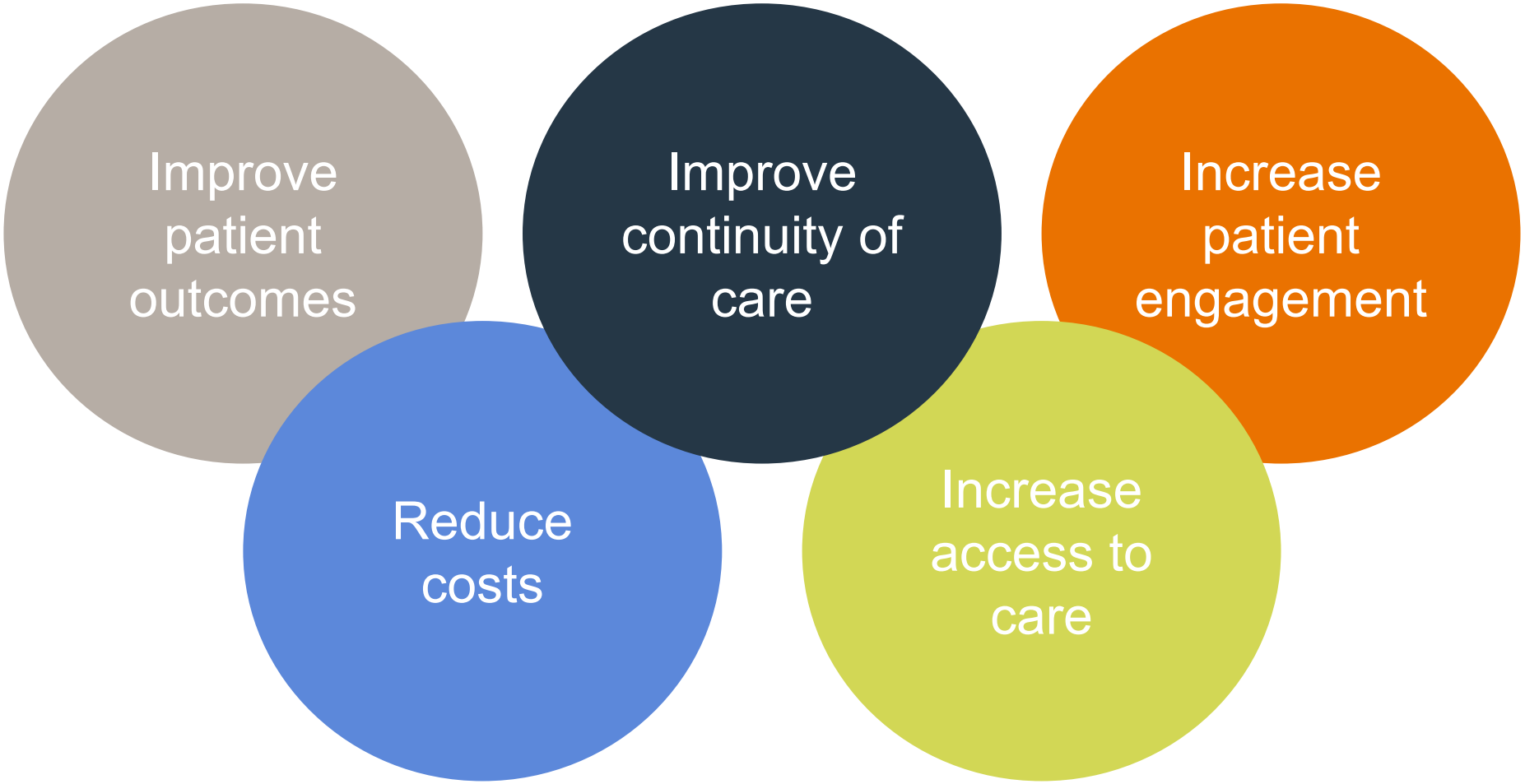


Seniors and Smartphones

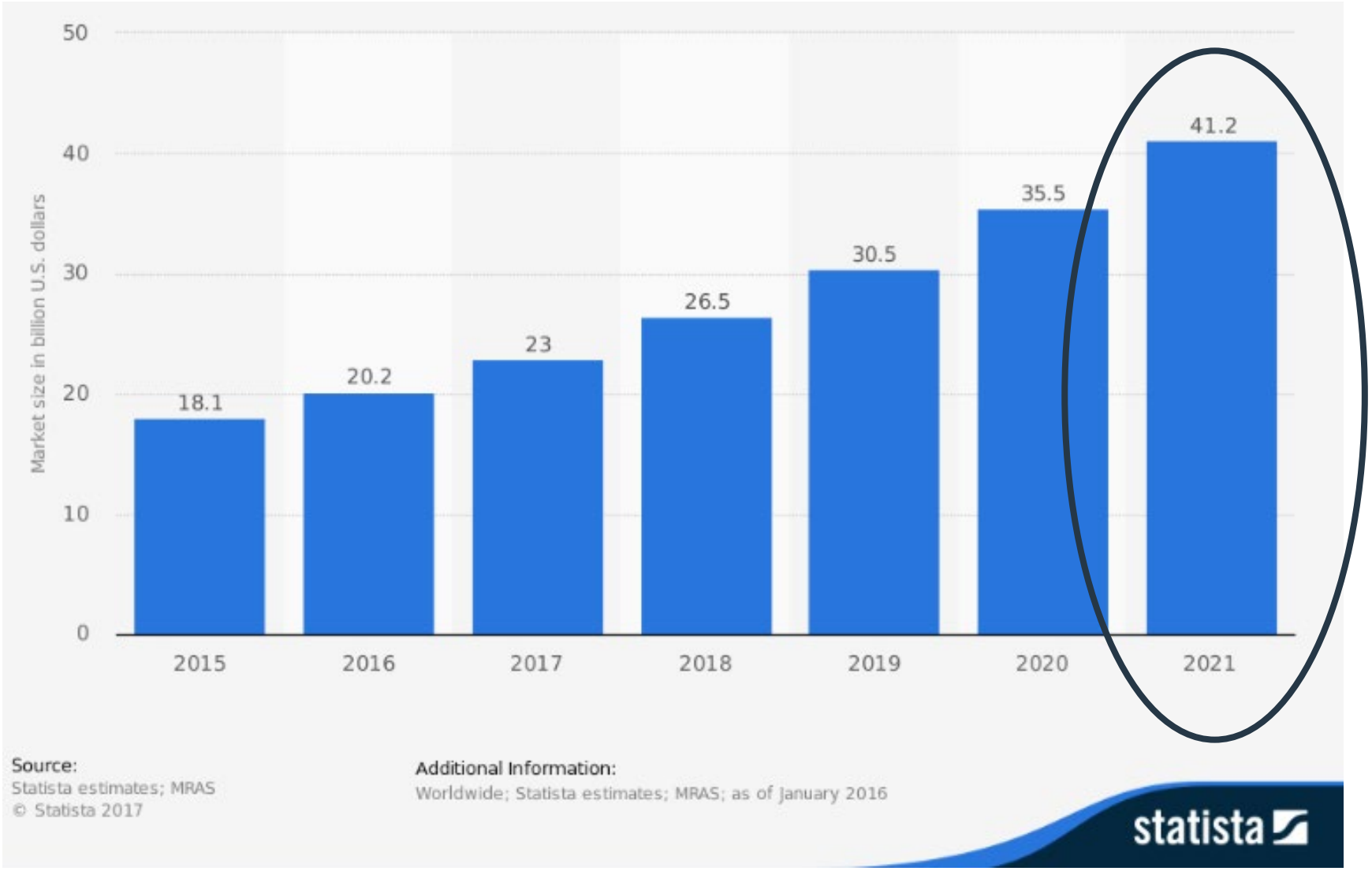


- Pandemic was especially isolating for seniors
- Smartphones played a role in mitigating some of this isolation
- HCPs should be promoting Smartphones to patients
- Only 10.4% of the 65+ population had a landline alone without cellphone service
- According to AARP, 77% of those aged 70+ own a smartphone, but from those aged 85+ this decreases to 65 – 70%

Why telehealth?



Global telemedicine market size from 2015 to 2021 (in billion U.S. dollars)*

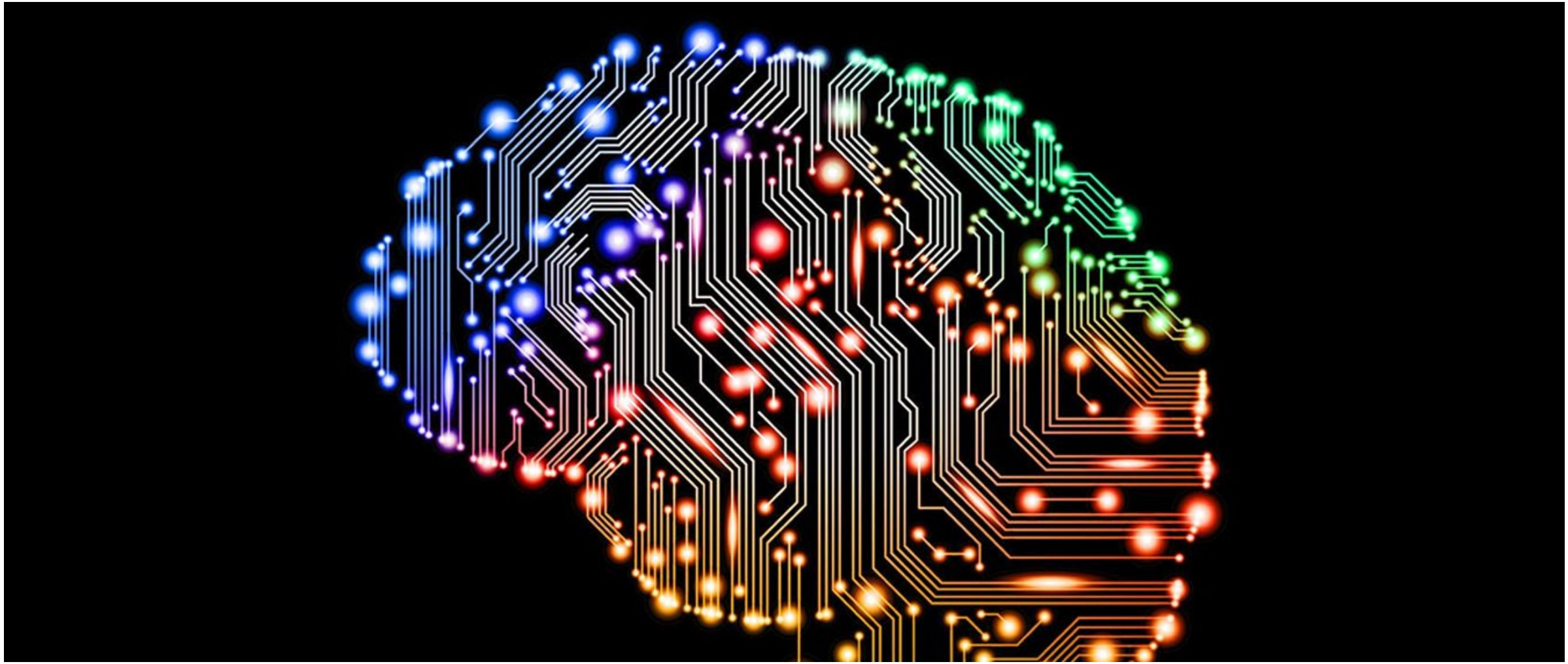


Apps to Control Hearing Aids

- program control
- volume control, including a mute option
- sound enhancer adjustments
- personalized settings and programs
- battery life monitoring
- tinnitus management
- saving settings for specific locations
- find my hearing aids feature
- audio streaming
- support from hearing care professionals

And more will come……

Artificial Intelligence



Artificial Intelligence

Artificial Intelligence

Artificial intelligence (AI) describes the development and use of a computer system with the ability to perform some of the functions that are normally associated with human intelligence and discernment, such as learning, problem-solving, decision-making, and pattern recognition.

Machine Learning

Machine learning is a type of artificial intelligence that enables (trains) an algorithm to build a predictive model from input data and then applies that learning without the need for human intervention – to make useful predictions from new data.

Deep Learning

Deep learning is a Machine Learning method based on artificial neural networks that mimics the workings of the human brain in processing data. Deep learning can even happen without human supervision and draw from unstructured and unlabeled data.

Sensors in AI

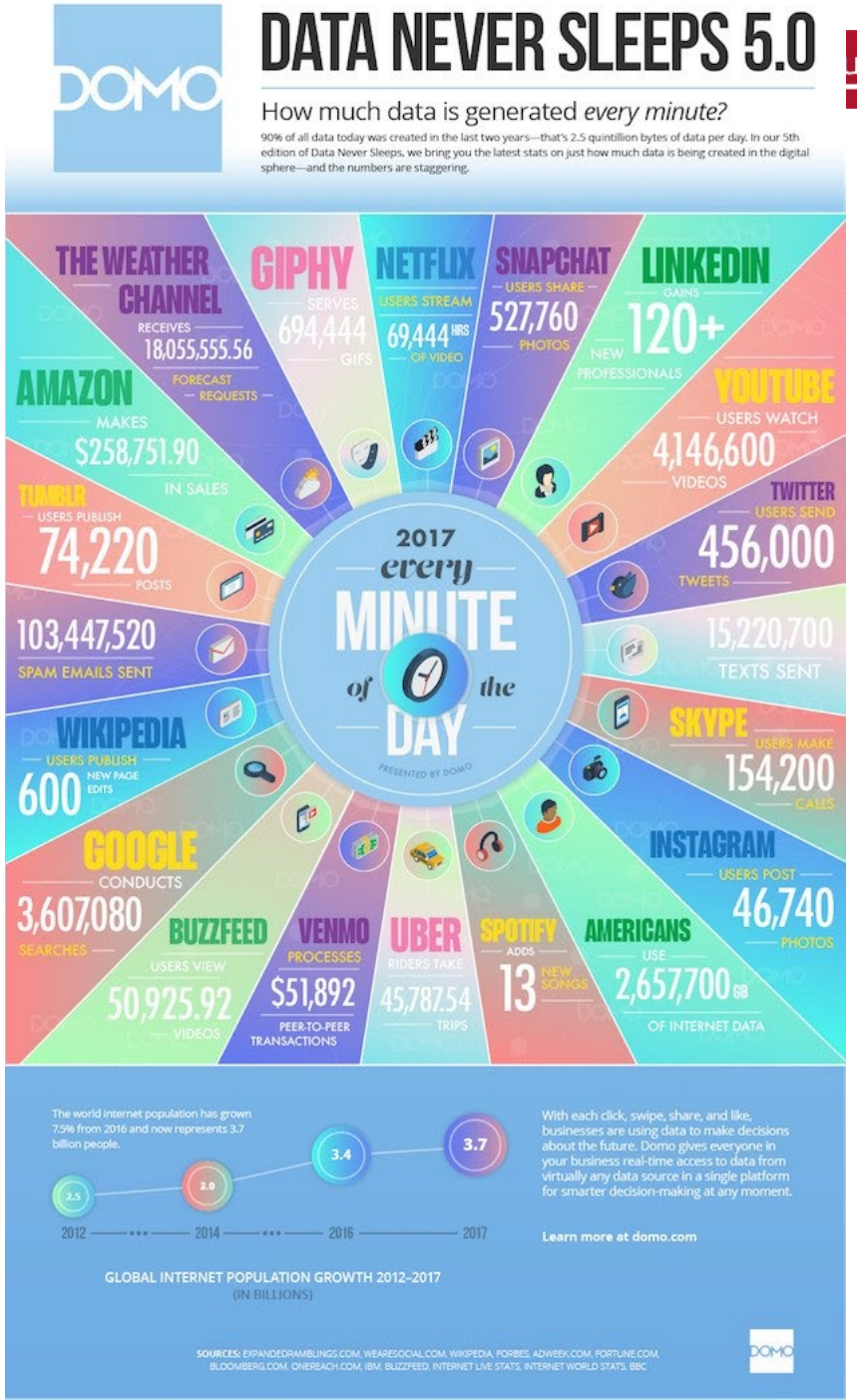
Like sense organs in the human body, electronic sensors can play a vital role in AI. Sensor solutions are mostly responsible for data acquisition that is then transmitted and computed by a more capable network device.

Data Analytics

We live in a world where there is more information captured on a minute-by-minute basis about our daily lives than ever before.

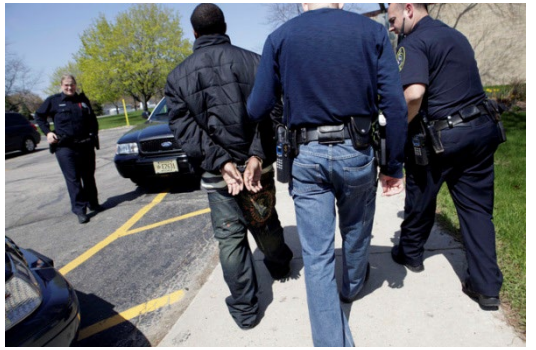
Practically everything we do leaves a trail.

BIG DATA - term for data sets that are so large or complex that traditional data processing application software is inadequate to deal with them. Since the data sets are so huge, the challenges include capture, storage, analysis, data curation, search, sharing, transfer, visualization, querying, updating and information privacy.



Where is Big Data being used?

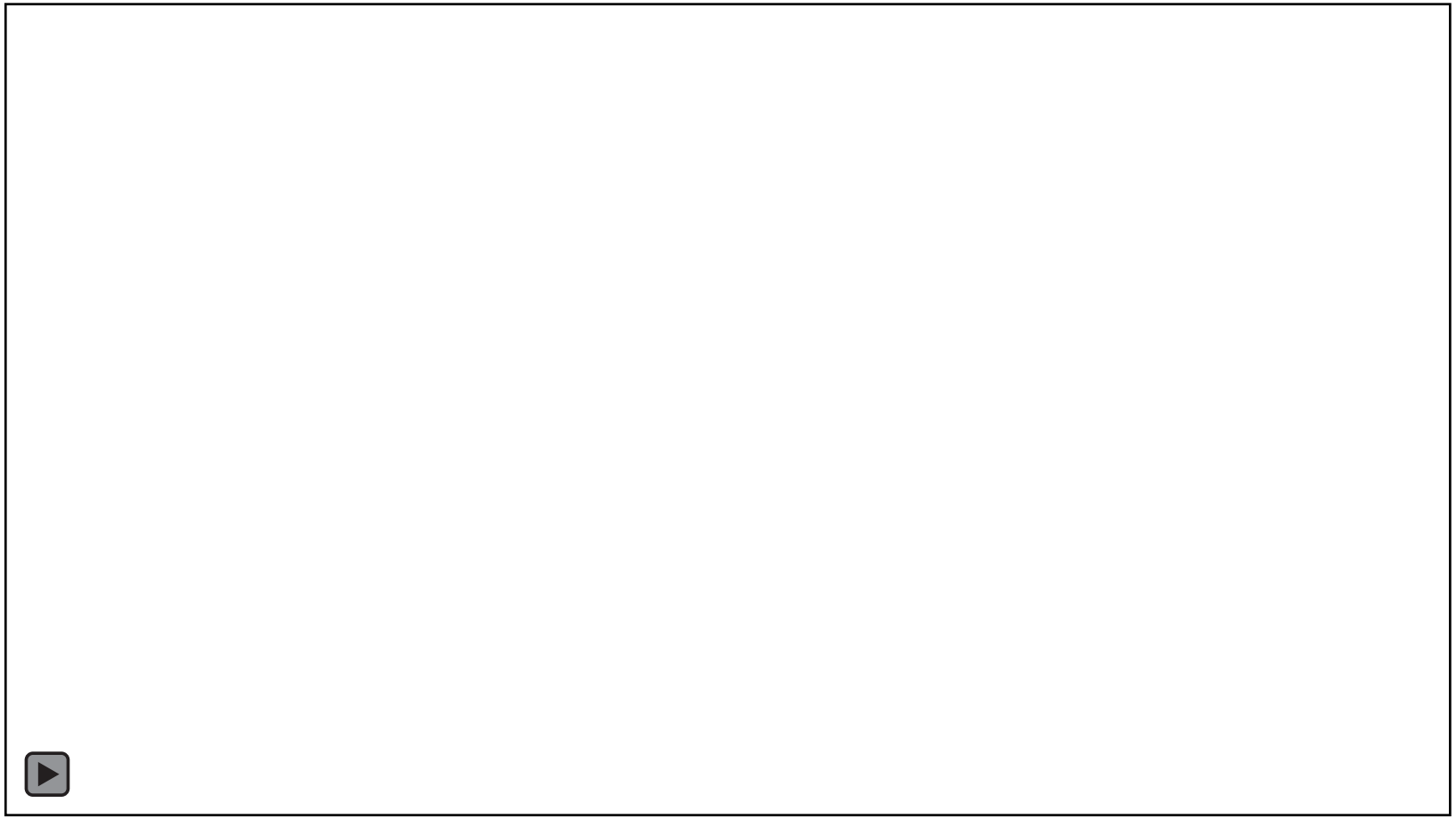
- **Retail –** what is selling, where is it positioned, what time of day does it sell – all used to organize stores
- **Feeding the hungry** –data can be used to maximize crop yields, minimize the amount of pollutants released into the ecosystem and optimize the use of machines and equipment
- **Fitness –** data used to track fitness, reward behavior, recommend fitness routines
- **Prevent crime** – data-driven strategies based on intelligence and public data sets help deploy resources more efficiently



Precision Medicine

A medical model that proposes the customization of healthcare, with medical decisions, treatments, practices, or products being tailored to the individual patient. In this model, diagnostic testing is often employed for selecting appropriate and optimal therapies based on the context of a patient's genetic content or other molecular or cellular analysis.

Precision Medicine



Individual user needs & preferences

- Hearing aid users wear their hearing aids in a variety of acoustic environments.
- The resulting individual preferences and needs are variable.
- The industry faces the challenge of providing users with appropriate solutions.

Where is AI Being Used in Hearing Aids Today?

Widex Evoke – Real-Time Machine Learning

- Learns your preferences in any listening environment through A/B comparison
- Learns from other users who send data to the Cloud

Starkey Livio

- Uses integrated sensors and artificial intelligence which can detect if you've fallen

Oticon More

- Used offline DNN to develop an environmental classifier to steer hearing aid features

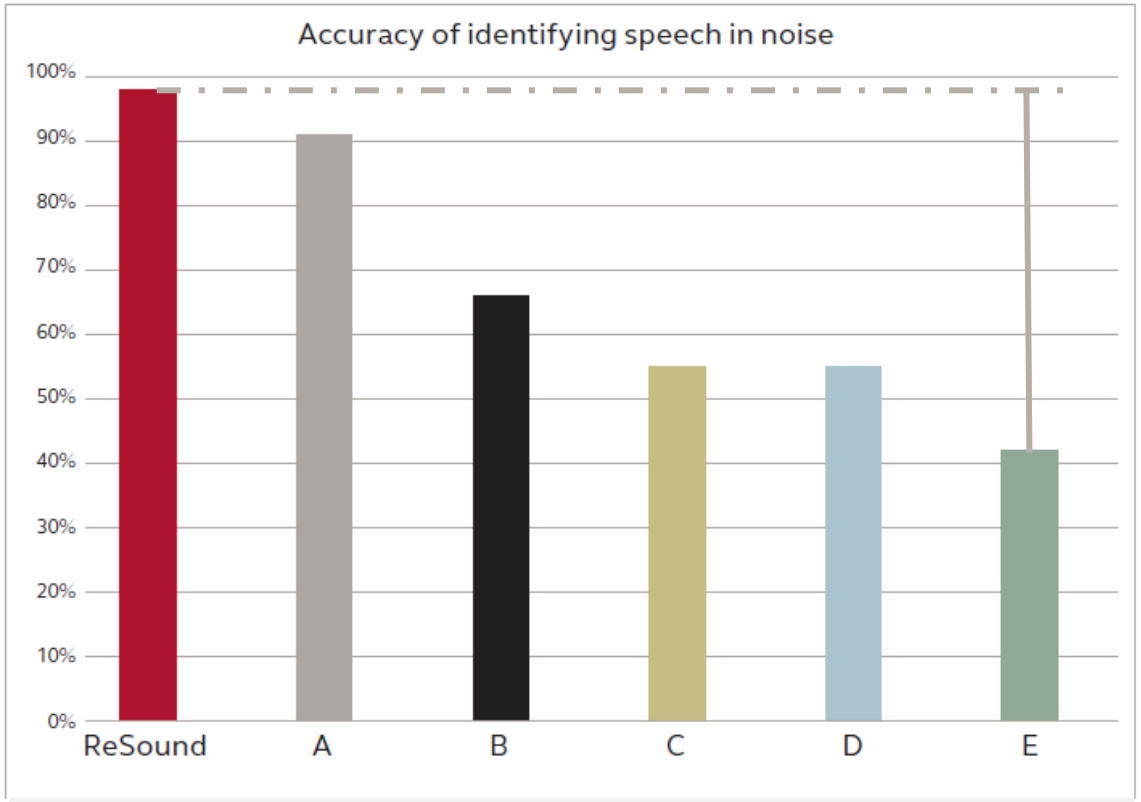
Environmental Classification

Classifier – Yelamsetty et al., 2021
This study has a lot of people talking!

Repeated Groth and Cui – but only for classifiers that classified Music

- The top concern they identify is classifying music, especially music in the presence of any other environmental sound.
- They point out that the signal processing strategies to enhance music and the signal processing to enhance speech and/or reduce background noise are most often opposed so the hearing aids will struggle in environments with both music and other sounds.
- People know when they want to listen to music. It is an intentional activity. You don't really need the hearing aid to decide that for you. If the hearing aid does decide it is very likely that hearing in noisy environments will suffer.

ReSound ONE – Environmental Classification



Source: Groth (2015)

ReSound and premium hearing aids from 5 other manufacturers were exposed to a conversation between a male and a female speaker in different kinds of noisy environments (party, train station, grocery store, hand mixer etc.)

The hearing aids were connected to their respective fitting software and the data logging was read from the hearing aids

All manufacturers have classification environments that include speech-in-noise

ReSound showed the greatest accuracy at 98%. The least accurate hearing aid classified only 42% of hours as speech-in-noise.

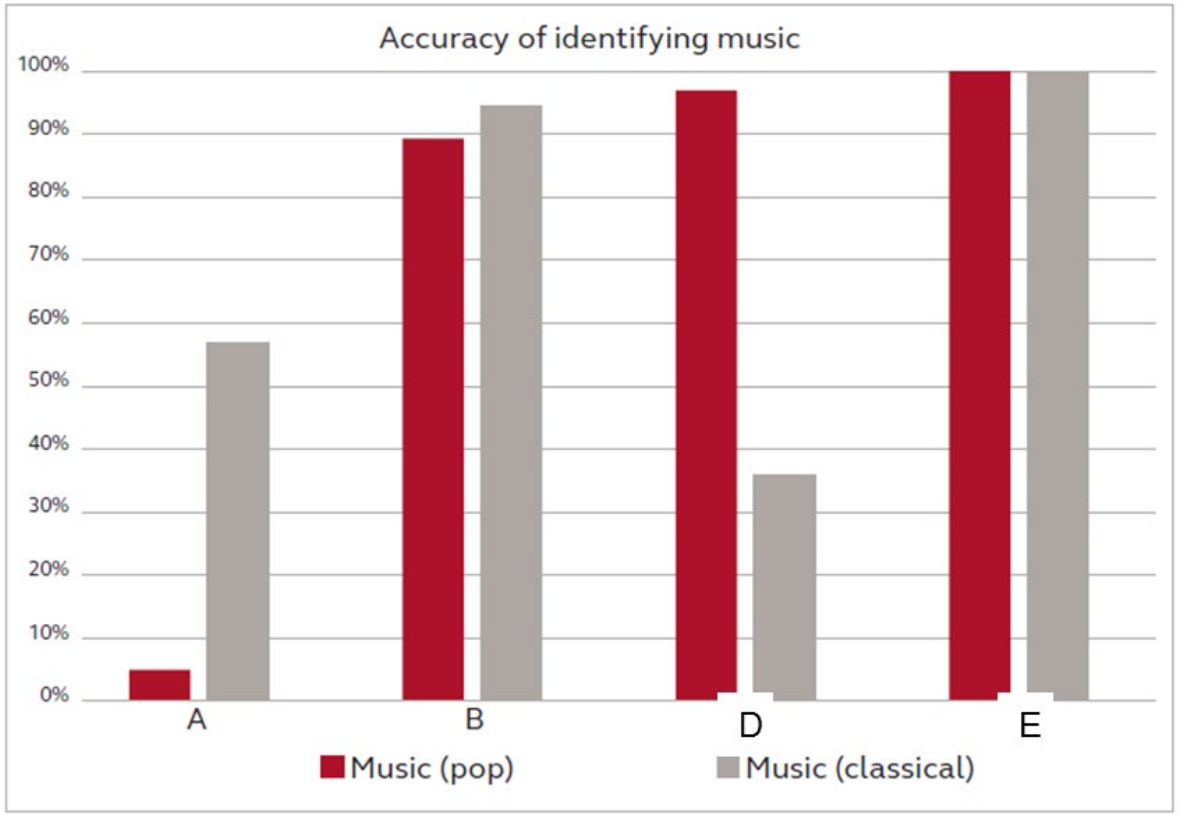
Music Classification: Limited accuracy

Tested music classifier from four manufacturers

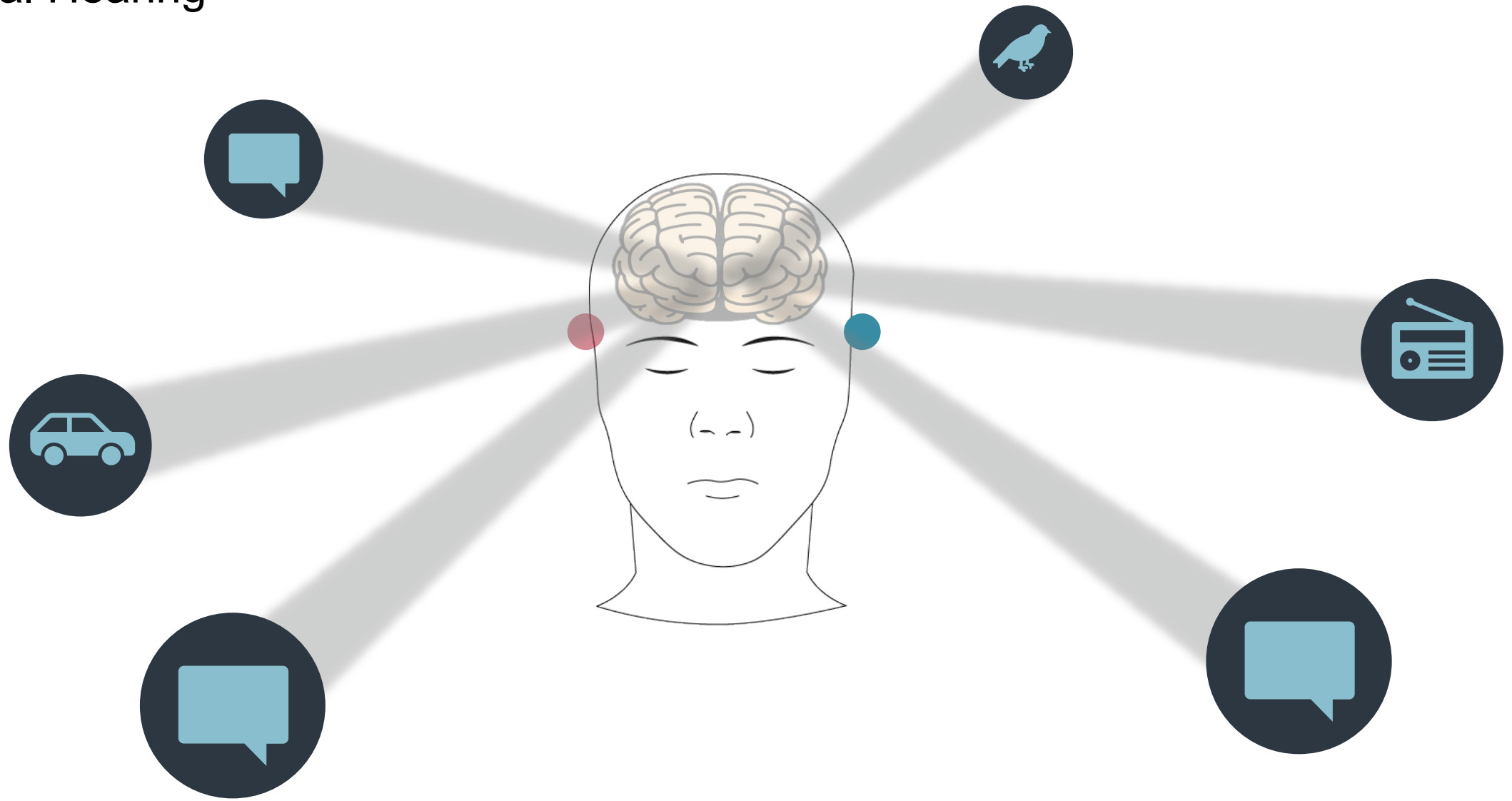
Evaluated in a test box with looped sound files and read data logging

Two different genres of music

Note: Brand E was least accurate for speech-in-noise



Spatial Hearing

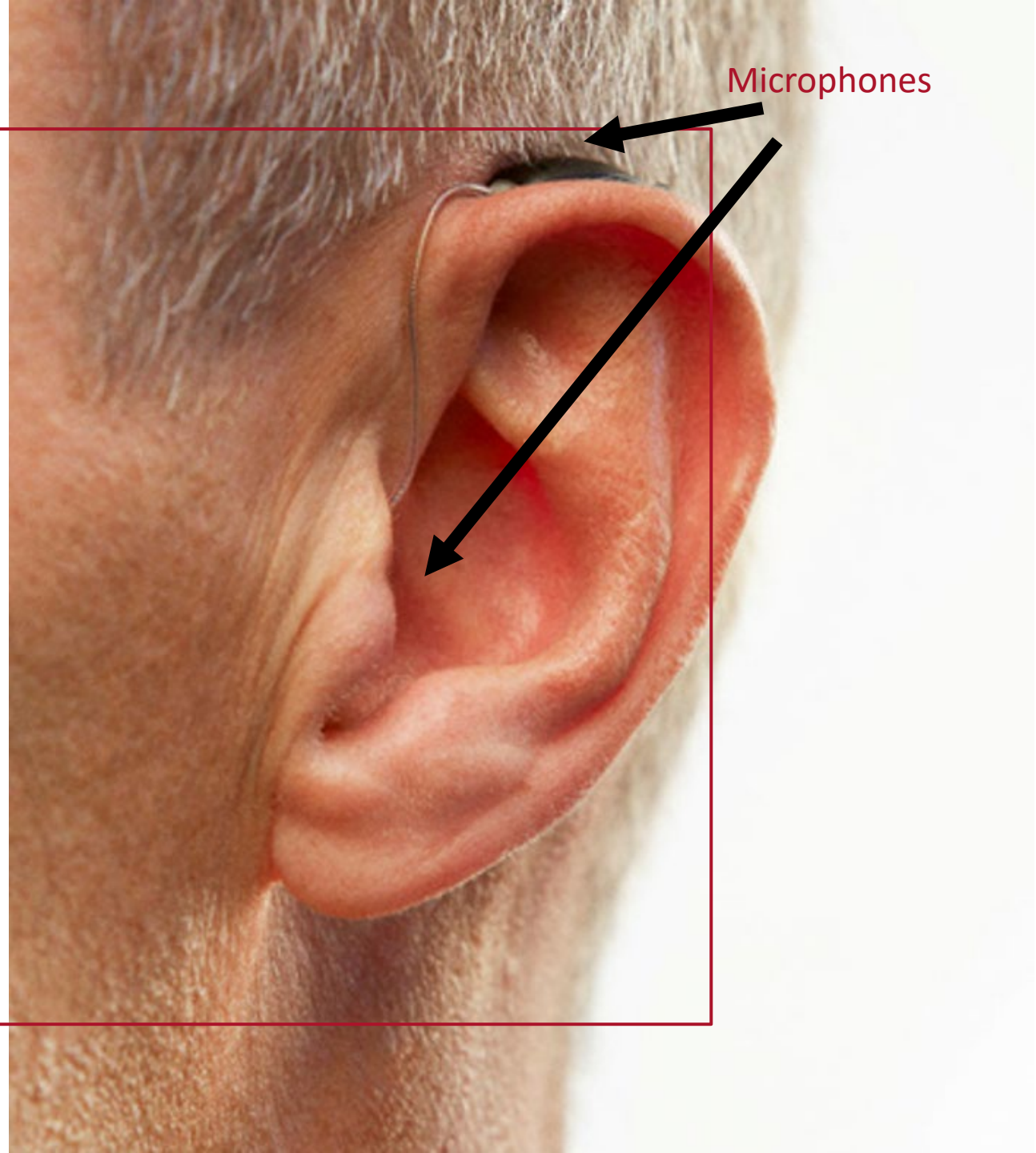


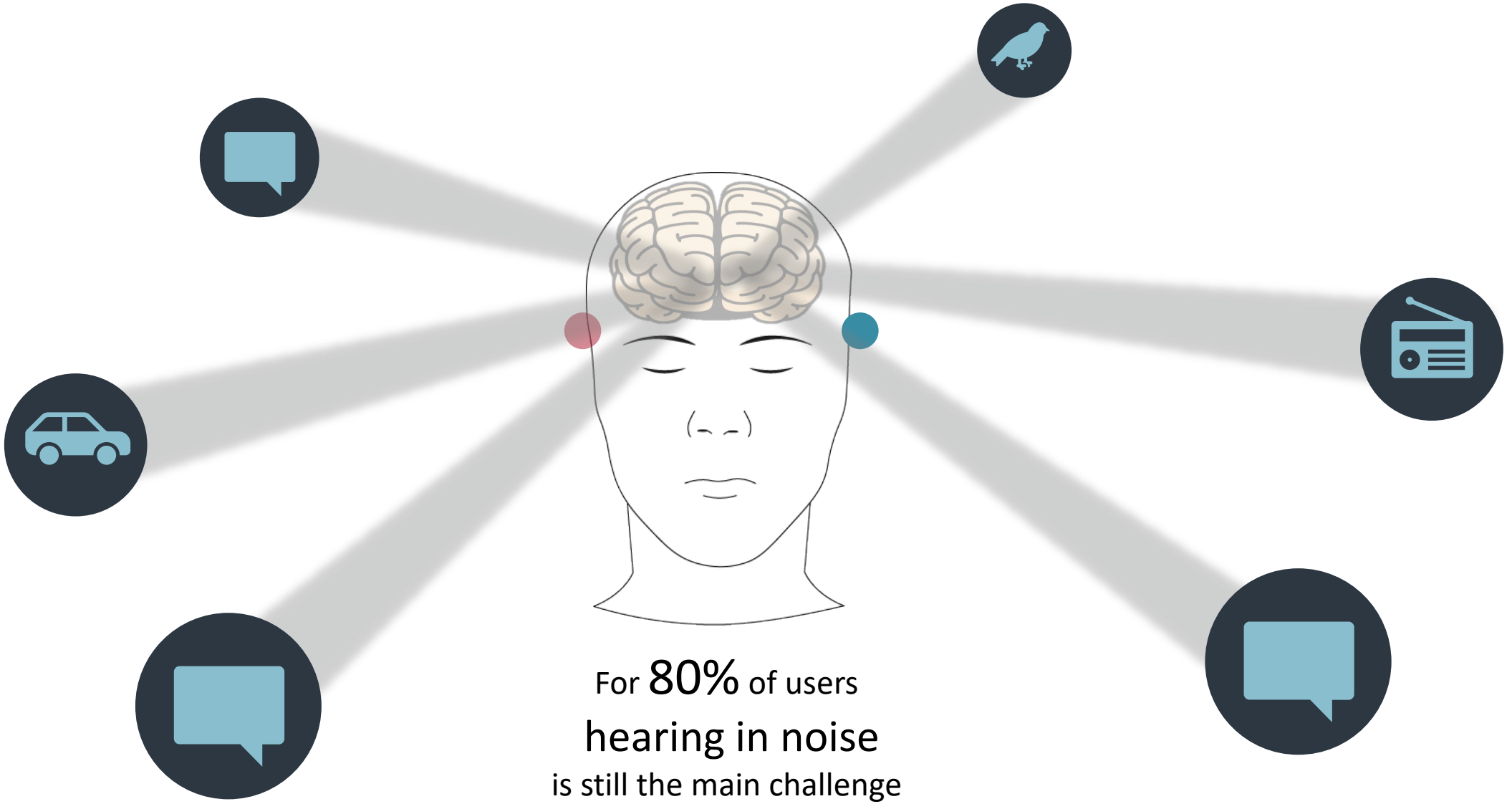
M&RIE

M&RIE MAKES SENSE

Our individual ear provides

- Our own unique acoustics
- Localization
- Spatialization





For 80% of users

hearing in noise

is still the main challenge

(source: MarkeTrak 10, 2019)

For 80% of users

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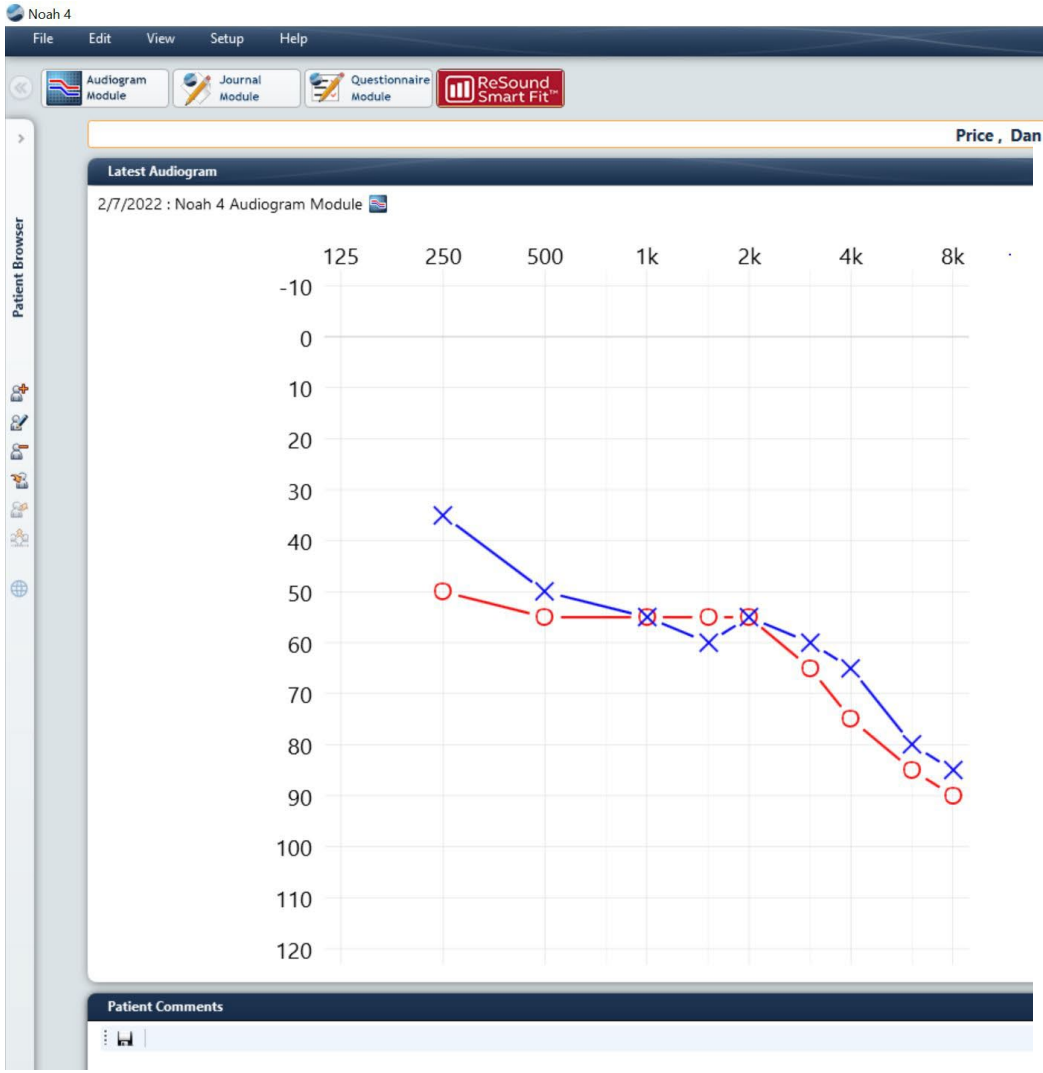
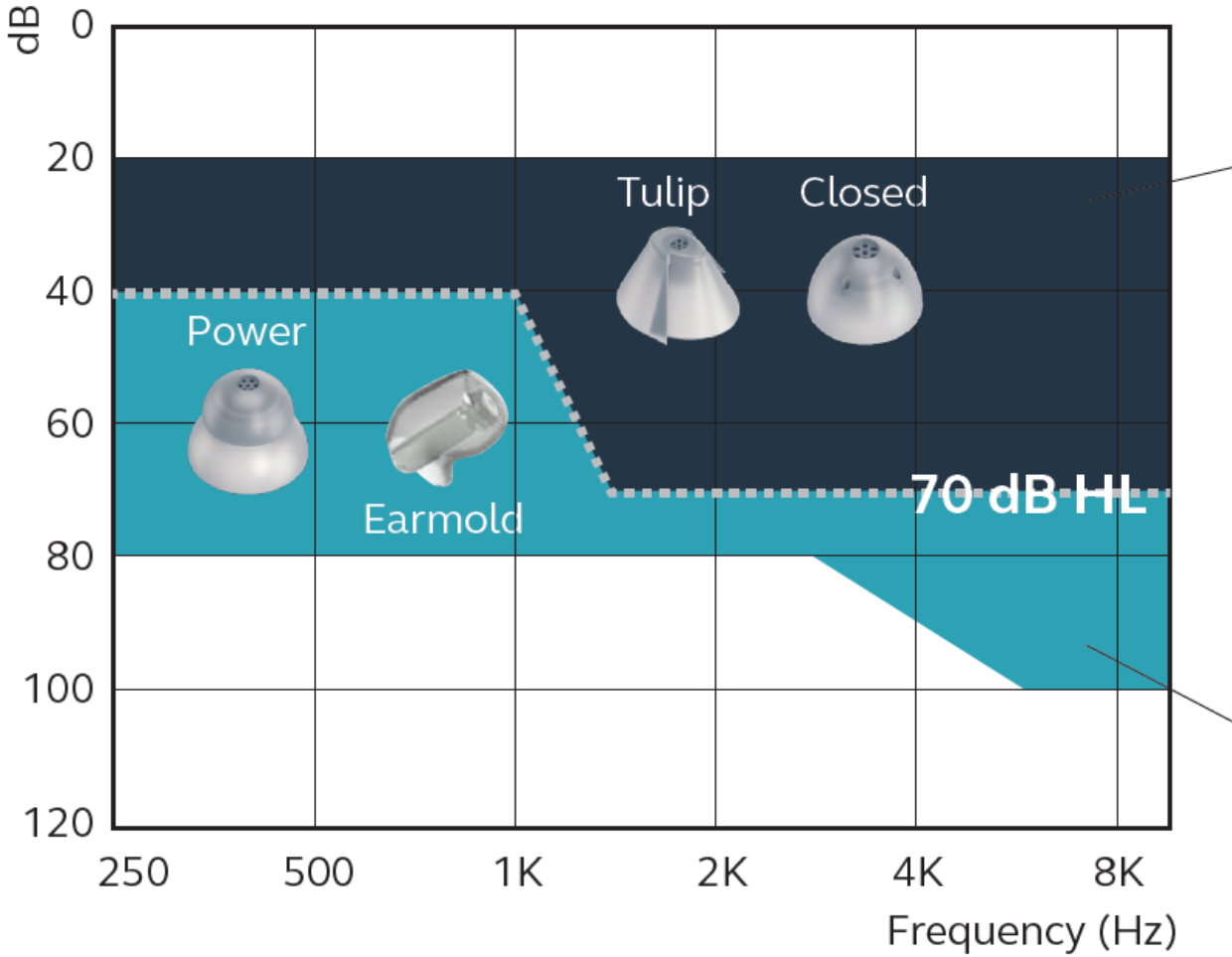
(source: MarkeTrak 10, 2019)

Hearing Loss





Sound Quality

Natural sound quality with depth & detail

90% Of listeners prefer M&RIE for natural sound quality[1]

Speech Understanding in Noise

Better speech understanding in noise

20% Percentage point increase in speech recognition in noise with M&RIE placement[4]

Localisation

Better localisation and spatial awareness

31% Immediate benefit of 31% better front-back localisation with M&RIE[3]

Better localisation and spatial awareness

57% Front-back localisation benefit, increasing to 57% after 4 months of wearing M&RIE[3]

Listening Effort

Less listening effort with M&RIE

2.6dB Average listening effort benefit[4]

Easy, natural placement for calls

95% Report near effortless non-streamed phone calls with M&RIE[5]

Wind noise

Wind noise protection

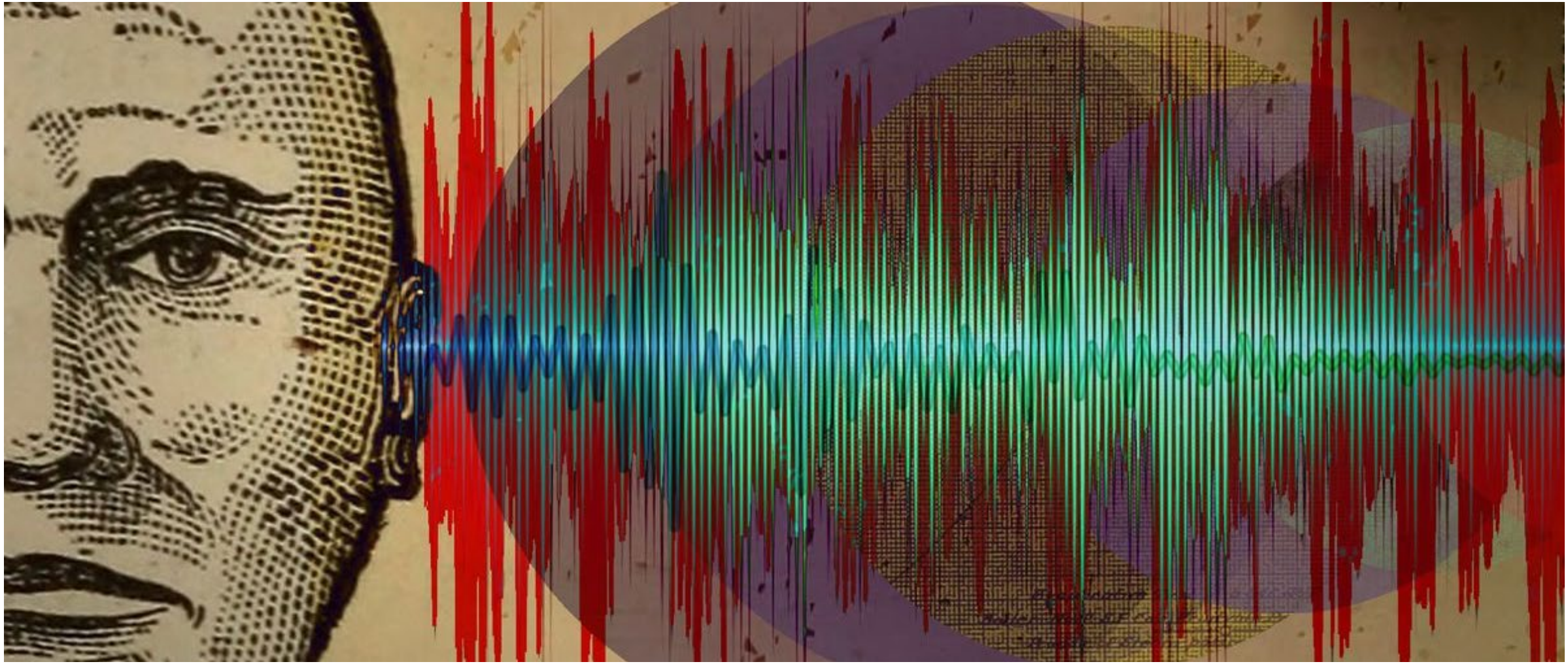
15dB Natural wind noise protection without reducing gain[1]

Wind noise benefit

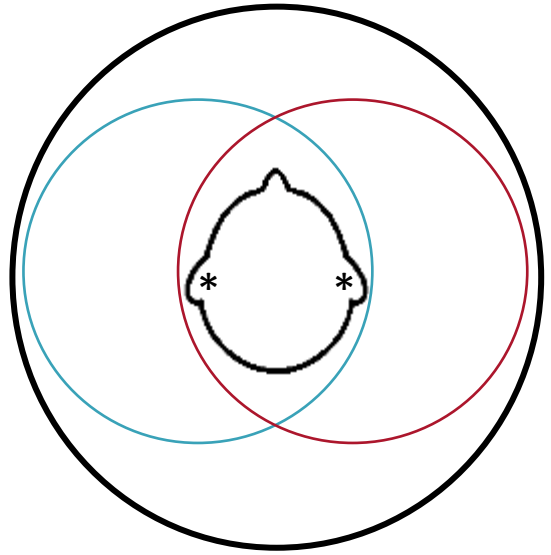
33% Better sound quality rating in wind noise[2]

1. Groth J. An innovative RIE with microphone in the ear lets users “hear with their own ears”. ReSound white paper, 2020.
2. Andersen P, Schindwolf I, Jespersen C. Less wind noise with M&RIE leads to better sound quality. ReSound white paper, 2021.
3. Jespersen C, Schindwolf I, Groth J. Benefits of M&RIE with long-term use. ReSound white paper, 2021. Write up in progress, title subject to change
4. Quilter M, Groth J, Krueger M. Reduced listening effort and improved speech intelligibility with M&RIE. ReSound white paper, 2021. Write up in progress, title subject to change
5. Quilter M, Hartenstein R, and Groth J. Percentage of users who report regular calls without effort or very little effort, 2021
6. Jespersen C, Kirkwood B, Schindwolf I. M&RIE receiver preferred for sound quality and localisation. ReSound white paper, 2020.

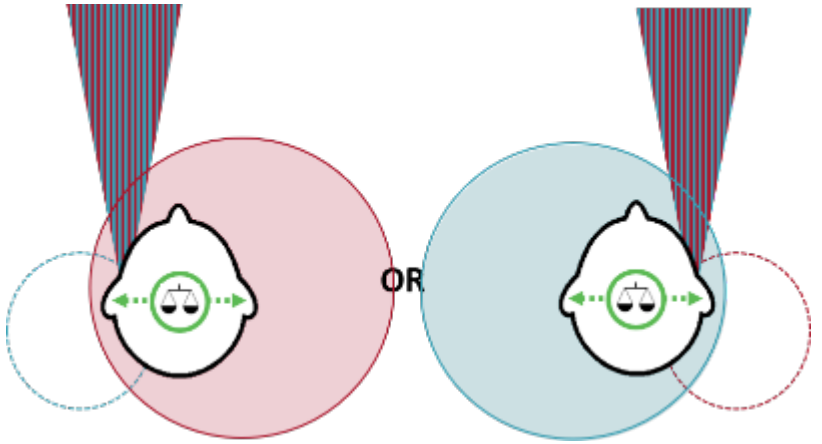
Hearing in Noise



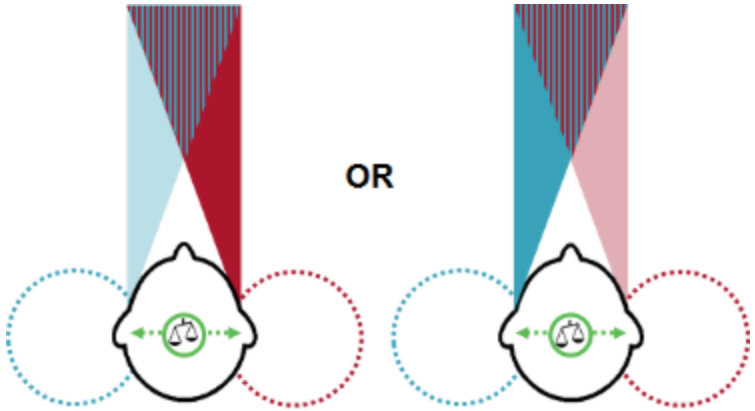
OMNI HEARING



BEAMFORMERS + OMNI



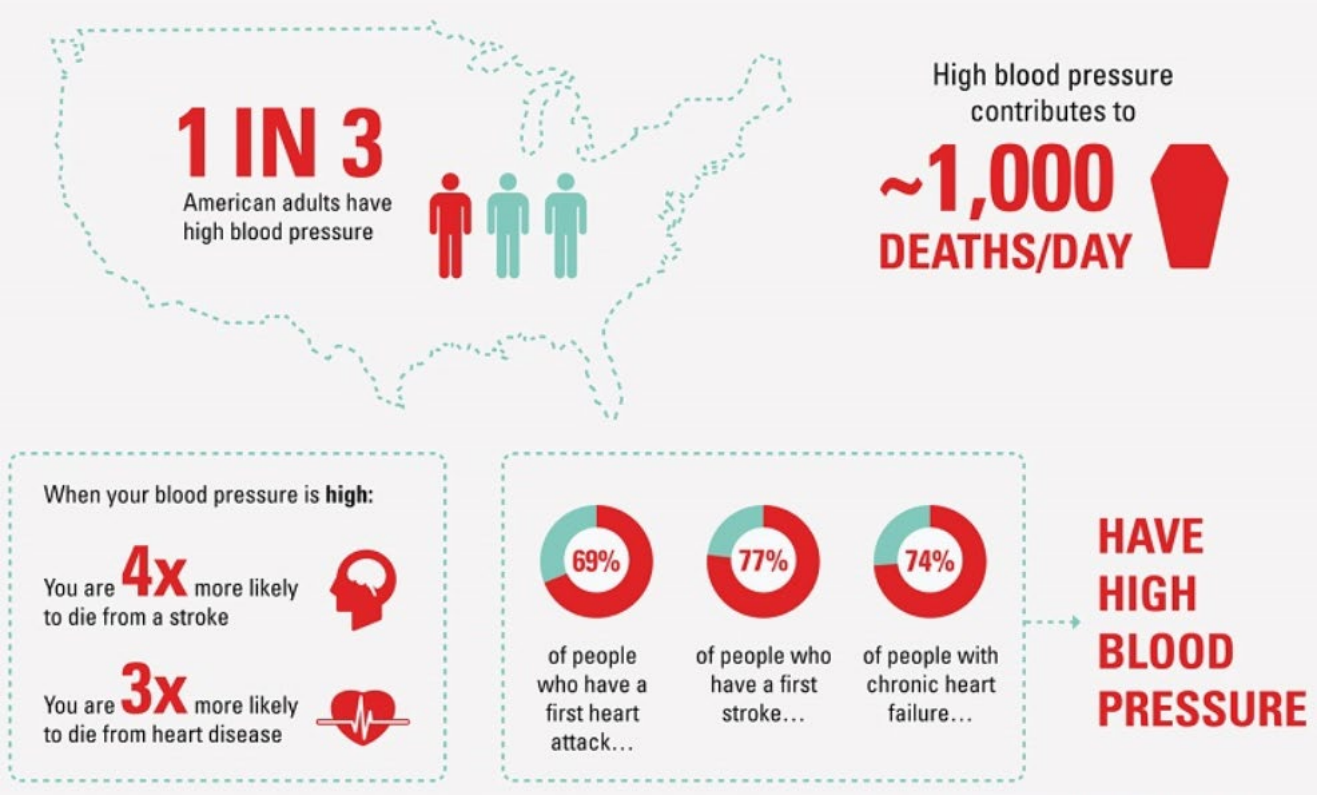
BEAMFORMERS



Accessories

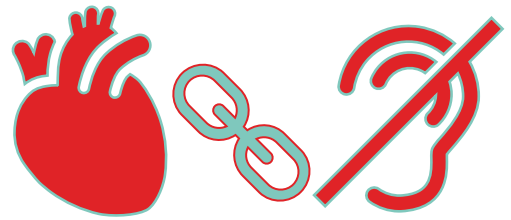
Health

High Blood Pressure



Connection between Hypertension and Hearing loss

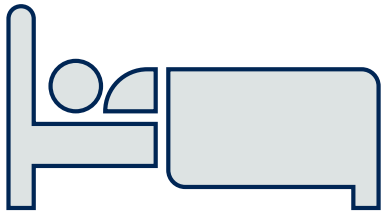
- Patients with hypertension have greater increase in hearing loss compared to those without
- Hearing system susceptible to vascular changes



Source: NIH, Agarwal et al., 2013

Sleep apnea is linked to:

- High blood pressure
- Atrial fibrillation
- Sudden cardiac death
- Heart failure

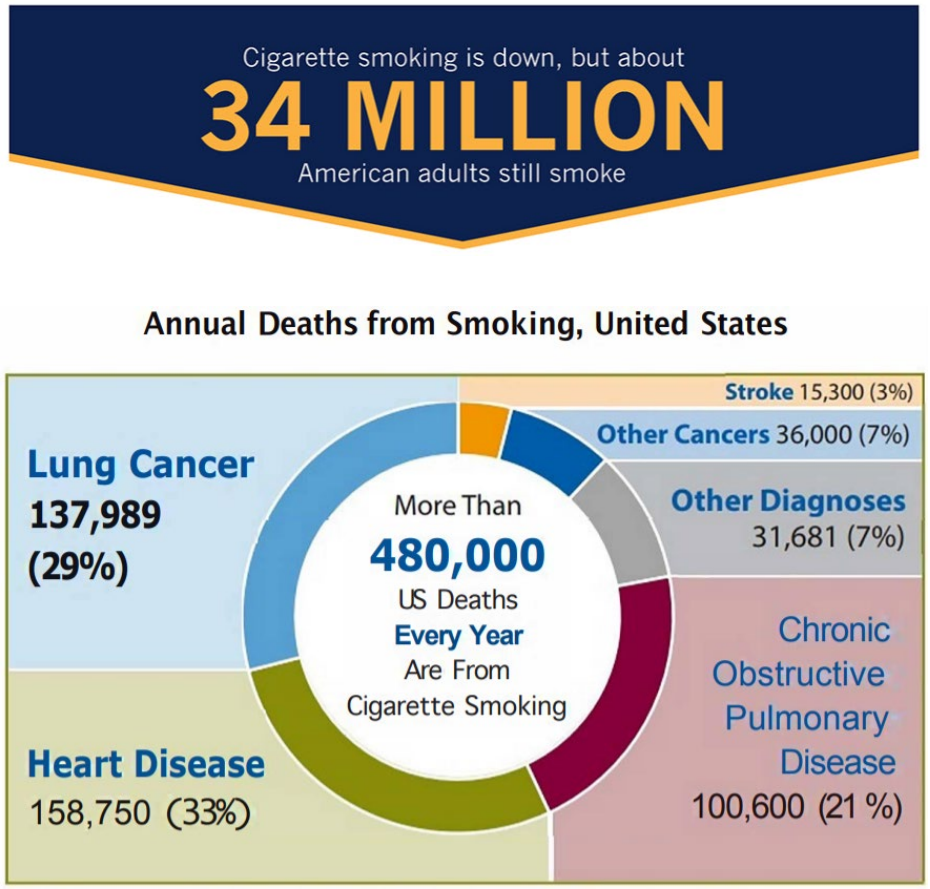


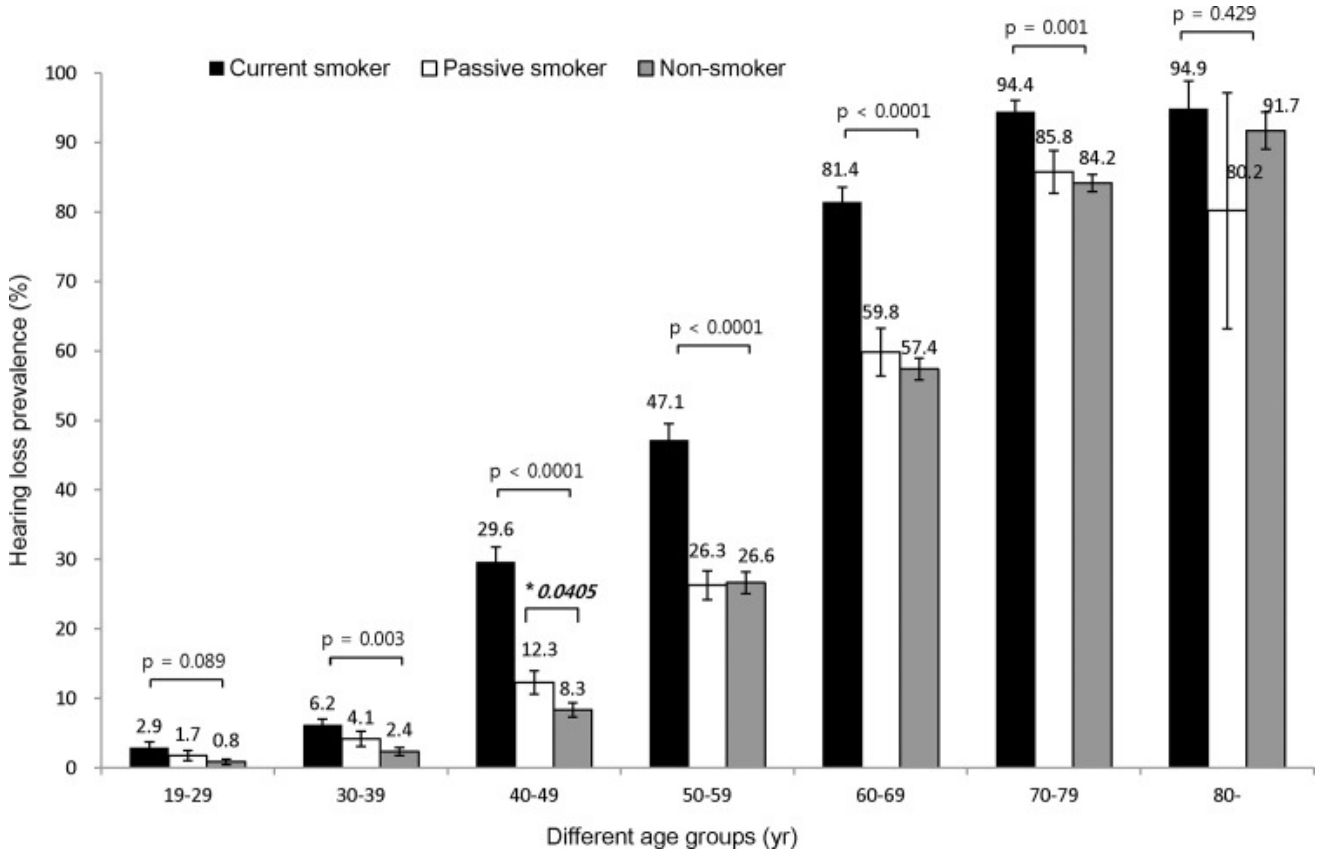
Connection between Sleep Apnea and Hearing loss

- 31% increased risk of HF HL
- 38% increased risk of any HL
- 90% increased risk of LF HL

Source: American College of Cardiology, Chopra et al., 2014

Smoking

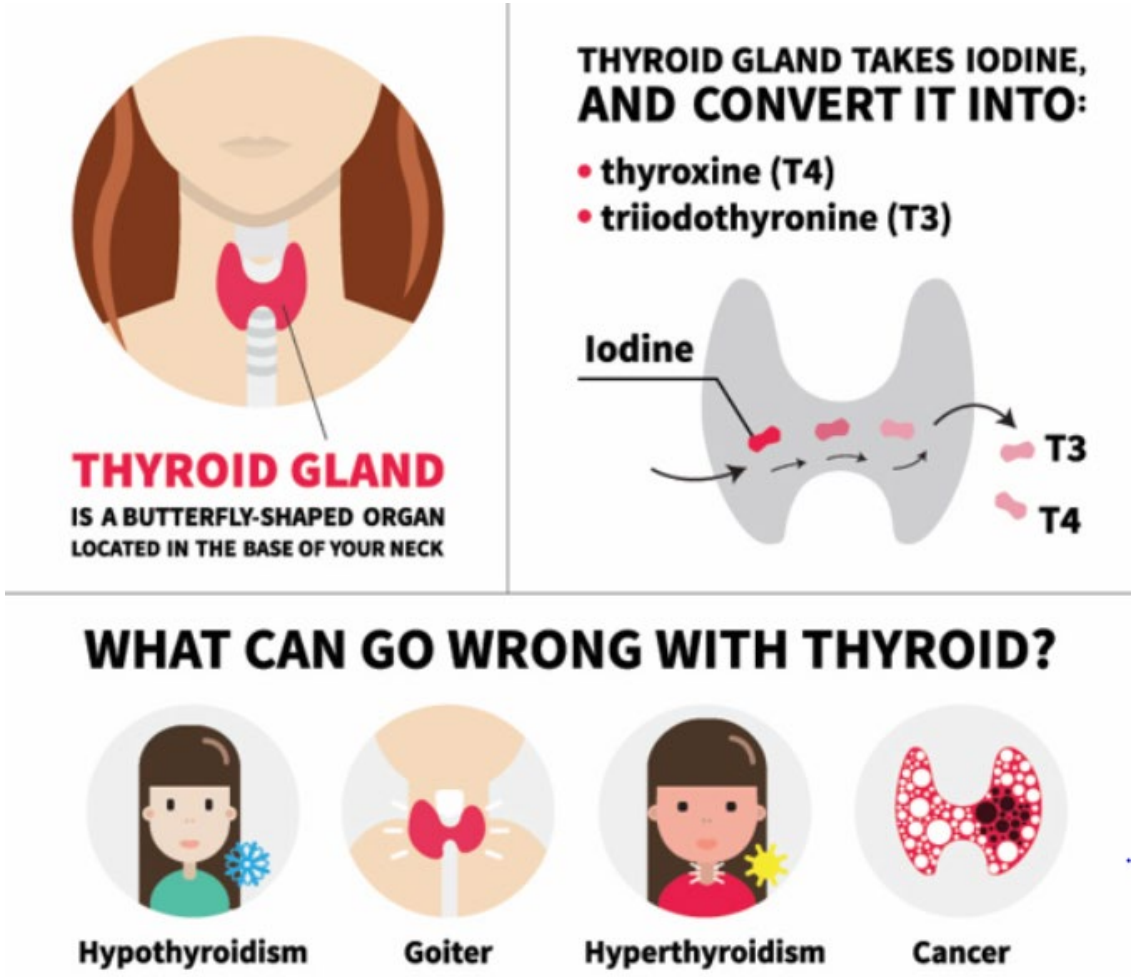




Prevalence of bilateral HF HL

Source: CDC, Chang et al, (2016)

Thyroid Disease



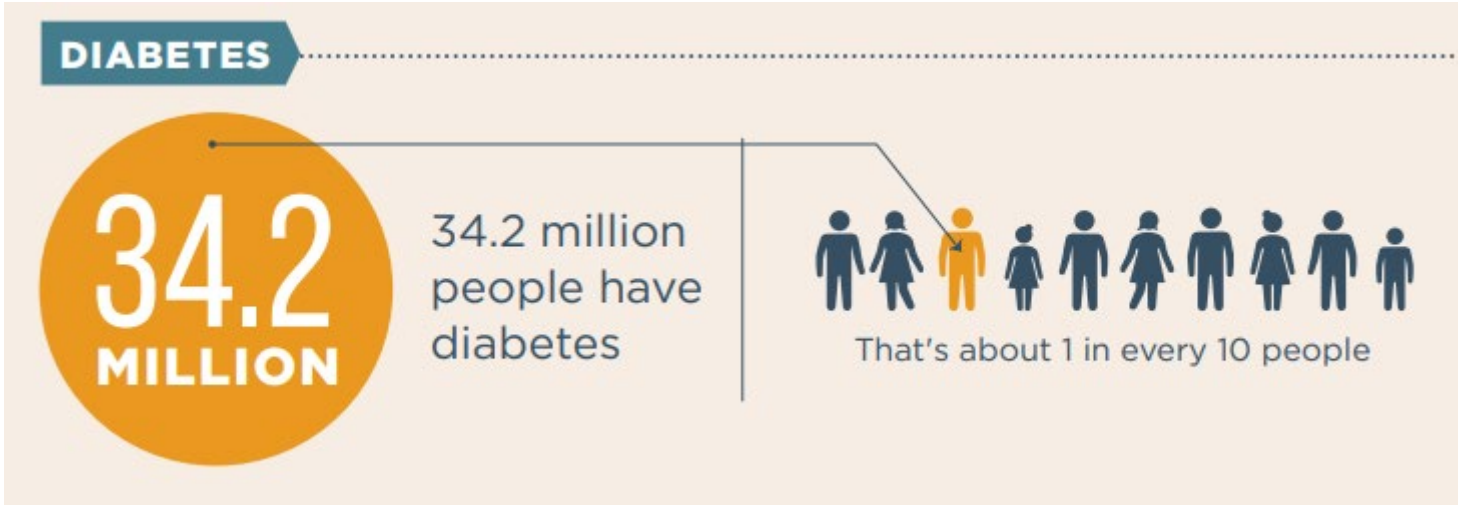
Hypothyroidism

- Iodine is essential for thyroid function
  - Thyroid hormone needed for auditory system maturation
- HL is more than twice as high for those with low iodine levels (ped)

Hyperthyroidism

- Propylthiouracil (Rx)
  - Cytoplasmic antibody-associated small-vessel vasculitis

Source: St. Clair Hospital, Sano et al (2014), Scinicariello and Buser (2018)



Hearing loss is twice as common in adults with diabetes compared to those who do not have the disease

Source: NIH (2008), Bainbridge et al., 2008

GN Making Life Sound Better

Ototoxicity

>200

OTC and Rx Meds

Common examples:

- Salicylates – Aspirin
- Antibiotics - Aminoglycosides,
- Loop Diuretics - Lasix, Edecrin, Bumex
- Chemotherapeutic Agents - Cisplatin, Nitrogen Mustard, Vincristine
- Nonsteroidal Anti-inflammatory Drugs (NSAIDS) - Advil, Aleve, Motrin

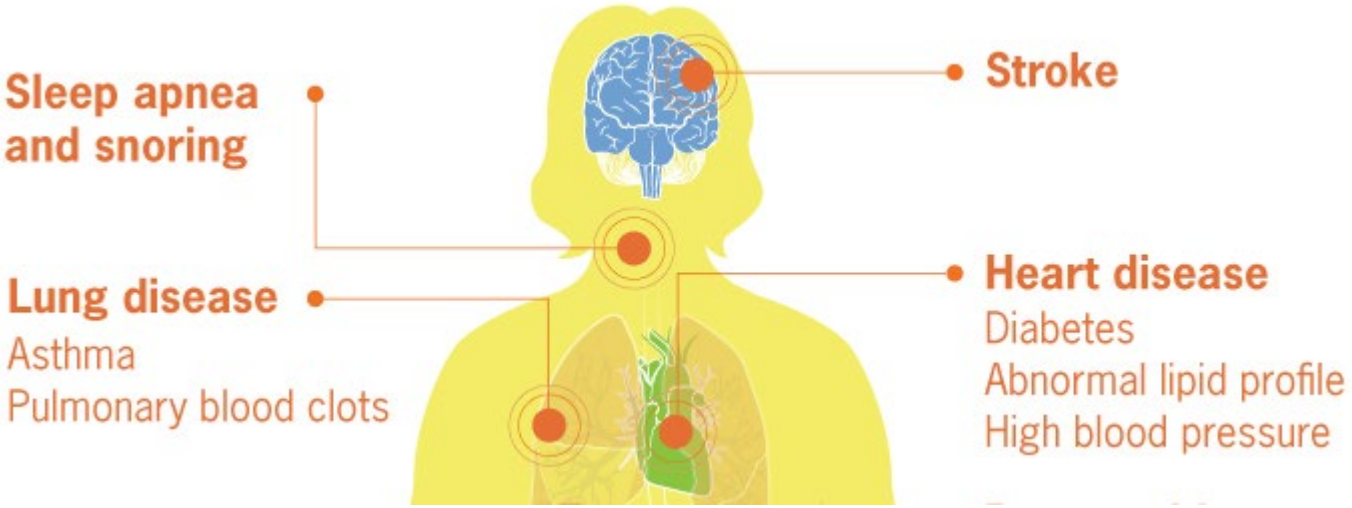
Chronic Kidney Disease

18%

Source: NIH NIDCD (2018), NCOA (2017)

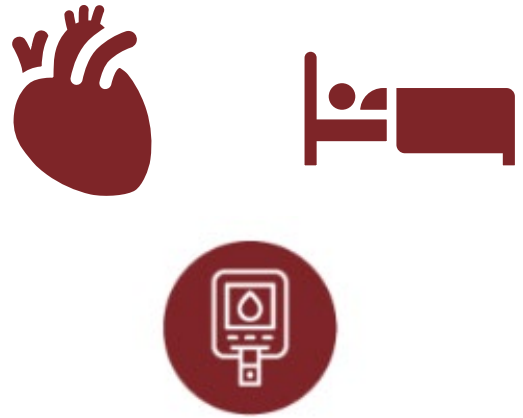
Obesity

Increased incidence of



Connection with Hearing loss

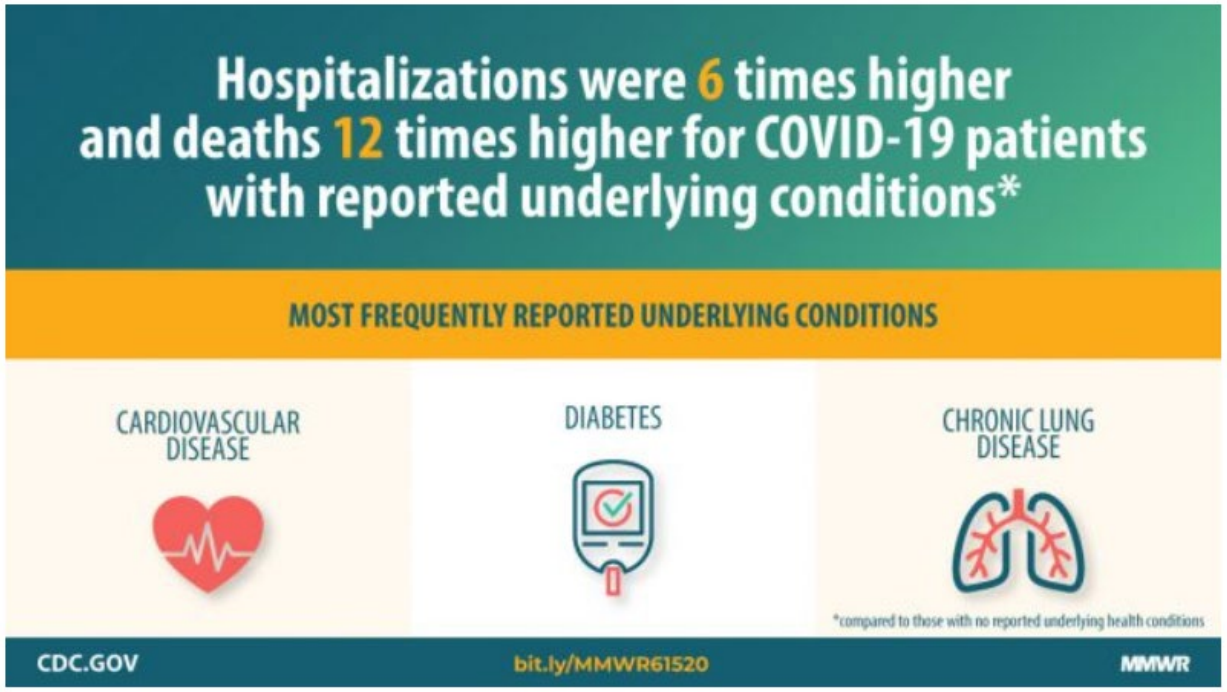
- 21.5% rate of SNHL
  - 13.44% in non-obese
- 1.73-fold increase in odds of SNHL



Source: CDC, Kohnberg et al., 2018

Covid-19 (Coronavirus)

- Reduced TEOAE and HF hearing (Mustafa, 2020; Karimi-Galougahi et al., 2020)
- Some balance symptoms noted (Karimi-Galougahi et al., 2020)
- Possible impact
  - Viral infection – impact on hair cell function
  - Hypoxia – respiratory illness
  - Ototoxic medication (Ciorba et al., 2020)
    - azithromycin, favipiravir, remdesivir, lopinavir, and hydroxychloroquine



Source: Stokes et al., 2020; CDC.gov; Mustafa, 2020; Karimi-Galougahi et al., 2020; Ciorba et al., 2020

Hearing loss impact on health

- Irritability, negativism and anger
- Fatigue, tension, stress, and depression
- Avoidance or withdrawal from social situations
- Social rejection and loneliness
- Reduced alertness and increased risk to personal safety
- Reduced job performance and earning power
- Diminished psychological and overall health

Source: Kochkin, 2007, 2011

MarkeTrak 10 (Harvey, 2020)

Those with hearing difficulty are 3.5+ times more likely to have each of the conditions below.

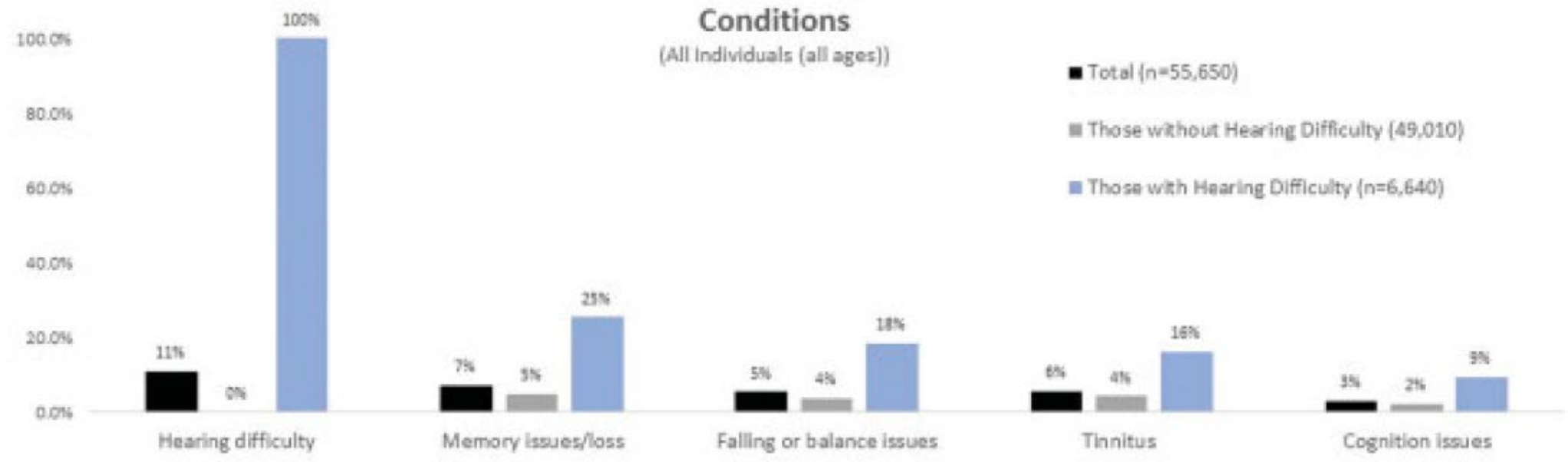
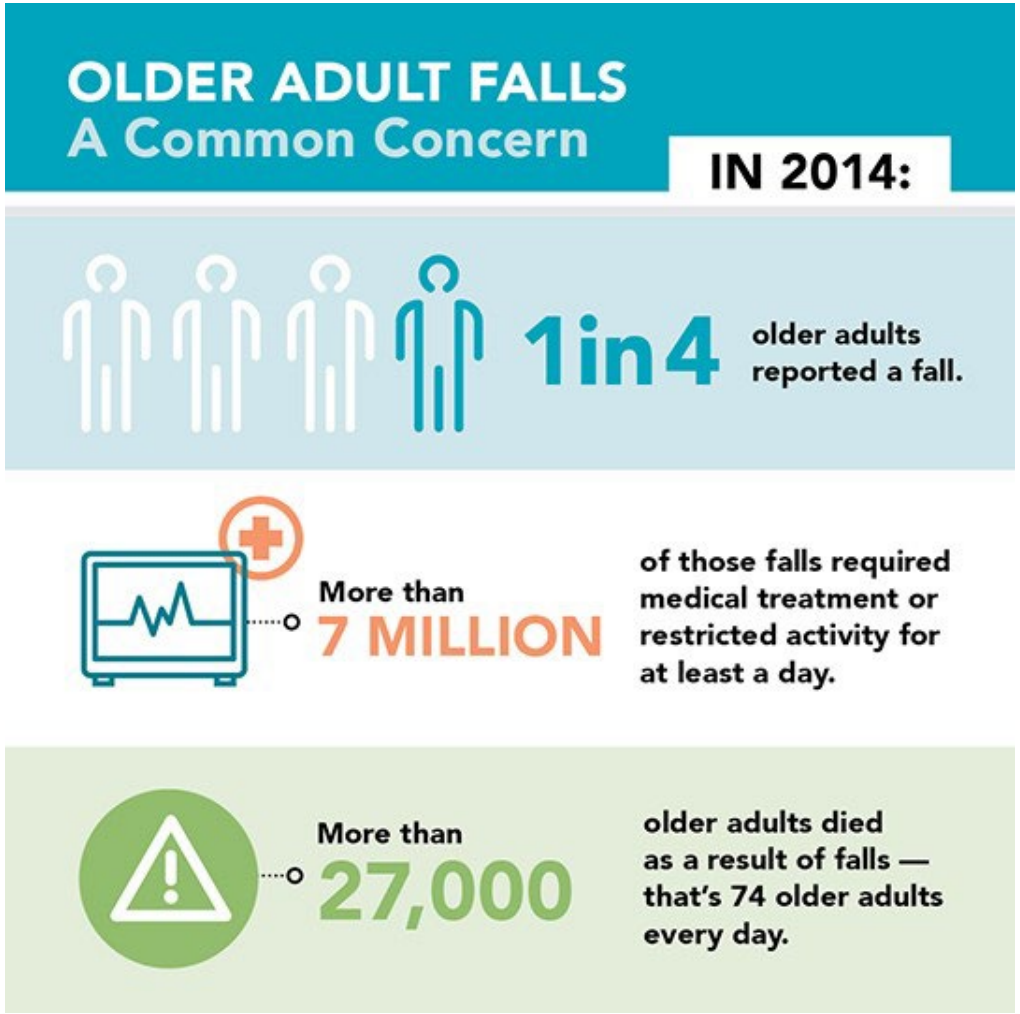


Figure 4 Those with hearing difficulty are 3.5+ times more likely to have each of the conditions listed within the graph.

Falls



- People with a 25-decibel hearing loss, classified as mild, were nearly 3X more likely to have a history of falling
- Every additional 10-decibels of hearing loss increased the chances of falling by 1.4-fold

Source: CDC, Lin et al., 2012

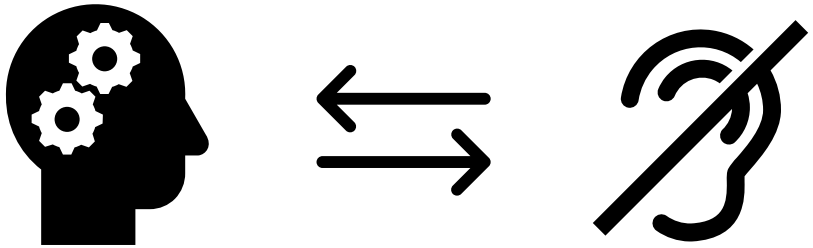
Health care burden and Hospitalizations

Uncorrected hearing loss may raise the risk of mental and physical health problems and leads to higher hospitalization rates and health care costs.

- Analysis of health data from more than 150,000 people 50 and older reporting age-related hearing loss and no evidence of hearing aid use
- Untreated hearing loss is associated with a greater risk of
  - Depression (41% greater risk over 10 years)
  - Dementia (52% greater risk over 10 years)
  - Heart attack
  - Falls (30% greater risk over 10 years).
- 50% more hospital stays, and a 44% higher risk of being readmitted to the hospital within 30 days (over a 10-year period)

JAMA (Reed et al., 2018)

Cognition and hearing loss



Dementia Epidemiology – Worldwide*

- 35.6 million estimated 2010 (24.2M 2001; 4.6M new cases/yr)
  - 46% Asia
  - 30% Europe
  - 12% North America
- Doubling ~ every 20 years
  - 65.7M 2030; 115.4M 2050
- Majority (57.7%) live in low- and middle-income countries
  - 40% increase Europe over next 20 yrs
  - 63% ↑ North America
  - 77% ↑ southern Latin America; 134-146% rest of Latin America
  - 89% ↑ Asia Pacific; 117% East Asia; 107% South Asia
  - 125% ↑ North Africa and Middle East
- $315 B (2005 US $) costs for dementia care/yr worldwide

* Alzheimer's Disease International World Report, 2009 www.alz.co.uk/worldreport ; Ferri et al., 2005; Wimo et al., 2003

Slide courtesy of Angela C. Roberts, PhD

All-Cause Dementia – NIA and AA (McKhann et al., 2011)

➢Revised version of NINCDS-ADRDA (McKhann, et al. 1984; Sensitivity 81%, Specificity 70%)

Cognitive or behavioural (neuropsychiatric) symptoms that:

1. Interfere with ability to function at work or usual activities
2. Represent a decline from previous levels of functioning and performing
3. Are not explained by delirium or major psychiatric disorder
4. Cognitive impairment detected and diagnosed through:
   a. History from client and knowledgeable informant
   b. Objective cognitive assessment (mental status or neuropsychological testing)

Slide courtesy of Angela C. Roberts, PhD

All-Cause Dementia – NIA and AA (McKhann et al., 2011)

5. Cognitive or behavioural impairment involves a minimum of two of the following.

➢Impaired:

a. ability to acquire and to remember new information (e.g., repetitive questions or conversations, misplacing personal items, forgetting events or appointments, etc.)

b. reasoning and handling of complex tasks (e.g., poor understanding of safety risks, poor-decision making, inability to manage finances, etc.)

c. visuospatial abilities (i.e., agnosia and apraxia) (e.g., inability to recognize faces, common objects, or environment; inability to operate simple implements or orient clothing to body

Slide courtesy of Angela C. Roberts, PhD

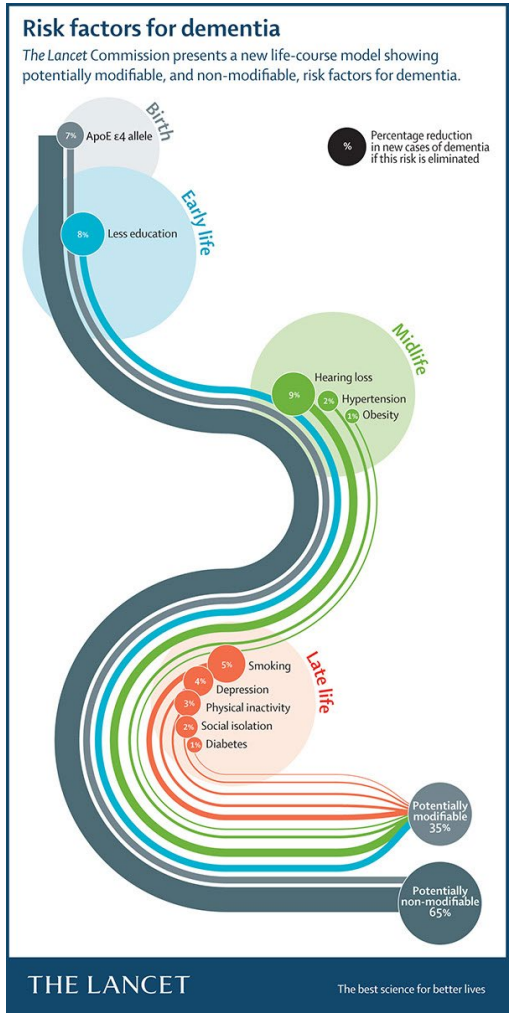
All-Cause Dementia – NIA and AA (McKhann et al., 2011)

d. Impaired language functions (e.g., speaking, reading, writing difficulty thinking of common words while speaking, hesitations; speech, spelling and writing errors)

e. Changes in personality, behaviour or comportment (e.g., uncharacteristic mood fluctuations – agitation, impaired motivation and initiative, apathy, loss of drive, social withdrawal, decreased interest in previous activities, loss of empathy, compulsive or obsessive behaviours, socially unacceptable behaviours)

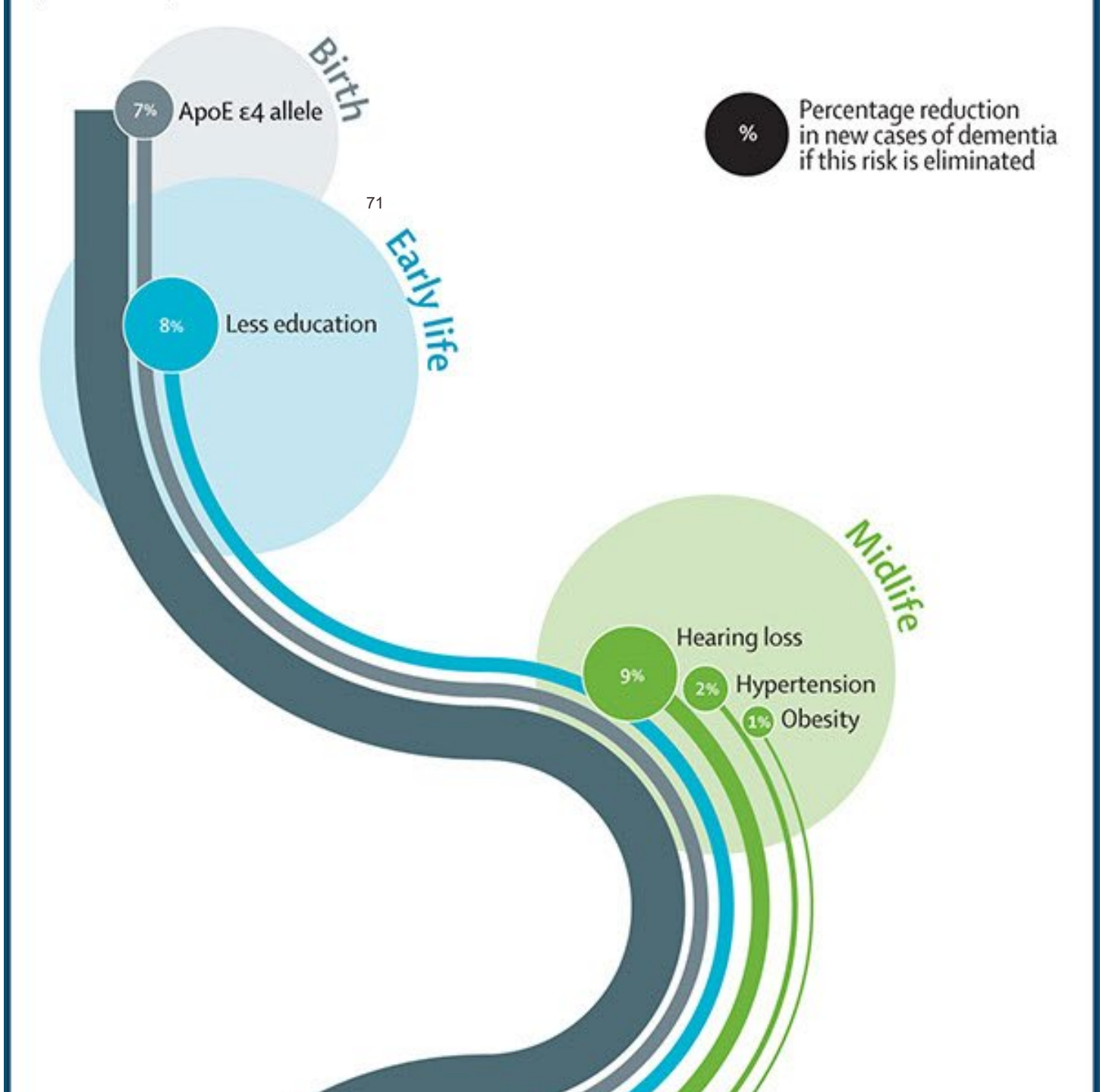
Slide courtesy of Angela C. Roberts, PhD

35% of Risk Factors for Dementia are Modifiable



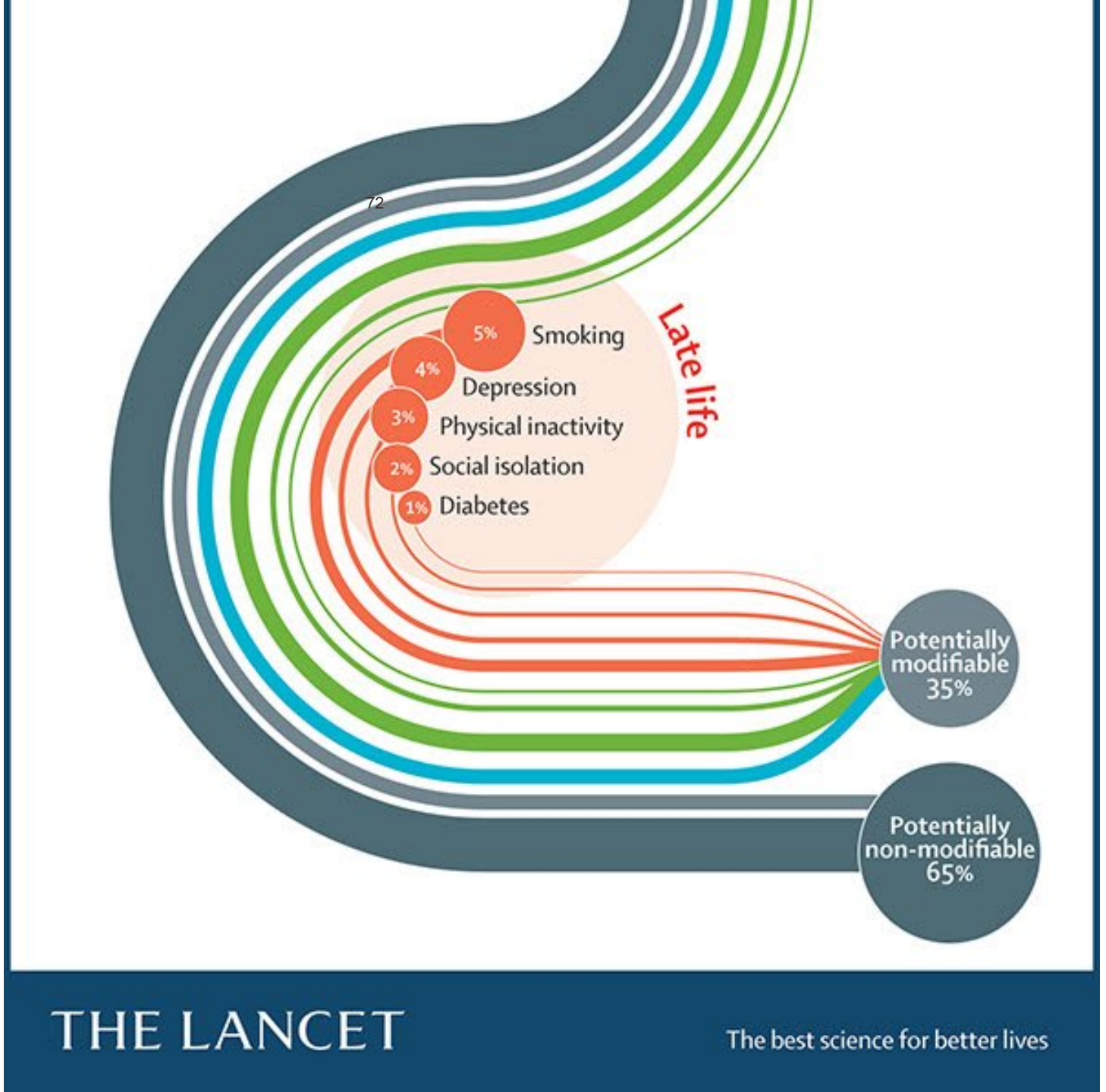
Source: Lancet, 2017

Birth, Early life, Midlife

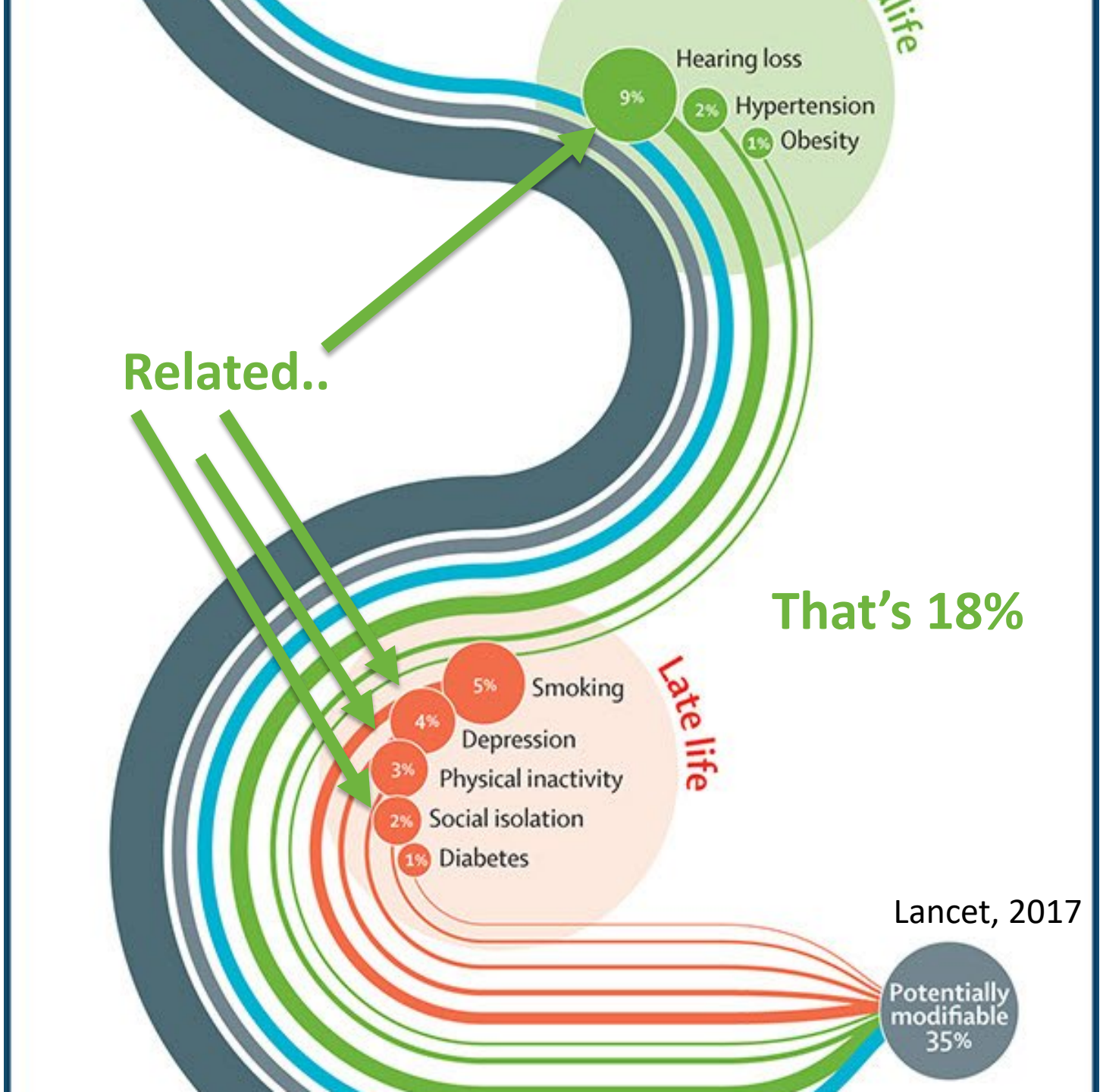


Source: Lancet, 2017

Later in life



Source: Lancet, 2017



Lancet, 2017

Source: Lancet, 2017

Relationship between Hearing Loss and Cognitive Decline

Greater cognitive decline in individuals with Alzheimer's who had HI at baseline compared with individuals with AD and NH (Uhlmann et al., 1986)

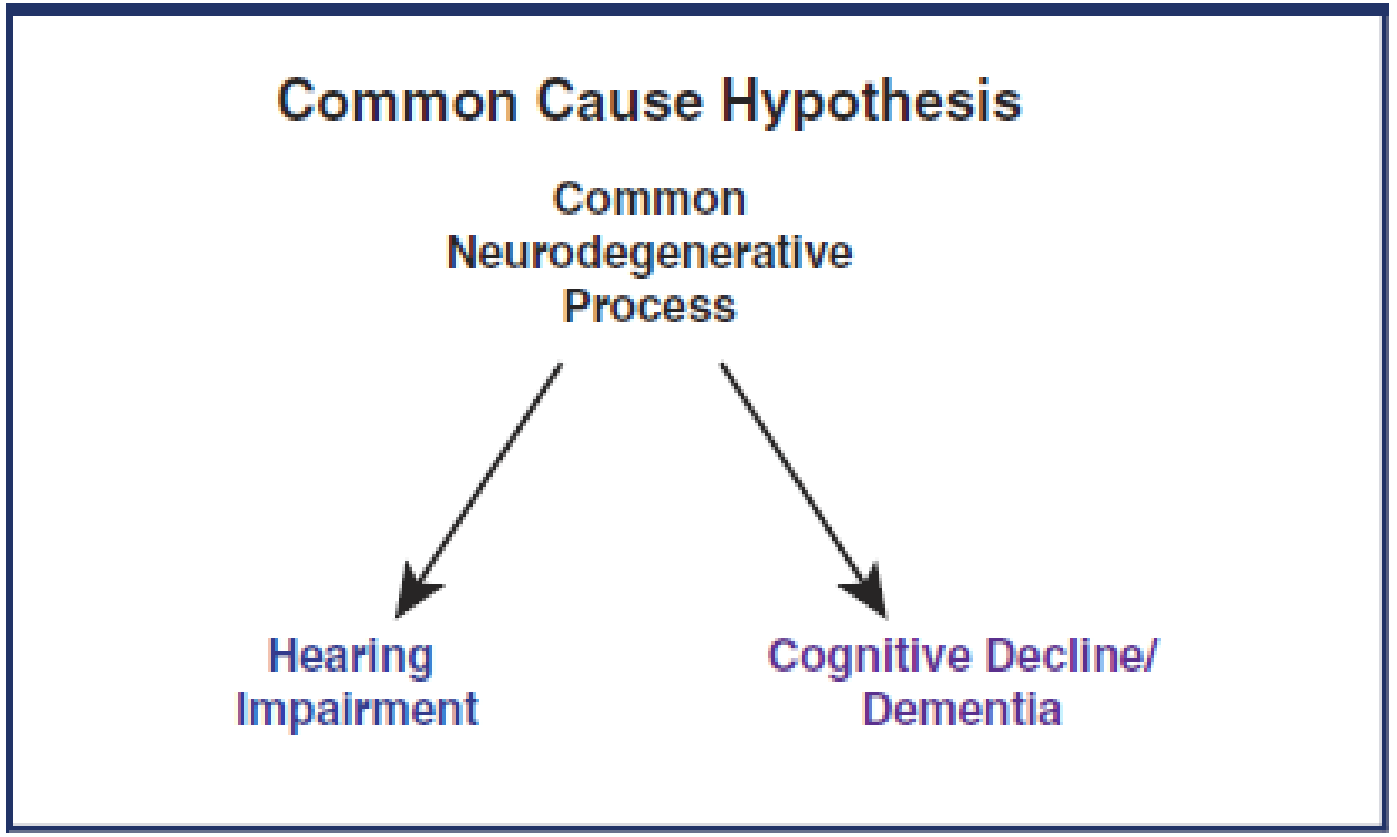
Correlation between the amount of hearing loss and the severity of cognitive impairment

Every additional 10 dB of hearing loss over a 25 dB hearing loss, 20% increase in risk of developing dementia (Lin et al., 2011)

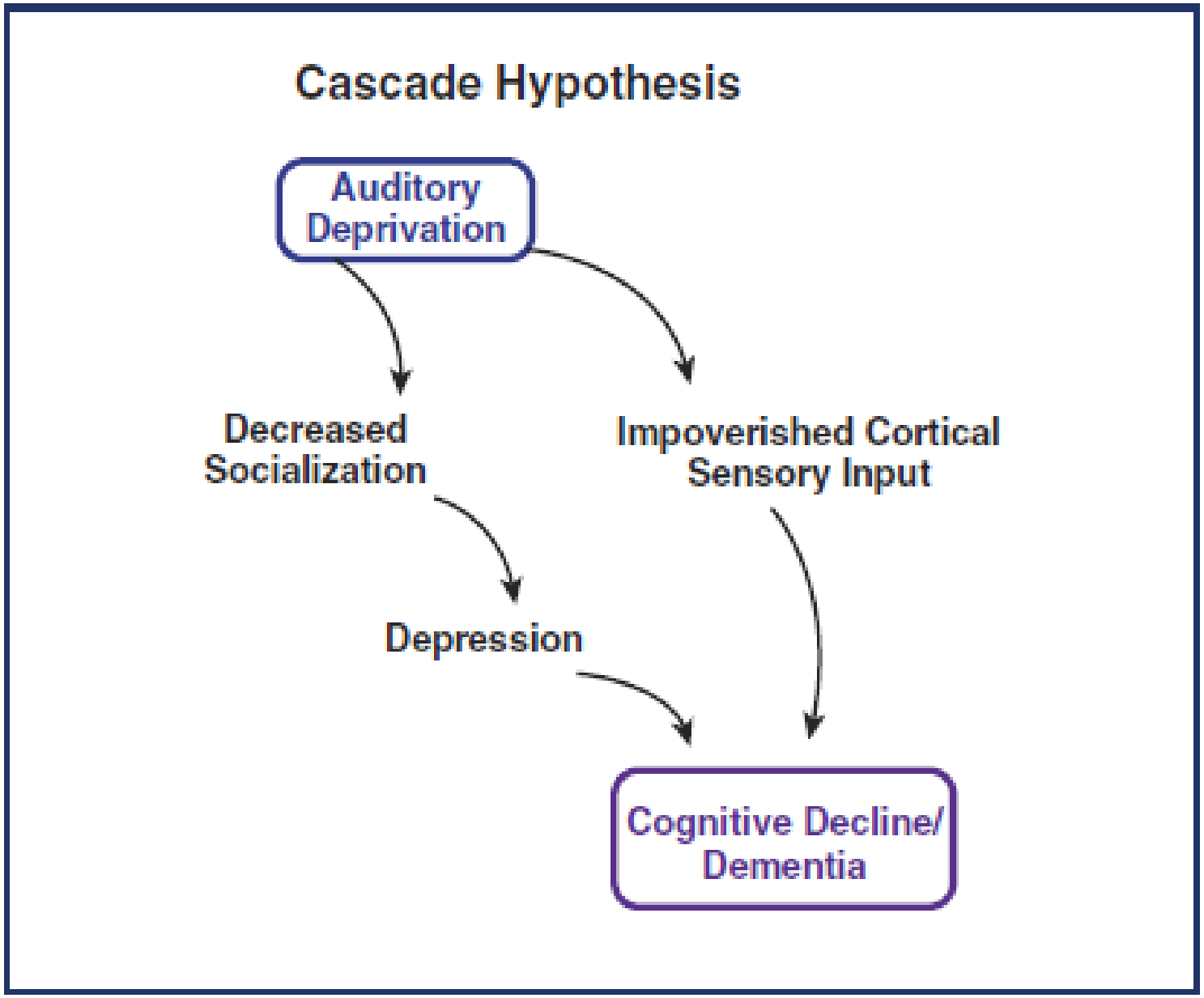
Pichora-Fuller et al.,2013

How are hearing and cognition decline related?

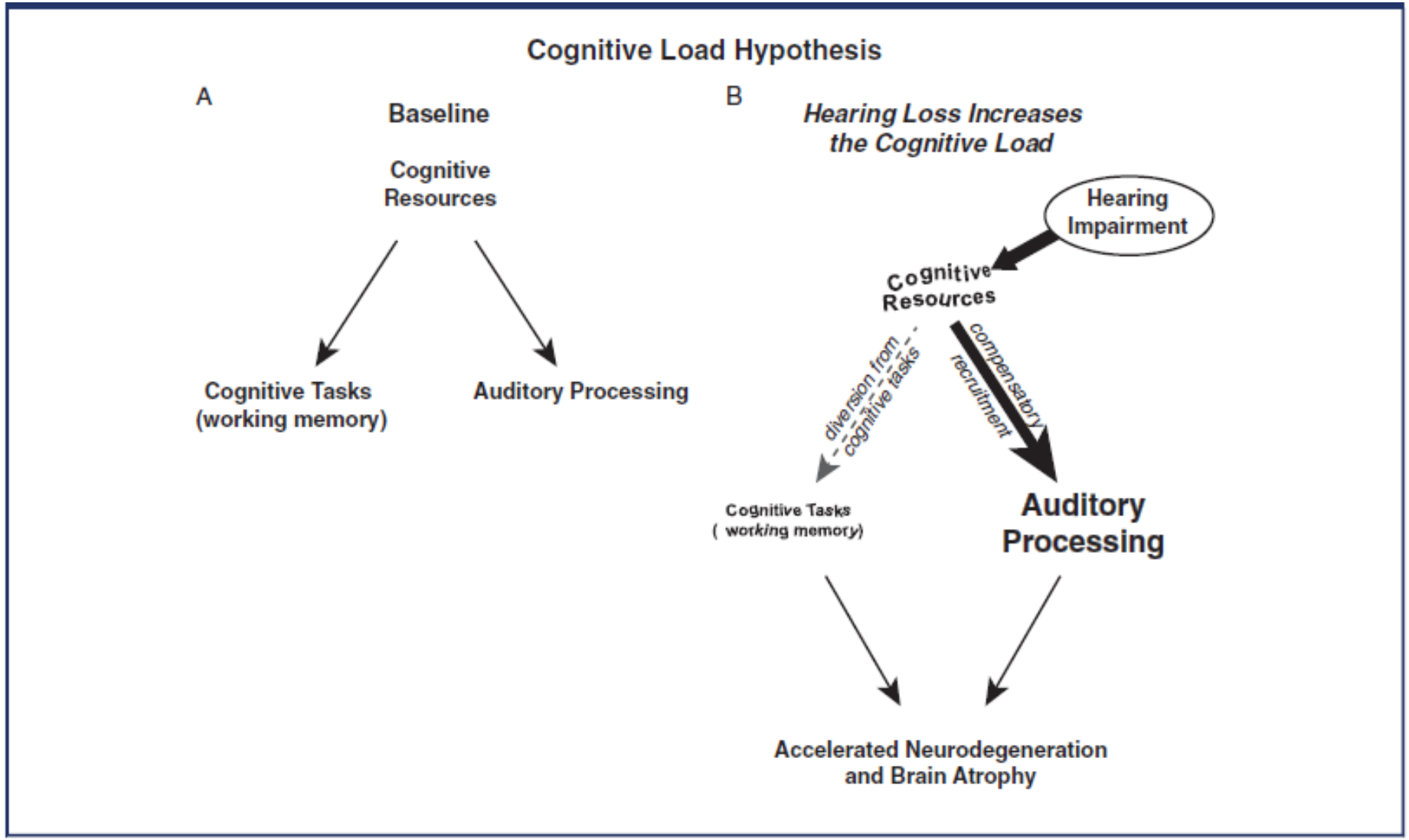
No definitive answers yet, but possible theories are…


Common Cause Hypothesis
Common Neurodegenerative Process
Hearing Impairment
Cognitive Decline/ Dementia

Stahl, 2017

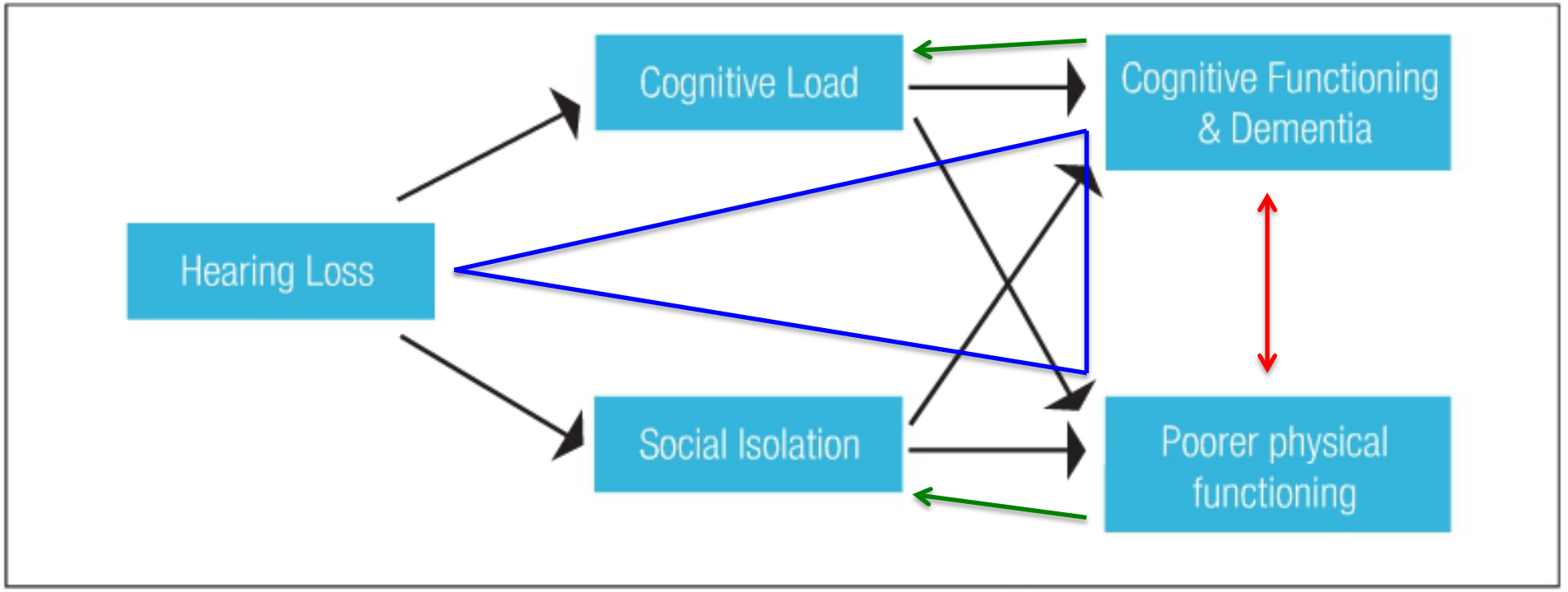

Cascade Hypothesis
Auditory Deprivation
Decreased Socialization
Impoverished Cortical Sensory Input
Depression
Cognitive Decline/ Dementia

Stahl, 2017


Cognitive Load Hypothesis
A
Baseline
Cognitive Resources
Cognitive Tasks (working memory)
Auditory Processing
B
Hearing Loss Increases the Cognitive Load
Hearing Impairment
Cognitive Resources
diversion from cognitive tasks
compensatory recruitment
Cognitive Tasks (working memory)
Auditory Processing
Accelerated Neurodegeneration and Brain Atrophy

Stahl, 2017

Listening effort, hearing loss, and cognitive decline



Conceptual model of hearing loss with cognitive and physical functioning in older adults.

Adapted: The Hearing Review International, Spring 2013

Hospitalizations

Table 2. Unadjusted Data of Nationally Representative Health Care Costs and Use Outcomes Among Older People With Self-reported Hearing Loss[a]

Patient Characteristic	Total	Hearing Aids		Difference (95% CI)
		Without	With	
No. of patients	1336	734	602	
Total cost, mean (SD), $				
Health care	12 839 (20 478)	12 254 (20 254)	13 435 (20 082)	1181 (−1247 to 3609)
Out of pocket	1727 (4448)	1463 (4792)	1997 (4098)	534 (94 to 973)[b]
Medicare	8293 (169 50)	8269 (17 000)	8317 (16 793)	48 (−1928 to 2024)
Any hospitalization, % (95% CI)	21 (19 to 24)	21 (17 to 24)	22 (18 to 26)	1 (−4 to 6)
Any ED visits, % (95% CI)	26 (23 to 29)	26 (22 to 31)	25 (21 to 30)	−1 (−7 to 4)
Any office visits, % (95% CI)	95 (93 to 96)	93 (90 to 95)	98 (95 to 99)	5 (2 to 7)[b]
Health care intervention, No. (SD)				
Hospitalization	1.60 (7.00)	1.80 (8.85)	1.39 (4.82)	−0.41 (−1.16 to 0.34)
ED visits	0.45 (1.21)	0.47 (1.35)	0.42 (1.07)	−0.05 (−0.18 to 0.08)
Office visits	14 (17.61)	13 (19.20)	15 (15.86)	2.71 (0.86 to 4.57)[b]

Abbreviation: ED, emergency department.

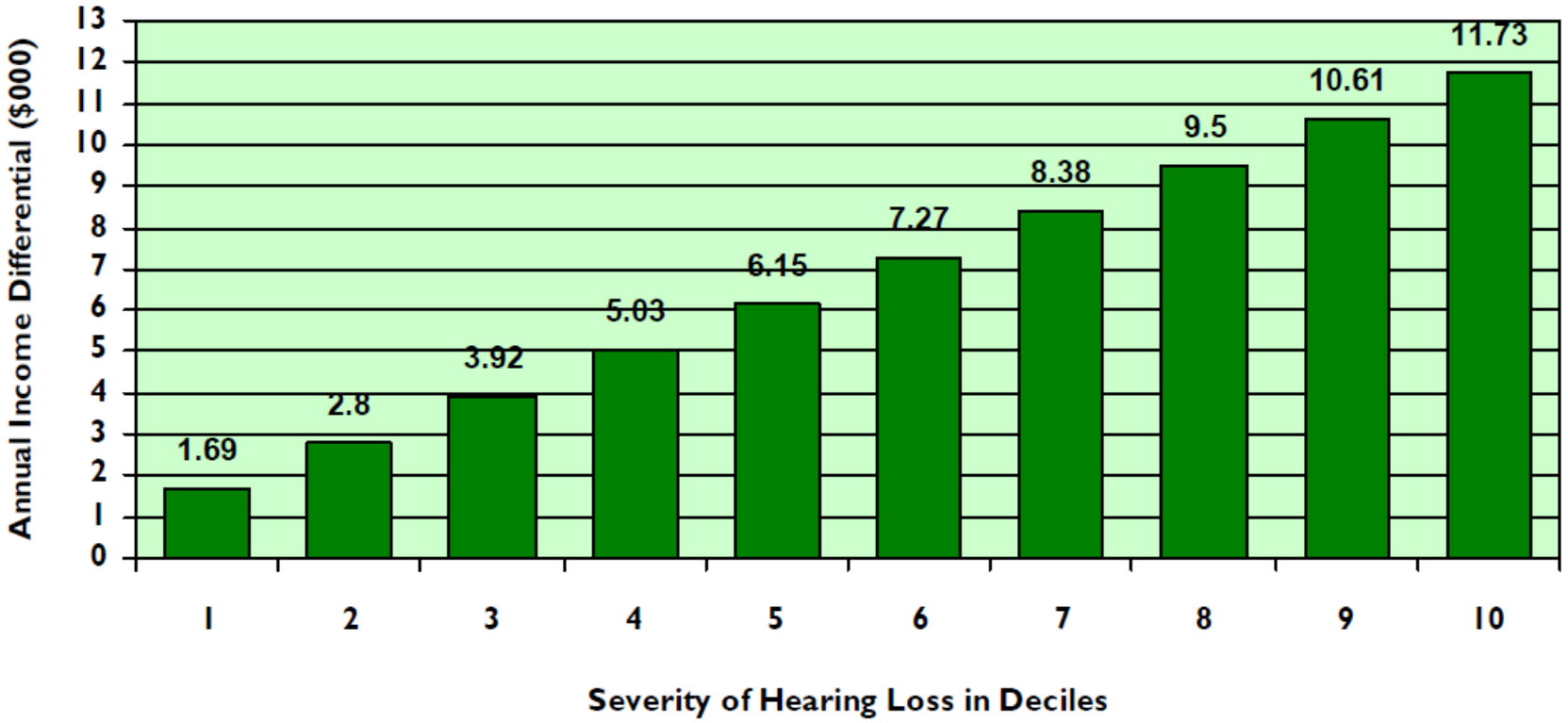
[a] Source: The 2013-2014 Medical Expenditure Panel Survey, Household Component Files.[22]

[b] Significant at α = .05.

Source: Mahmoudi et al., 2018

Income

Figure 3. Household income differential - aided versus unaided by severity of hearing loss (linear model)



Source: Better Hearing Institute, Kochkin, 2005

GN Making Life Sound Better FOR 150 YEARS

MarkeTrak 10 (Harvey, 2020)

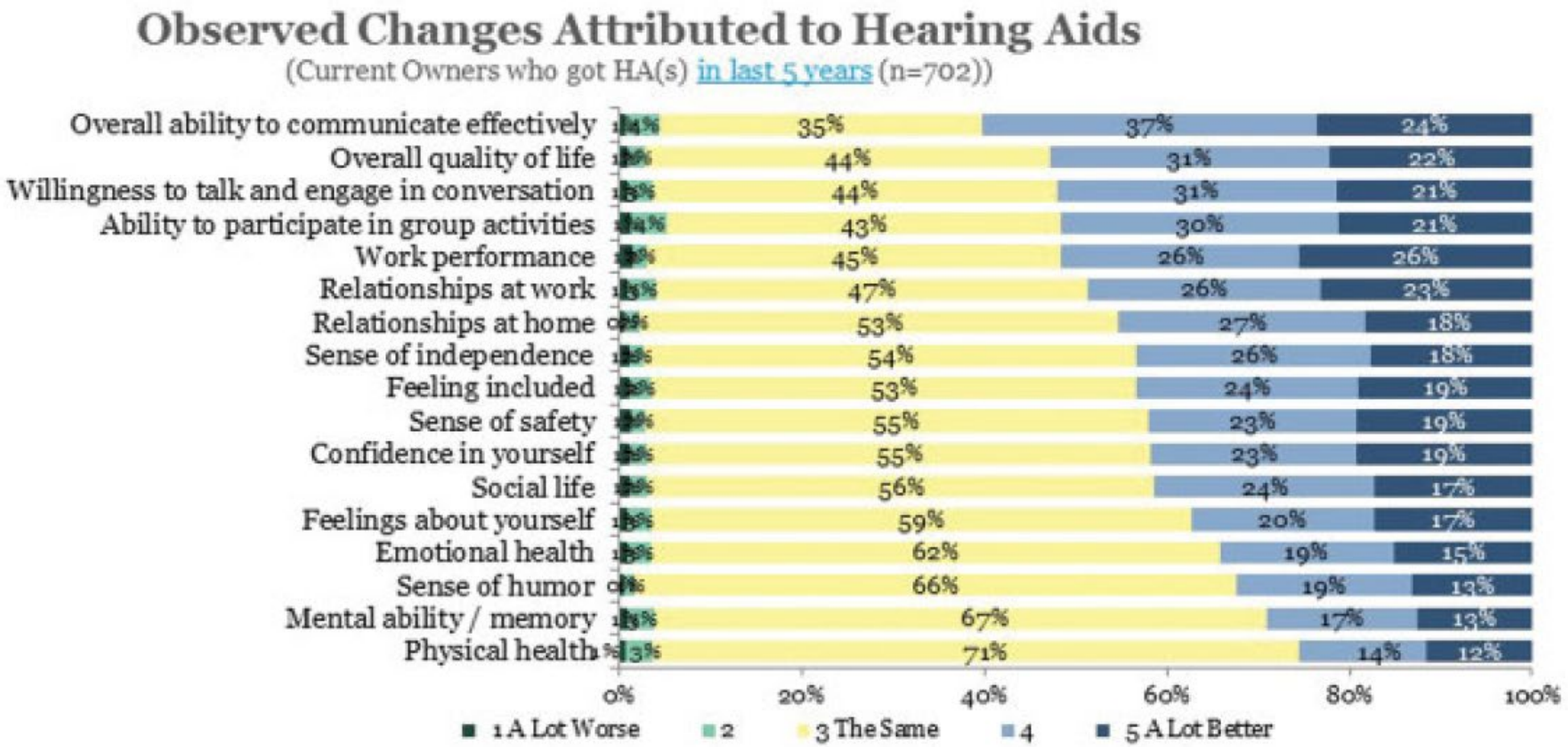


Figure 6 Observed changes attributed to hearing aids.

MarkeTrak 10 (Harvey, 2020)

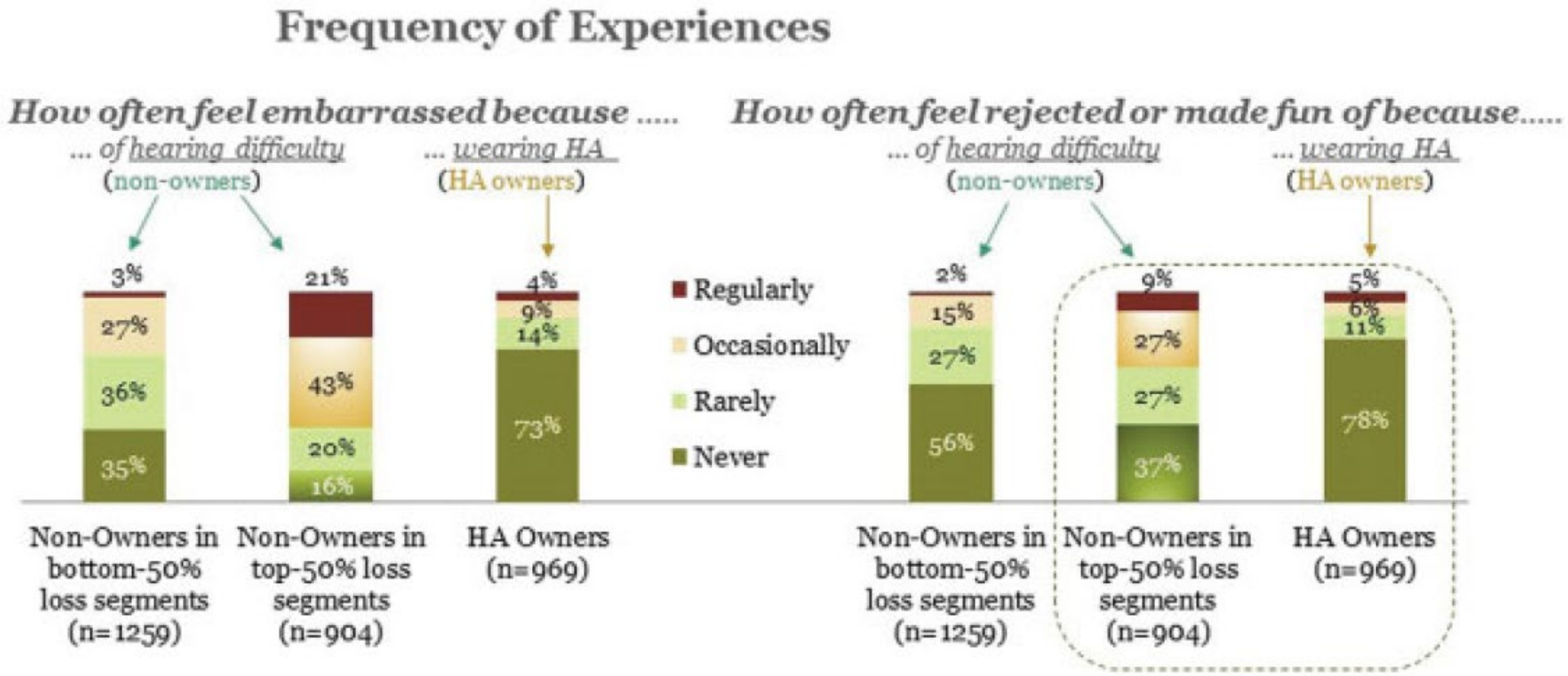


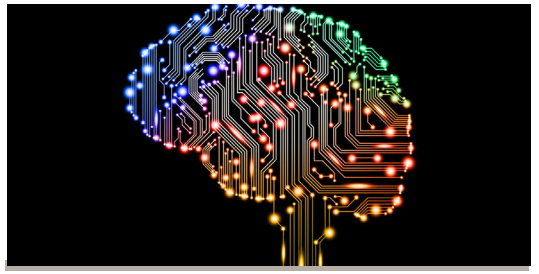
Figure 3 Frequency of experiences.

Topics

1 OTC

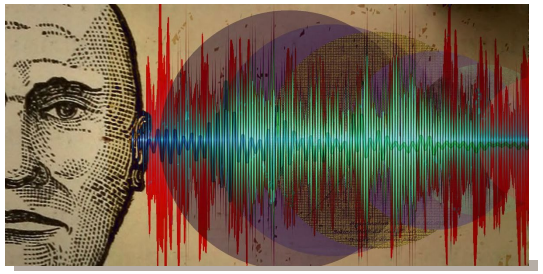
2 Convergence of CE and Hearing Aids

3 Connectivity

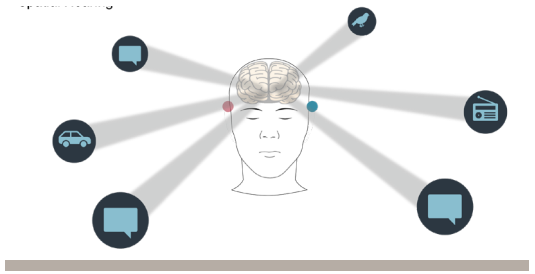


4 AI

5 Environmental Classification



6 Hearing in Noise



7 Spatial Perception

8 Health