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Ring! Buzz! Chirp!

Part 1: The Basics of Tinnitus

Starkey Education & Training

Sejal Kuvadia, AuD

Sejal Kuvadia joined the Education and Training department of Starkey Hearing Technologies in August 2015. Her duties include leading training classes for customers on Starkey products and software and assisting with online courses. Sejal received her B.S. from Purdue University and her AuD at Rush University in Chicago, IL. Prior to joining Starkey, Sejal worked for a private practice in the Chicago area.

Learning Outcomes

- After this course, participants will be able to identify the signs and symptoms of tinnitus.
- After this course, participants will be able to explain how to evaluate tinnitus and the handicap caused by the tinnitus.
- After this course, participants will be able to discuss treatment options for tinnitus.

POLL

How many people have people have experienced in the US?

a) **10 Million**
b) **20 Million**
c) **50 Million**
d) **300 Million**

50 Million

have experienced tinnitus

Hearing Health Foundation 2017

1 in 12 adolescents

have experienced tinnitus

Hearing Health Foundation 2017

1 in 10 adults

have experienced tinnitus

Hearing Health Foundation 2017

20 Million

seek medical attention

Data from the 1999-2004 National Health and Nutrition Examination Survey, conducted by the Centers for Disease Control and Prevention

2 Million

debilitated by tinnitus

Data from the 1999-2004 National Health and Nutrition Examination Survey, conducted by the Centers for Disease Control and Prevention

CONTENT WARNING

9% of women

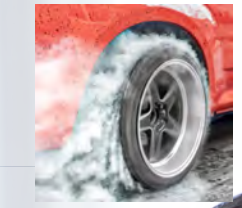
and

5.5% of men

with severe tinnitus
attempted suicide

JAMA Otolaryngol Head Neck Surg. 2019;145(7):685-687. doi:10.1001/jamaoto.2019.0566

Tinnitus



tin·ni·tus

[*“TIN-it-us”, “tin-NITE-us”*]

“a sensation of noise (such as a ringing or roaring) that is typically caused by a bodily condition (such as a disturbance of the auditory nerve or wax in the ear) and usually is of the subjective form which can only be heard by the one affected”

Classifying Tinnitus

Traditionally classified by whether it could be heard by the clinician

Objective

Subjective

Classifying Tinnitus

Traditionally classified by whether it could be heard by the clinician

Objective

- Audible to another person
- Internal acoustic source
  (Ex. muscle spasms or vascular tumor)
- Detected via human ear, stethoscope, or microphone
- Represents less than 1% of cases

Subjective

Classifying Tinnitus

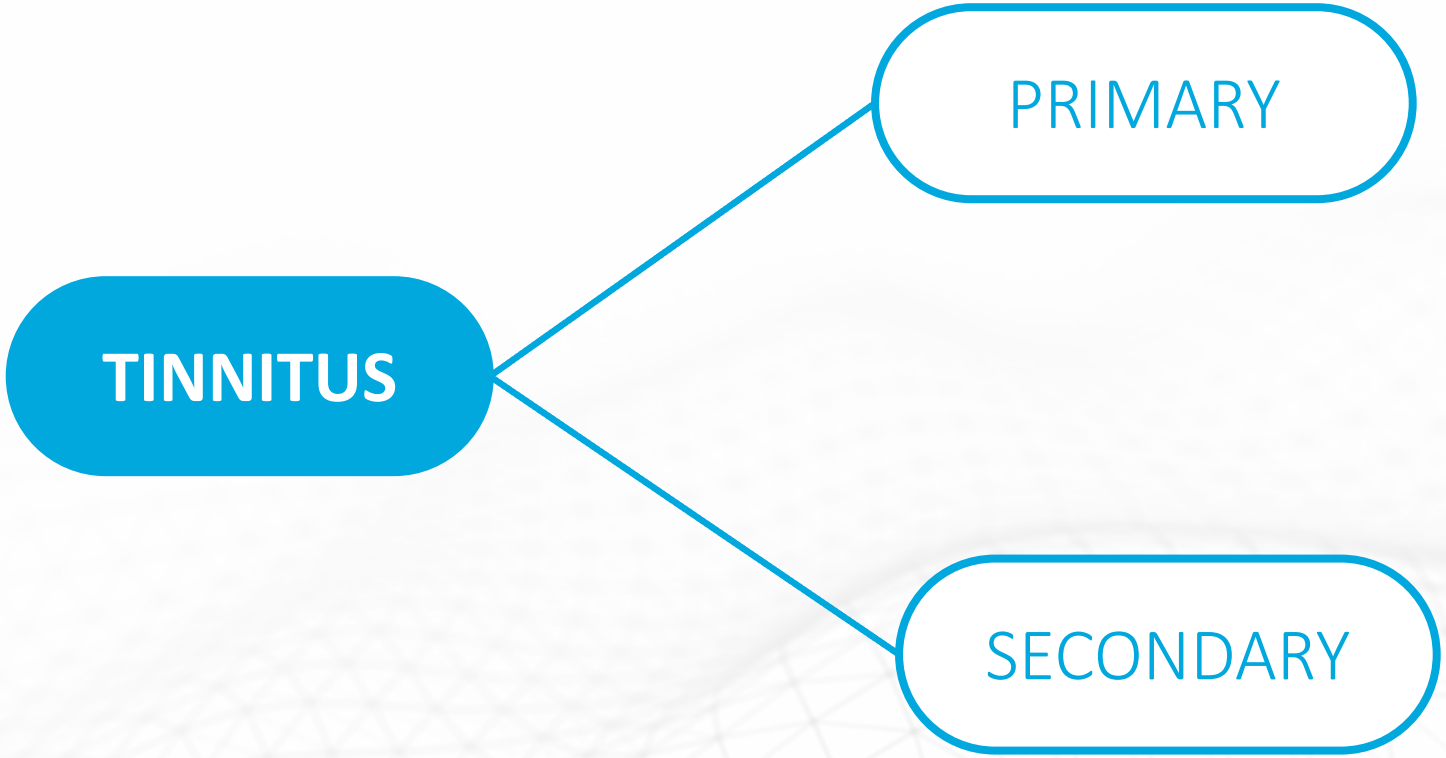
Traditionally classified by whether it could be heard by the clinician

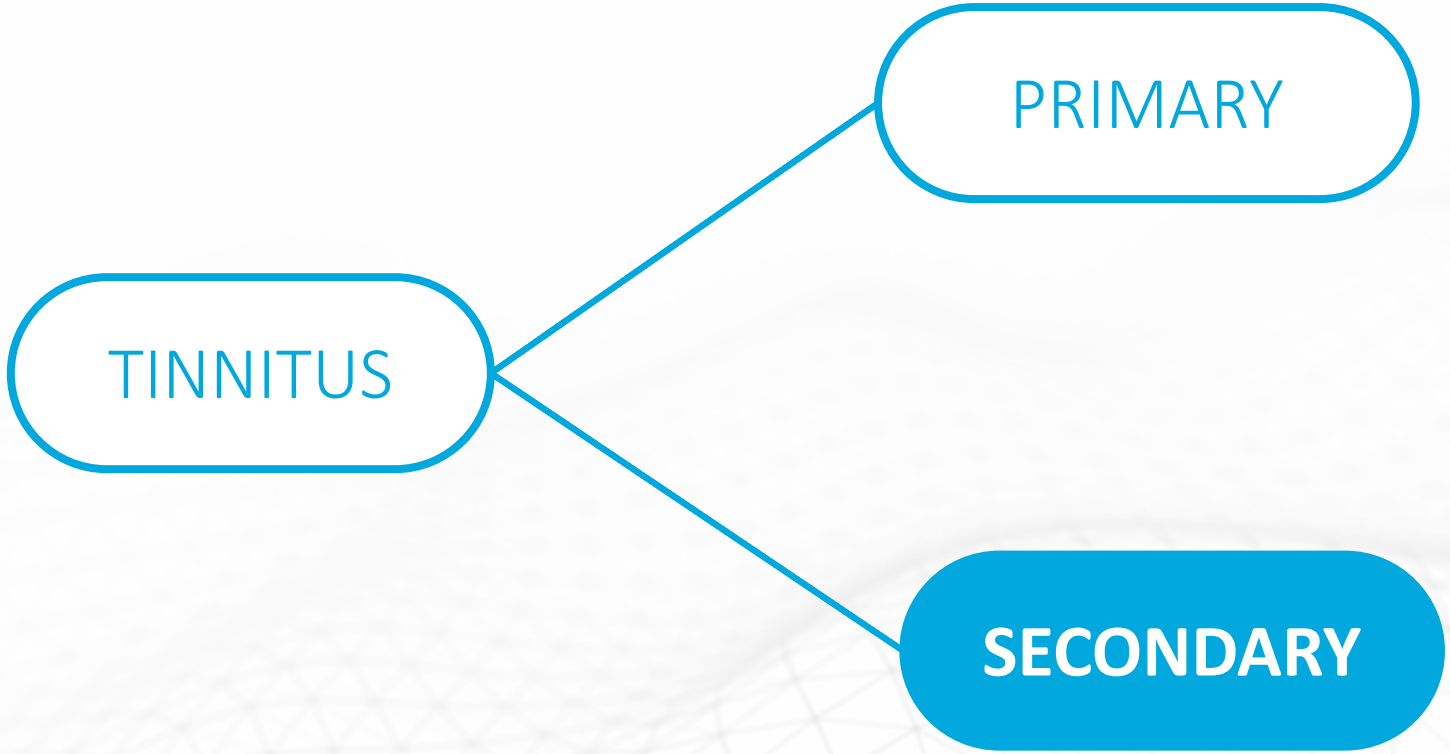
Objective

- Audible to another person
- Internal acoustic source
  (Ex. muscle spasms or vascular tumor)
- Detected via human ear, stethoscope, or microphone
- Represents less than 1% of cases

Subjective

- Only heard by the patient
- May be idiopathic or caused by various disorders involving the head/neck or other systems
- 99% of all cases

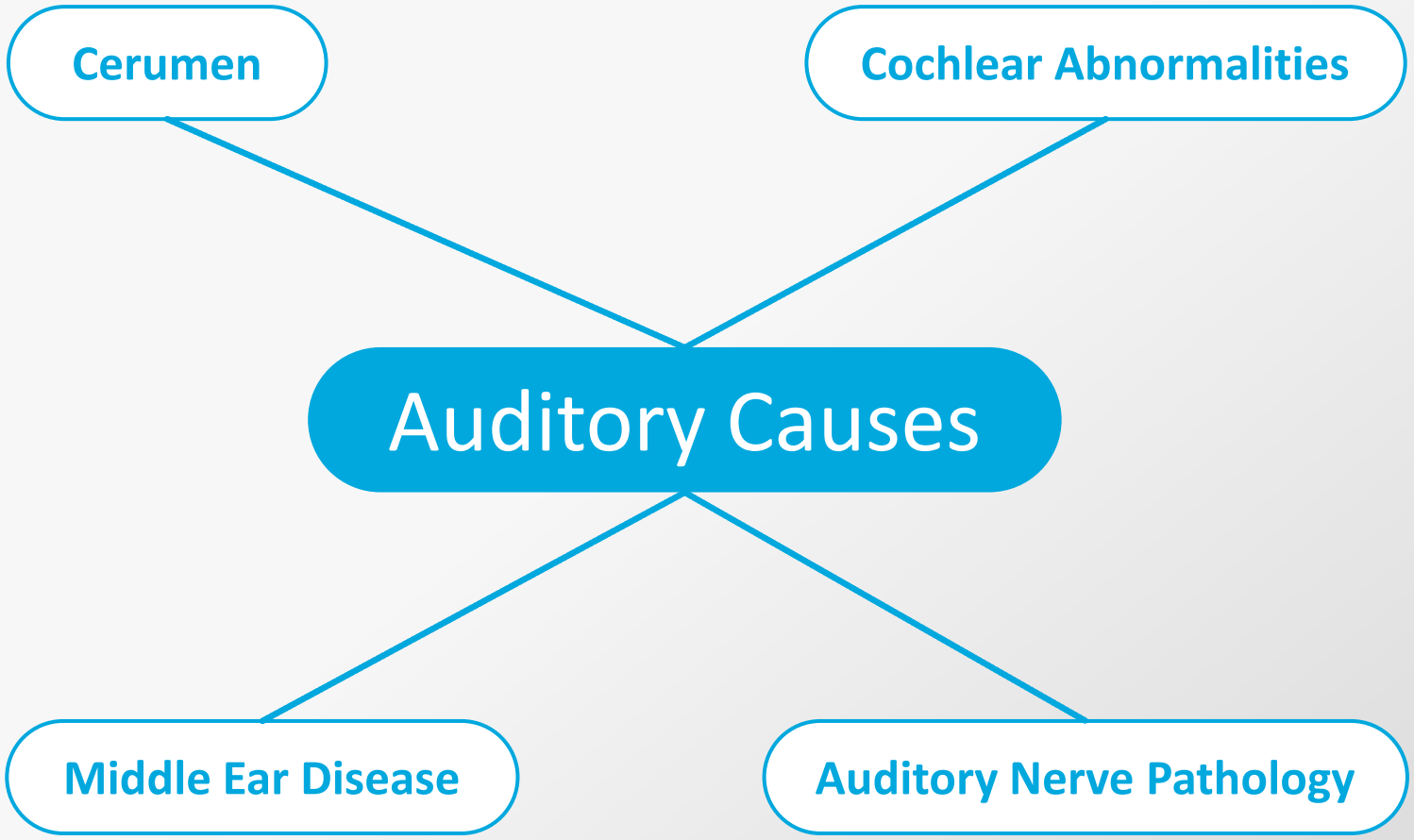

TINNITUS
PRIMARY
SECONDARY


TINNITUS
PRIMARY
SECONDARY

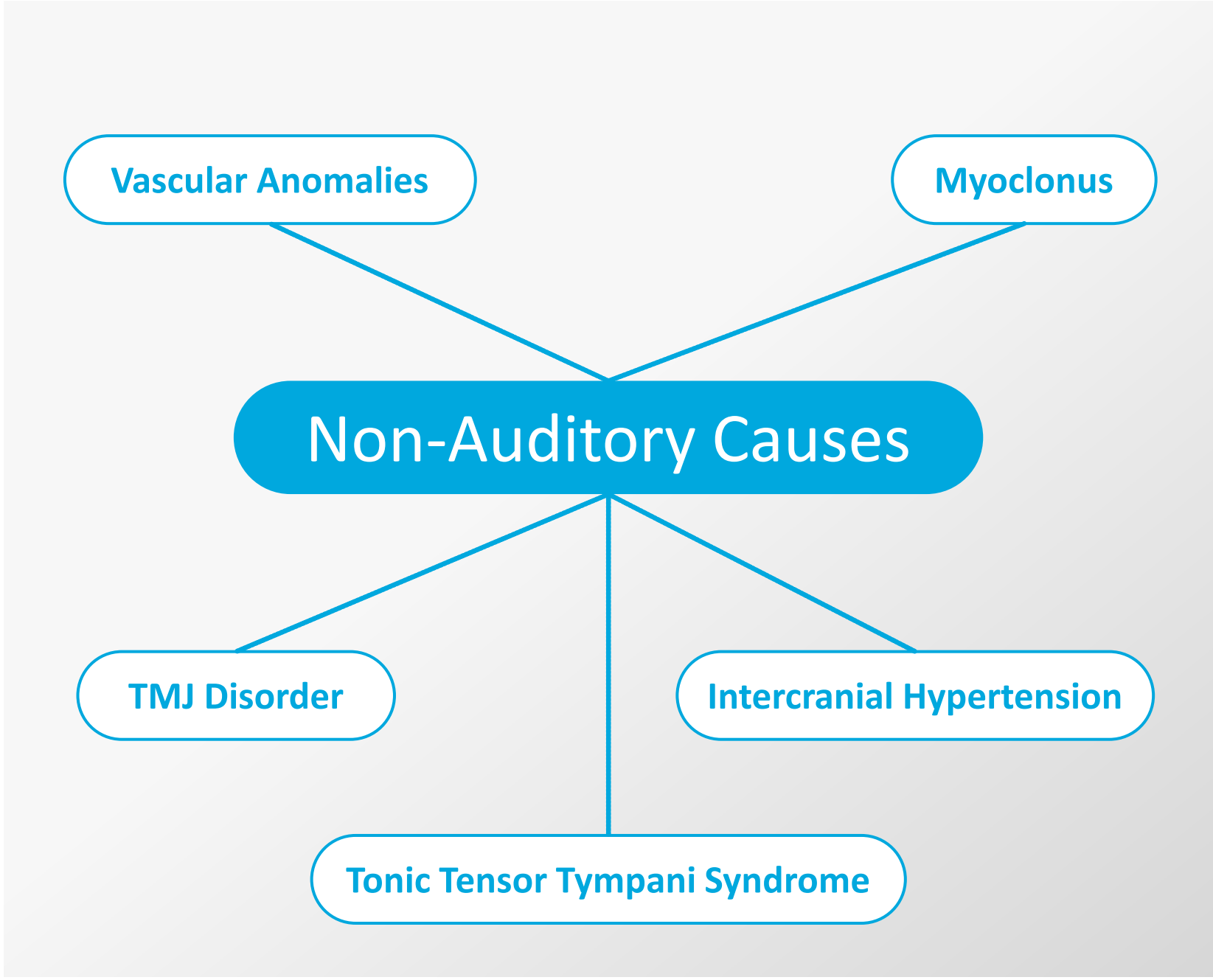
Secondary Tinnitus

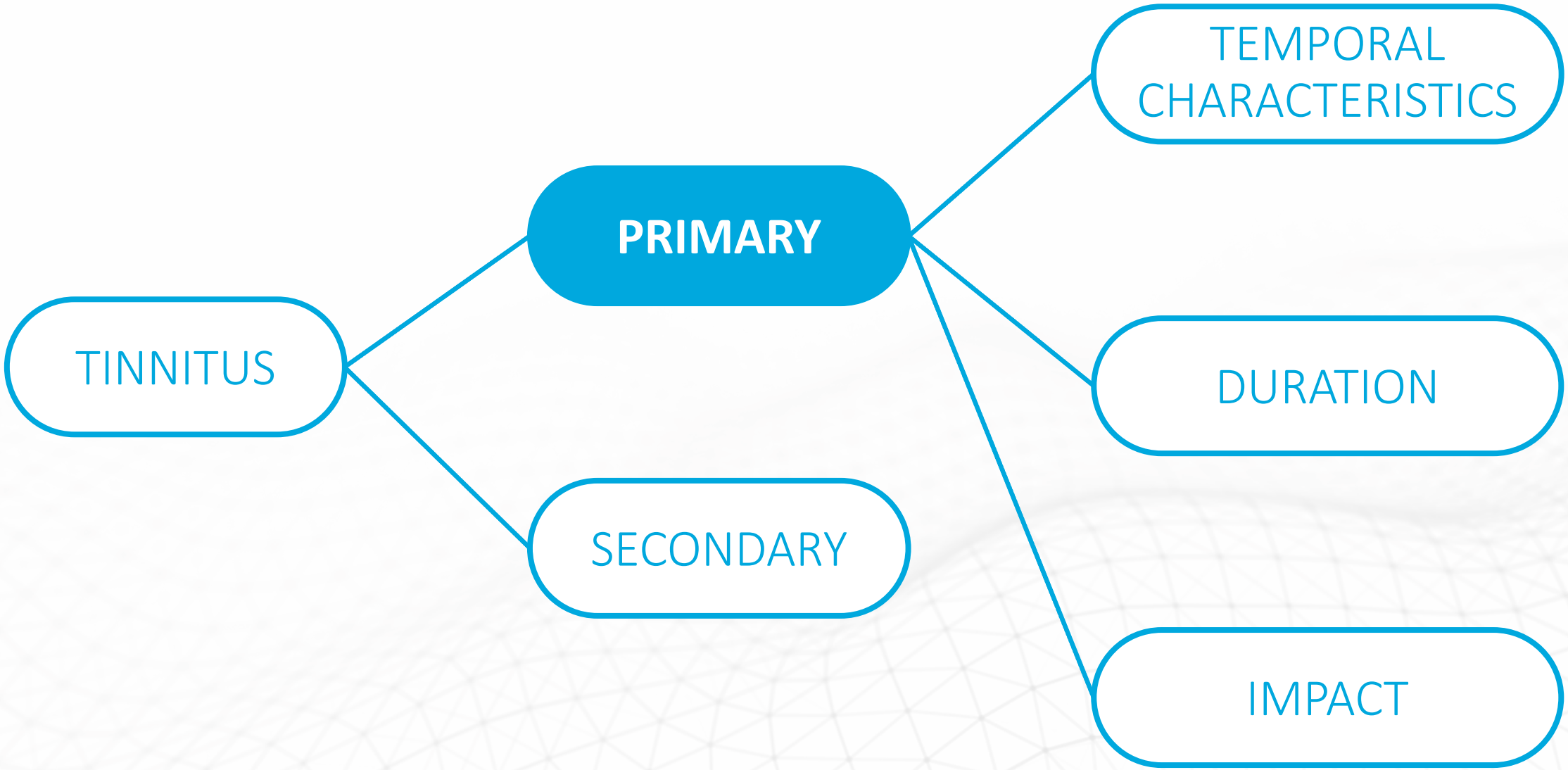
- Tinnitus associated with an underlying cause that is not sensorineural hearing loss
- Cause can be auditory or non-auditory
- Most common is pulsatile tinnitus
- Most treatable type of tinnitus

Secondary Tinnitus



Secondary Tinnitus




TINNITUS
PRIMARY
SECONDARY
TEMPORAL CHARACTERISTICS
DURATION
IMPACT

Primary Tinnitus

- Tinnitus that occurs from an unknown source
  - May or may not be associated with Sensorineural Hearing Loss
- Can be further characterized
  - Temporal Characteristics
  - Duration
  - Impact

Primary Tinnitus

TEMPORAL CHARACTERISTICS	DURATION	IMPACT
Spontaneous	Recent	Non-Bothersome
Temporary	Persistent	Bothersome
Occasional		
Intermittent		
Constant		

Tinnitus must be distinguished from other phantom auditory perceptions and perceived sound intolerances.

Phantom Auditory Perceptions

Auditory Hallucinations

Musical Ear Syndrome

Auditory Imagination

Tinnitus

Tinnitus Risk Factors and Mechanisms

Starkey

Known Causes of Tinnitus

Hearing Loss

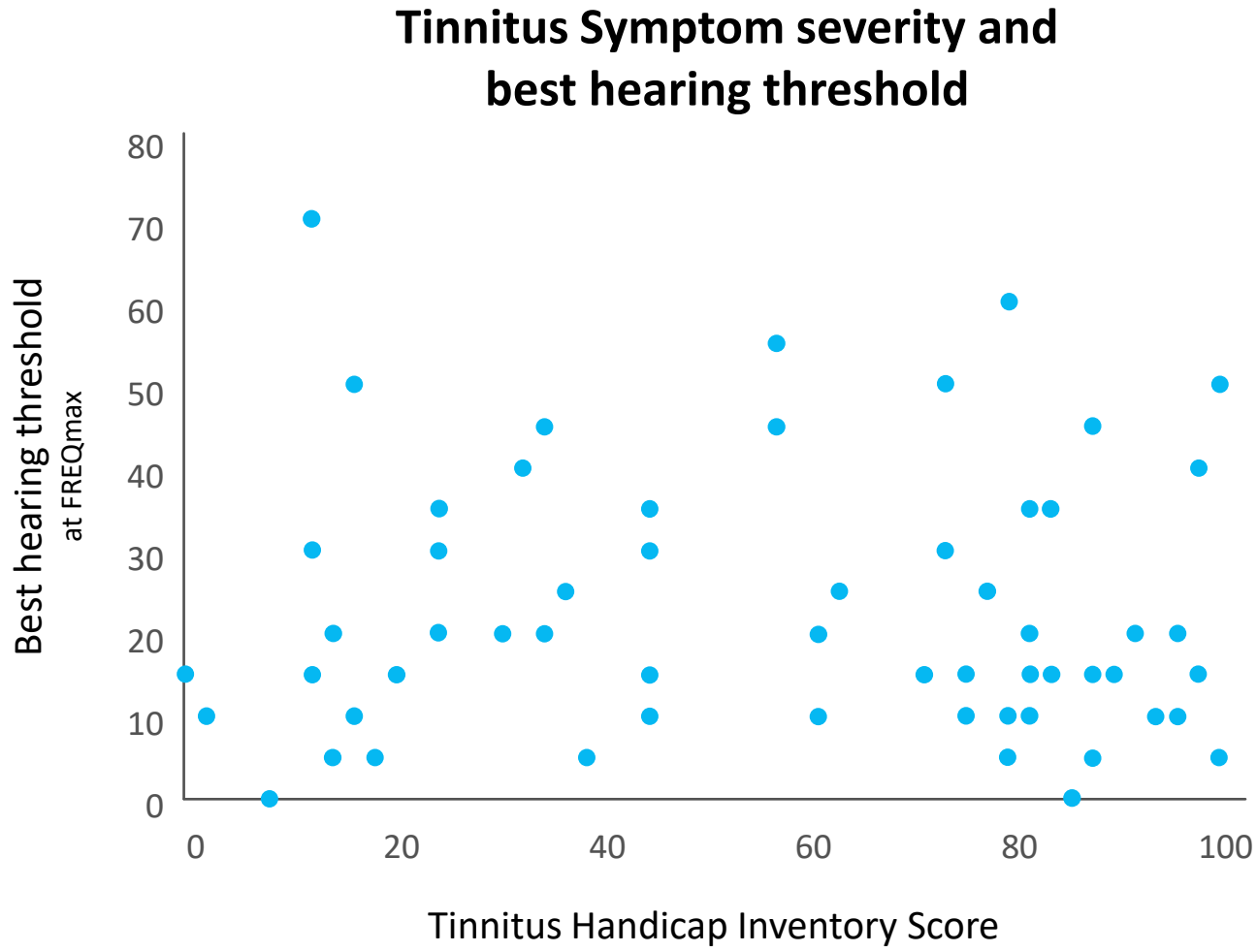
- **90%** of chronic tinnitus sufferers have some sort of hearing loss
  - Most common with SNHL
  - Secondary tinnitus associated with CHL

Noise Exposure

- Hair cell damage
- Biochemical changes in cochlea
- Damage to auditory nerve/CNS

Tinnitus and Hearing Loss

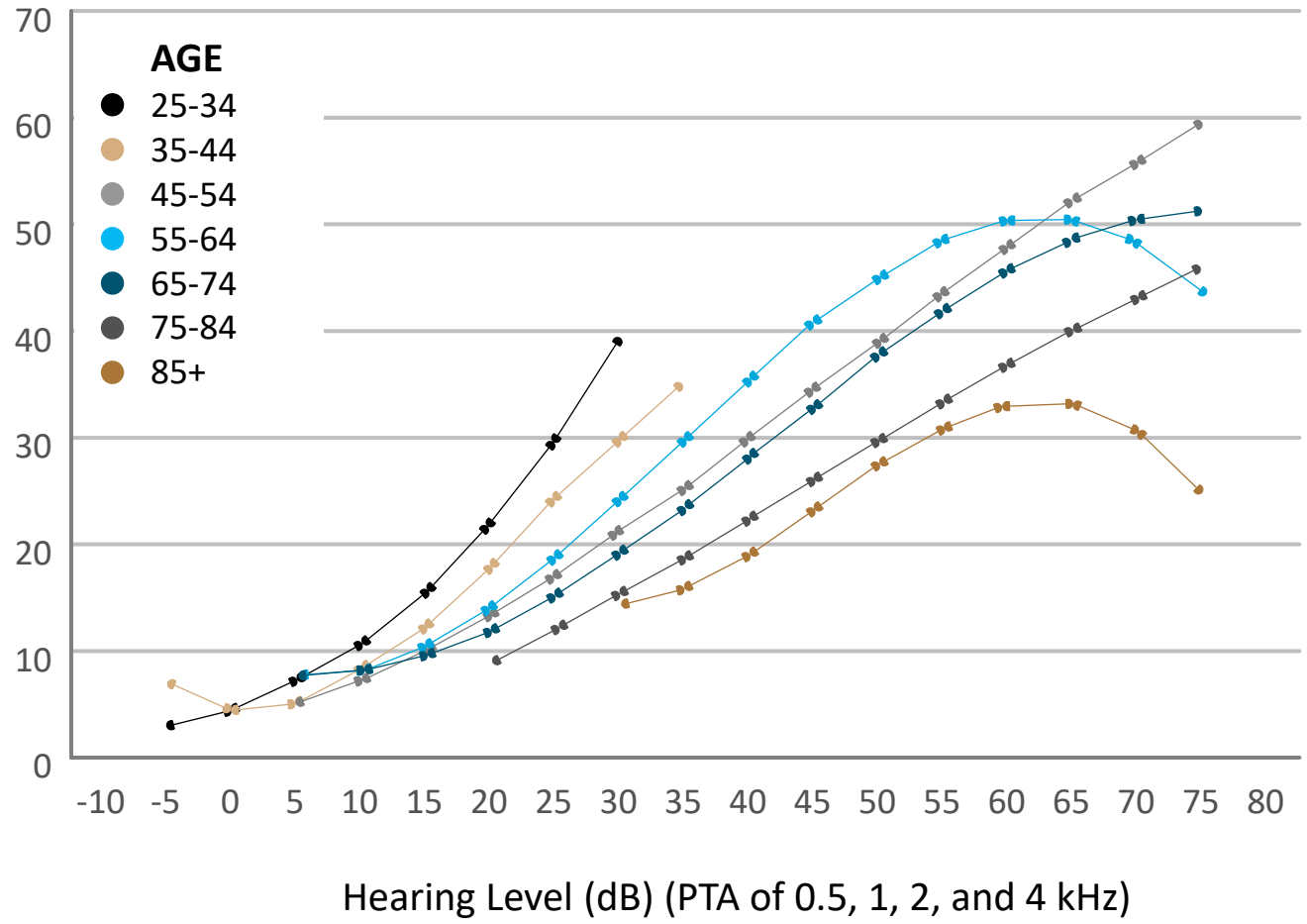
No correlation between tinnitus severity and hearing threshold



Tsai, Cheung, and Sweetow, Laryngoscope, 2012

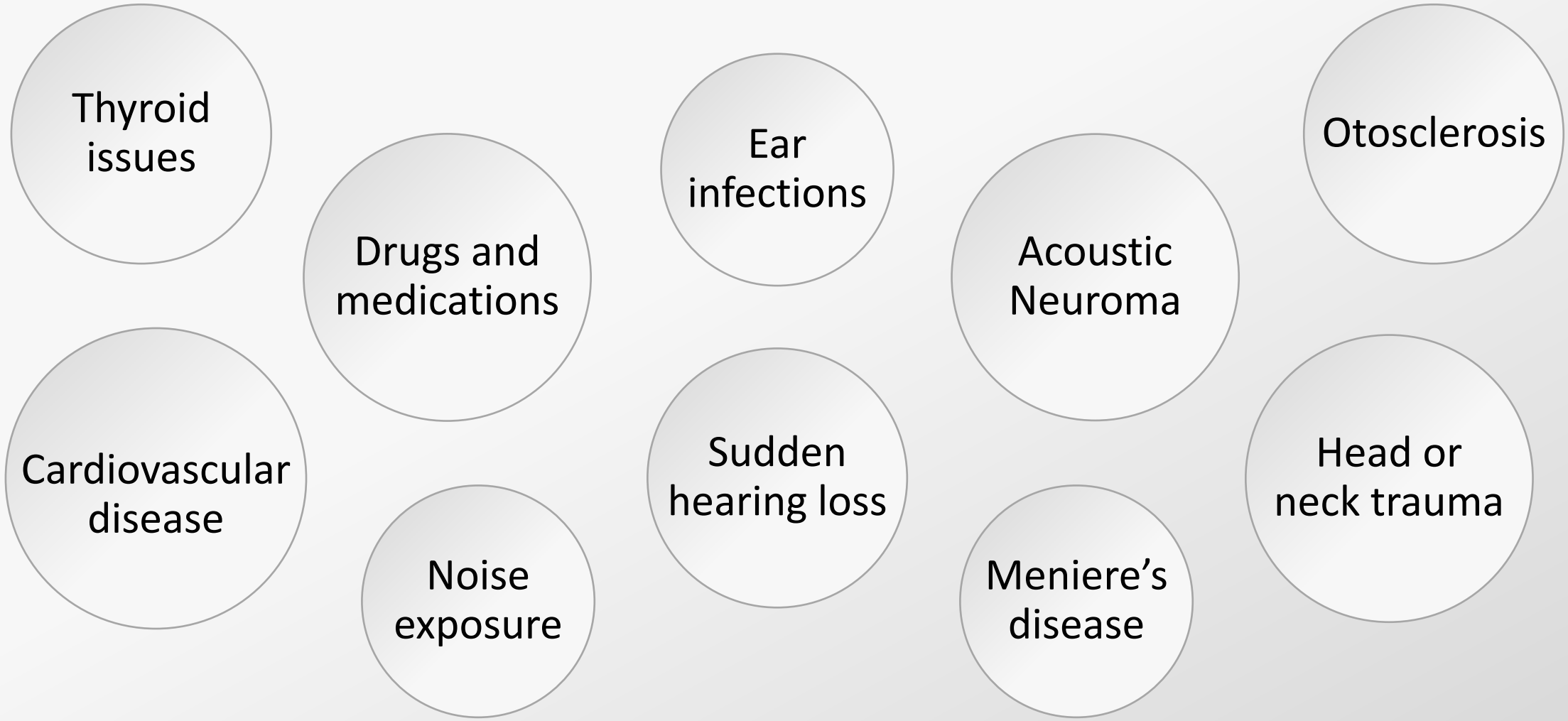
Tinnitus and Hearing Loss

For all age categories, as hearing loss increases, the prevalence of tinnitus increases



Borchgrevink et al., 2001

Risk Factors for Tinnitus



Causes

Cardiovascular Disease

- Restriction of blood flow in the blood vessels
- Heart Disease
- Coronary Artery Disease
- Hypertension
- Malformation of blood vessels

Causes

Medications

500+ prescription and OTC drugs, supplements associated with tinnitus

- Salicylate Analgesics (Aspirin)
- Antibiotics (Amoxicillin, Azithromycin, etc.)
- Painkillers (Oxycodone, Morphine, etc.)
- Cancer Drugs (Cisplatin, Carboplatin, etc.)
- Diuretics (Lasix)
- Cardiac Medications (Statins, ACE Inhibitors, etc.)
- Antimalarials (Quinine, Hydroxychloroquine, etc.)

Causes

Head and Neck Injury

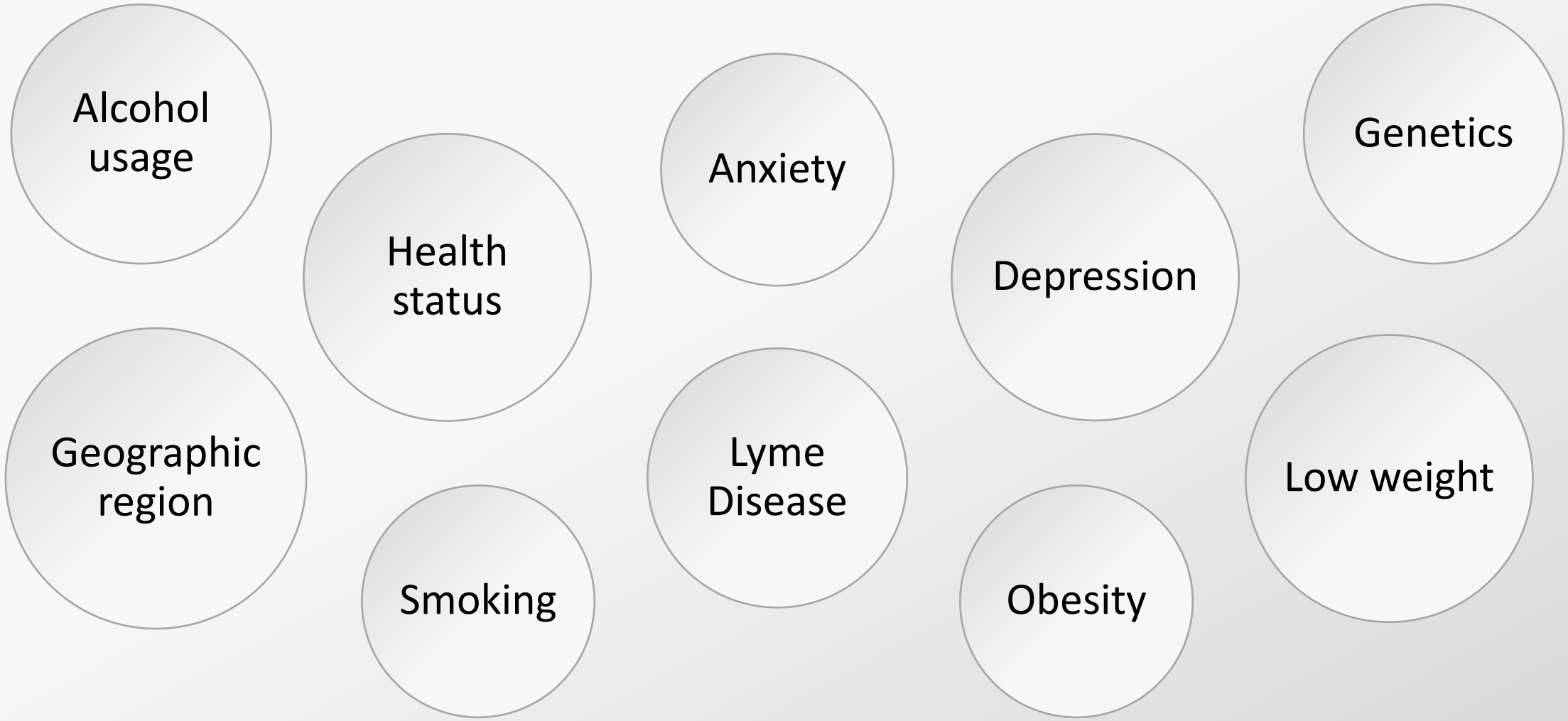
- Skull fracture, whiplash, blow to face/head, TMJ/jaw related problems
- Report onset shortly after injury/trauma

Causes

Auditory Related

- Ear Infections
- Noise Exposure
- Meniere’s Disease
- Otosclerosis
- Sudden Hearing Loss
- Acoustic Neuroma

Possible Risk Factors for Tinnitus



Who Experiences Tinnitus?

People from all walks of life but certain groups are more susceptible

- Men
  (especially in professions that expose them to noise)
- Senior Citizens
- Caucasians
- People with certain common health problems

(Brown SC, 1990; Coles R, 2000)

Other At Risk Populations

Veterans & Military Personnel

- Over 157,000 Veterans began receiving compensation benefits for tinnitus in 2015
- Over 1.5 million veterans with an auditory system disability

"…tinnitus became a major political issue in the U.S. since tinnitus and hearing loss are the most frequent health complaint of soldiers returning from Afghanistan and Iraq resulting in yearly compensation payments of over 2 billion US dollars per year."

- Yankaskas, 2011

Other At Risk Populations

- Workers in loud environments
  - Autoworkers
  - Firefighters/Police/EMT
  - Manufacturing Jobs
- Musicians and music lovers
- Motorsports and hunting enthusiasts
- Those who have had a traumatic brain injury
  - May be caused by the injury
  - May be caused by medications used to treat injuries

There are many **causes** of tinnitus, and as a result, there are likely many different mechanisms of tinnitus.

Mechanisms of Tinnitus

Theories of Causality

The Neurophysiological Model of Tinnitus

The Neural Synchrony Model

Theory of Causality

- Perception of tinnitus likely involves the auditory pathway and its interaction with other brain systems
- Current view is that all tinnitus originates in the central auditory system.

The Neurophysiological Model of Tinnitus

- Tinnitus results from the abnormal processing of a signal generated in the auditory system.
- This may result in 'feedback', whereby the annoyance created by the tinnitus causes the individual to focus increasingly on the noise, which in turn exacerbates the annoyance and so a 'vicious cycle' develops.

Neural Synchrony Model

- Irregular neural activity develops in regions of the primary auditory cortex that have been affected by hearing loss
- Increase neural firing in the regions affected by hearing loss are the cause of tinnitus.
  - The regions affected by hearing loss are “disconnected” from the brain.

How Many Suffer?

100 participants with normal hearing and no reported tinnitus were each asked to sit in an anechoic chamber for a period of time…

Heller & Bergman, 1953

The Tinnitus Patient

Presentation

Ringing

Hissing

Static

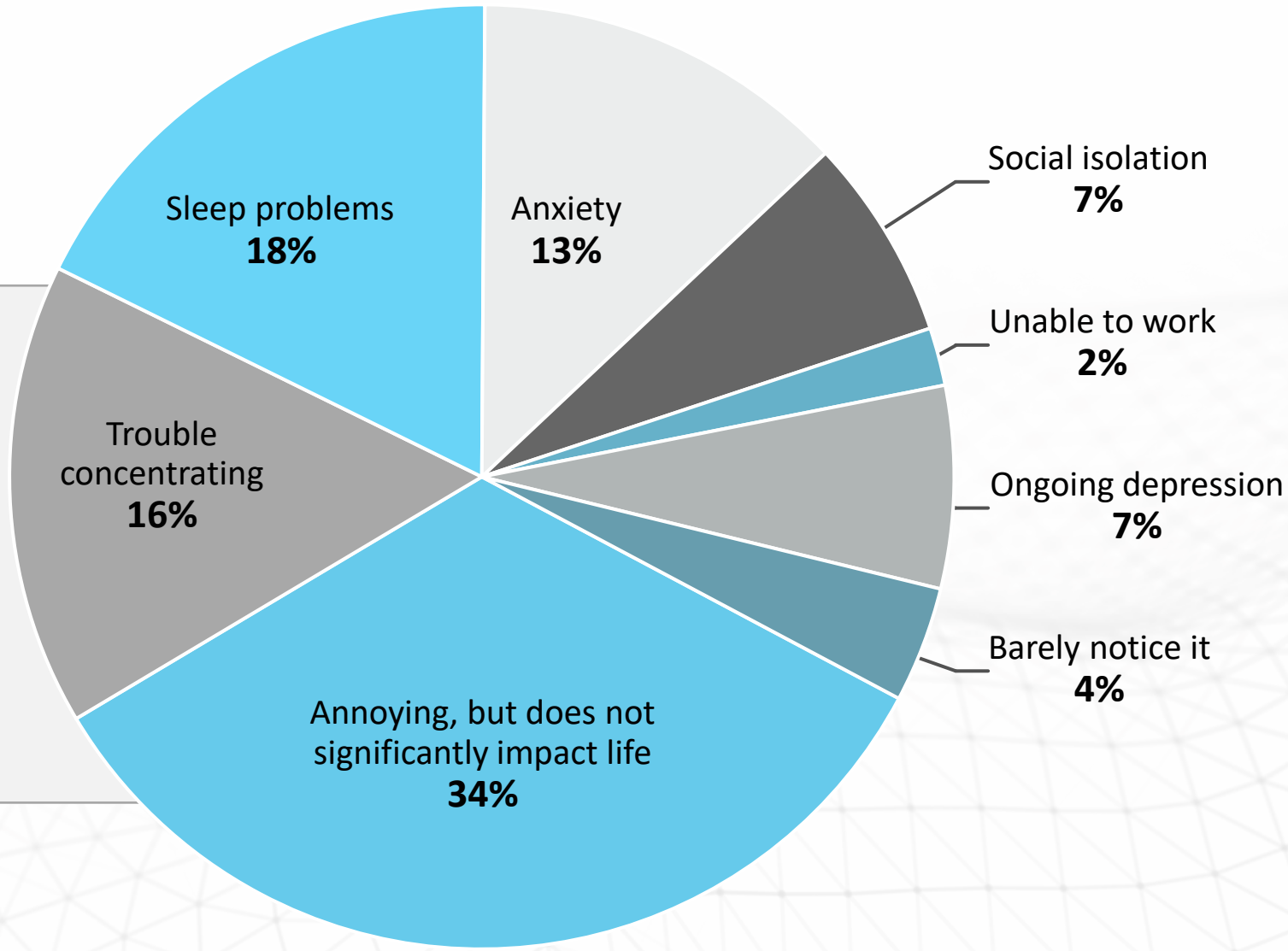
Buzzing

Waterfall

Crickets/
Cicadas

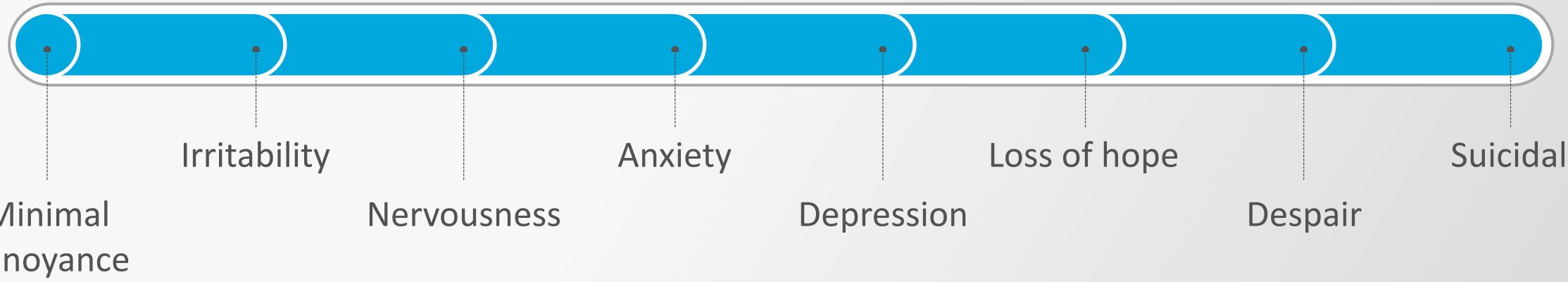
Quality of life impacts

- Thoughts and Emotions
- Sleep
- Concentration
- Socialization
- Physical Health
- Economic well-being



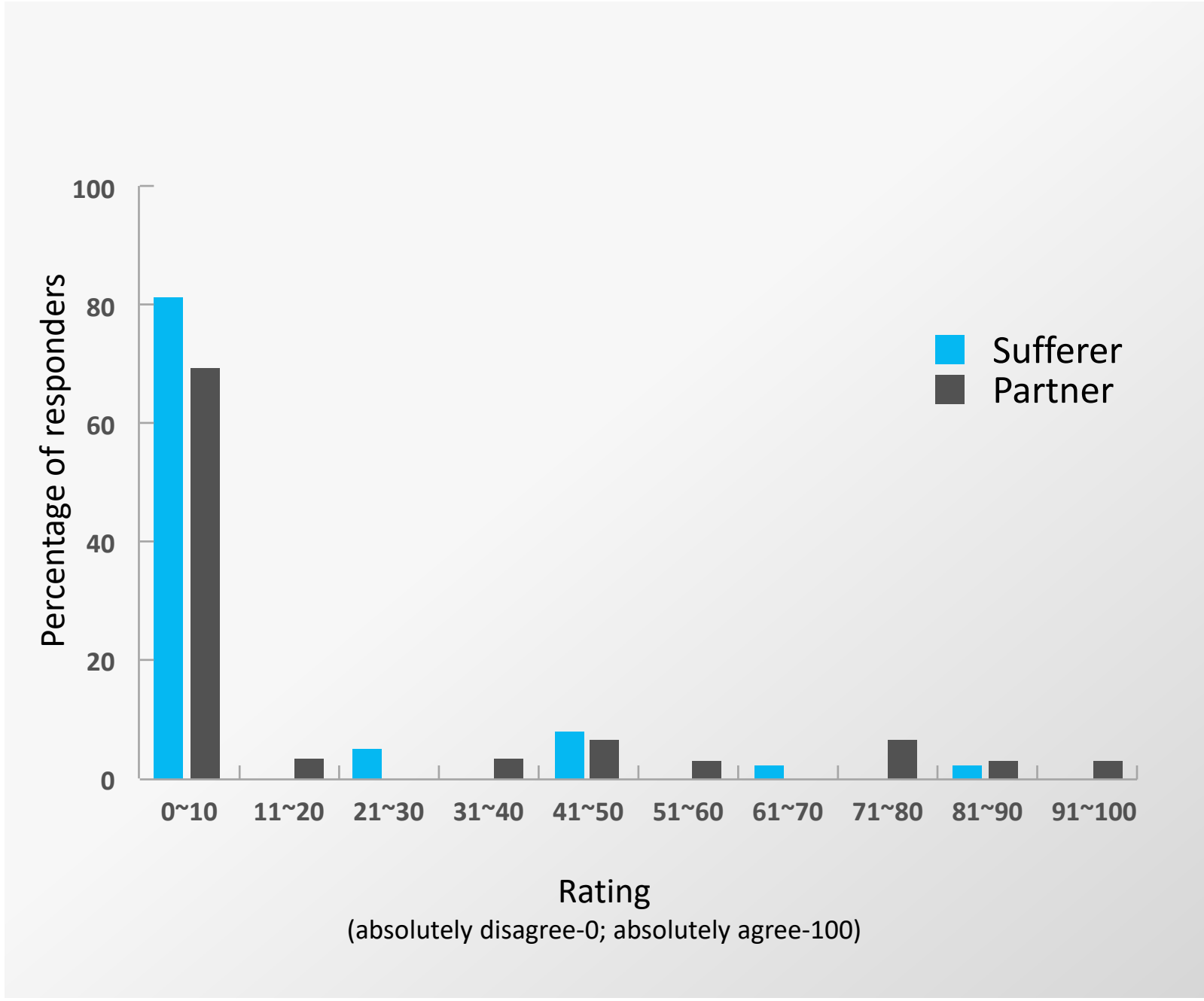
CONTENT WARNING

Thoughts and Emotions



Sleep and Concentration

Socialization



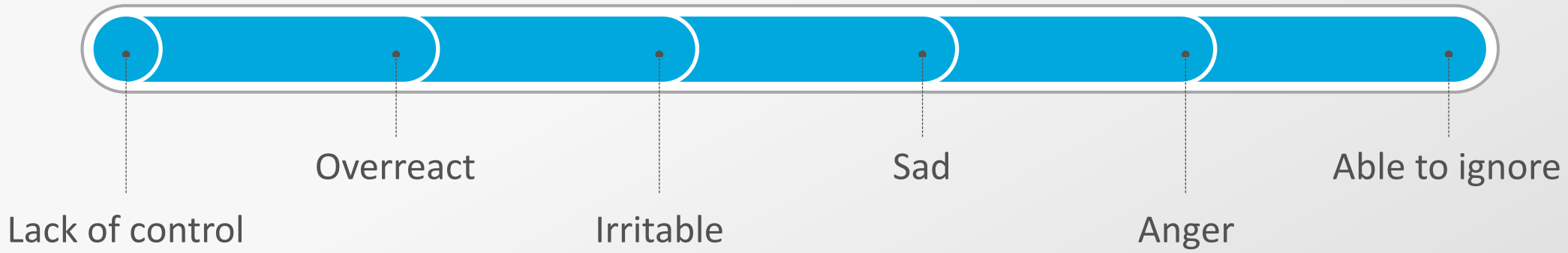
Physical Health

- Self Harm
- Health problems caused by the stress of tinnitus
  - Obesity
  - Diabetes
  - Heart disease
  - GI distress

Economic well-being

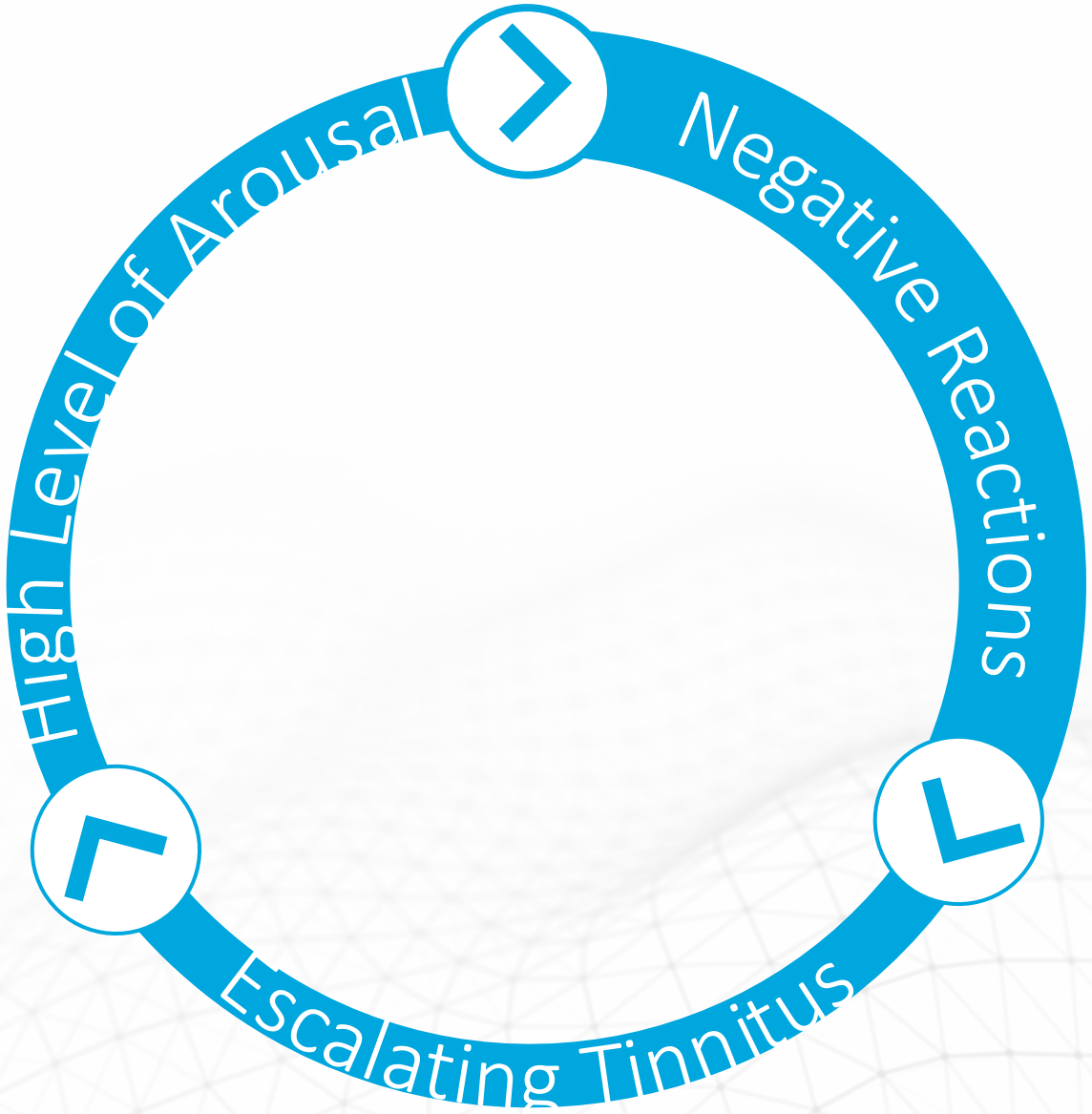
- Personal economic loss can be up to $30,000 annually.
- The cost to society has been estimated at upwards of $26 billion annually.

Reactions to Tinnitus



Why Are Some More Bothered Than Others?

- Research shows that there is no difference in psychoacoustic characterization of tinnitus when comparing groups of people who experience tinnitus and those who suffer from it.
- The **reaction** to tinnitus creates the distress, not the tinnitus itself.


High Level of Arousal
Negative Reactions
Escalating Tinnitus

By the time a patient comes for help, they have created their own attitudes and beliefs about their tinnitus.

Assessment of the Tinnitus Patient

Self-Assessment

Case History

Audiological Assessment

Counsel/ Treatment

Self-Assessment

- Patient’s perception regarding their tinnitus and hearing problems
- Many different questionnaires/surveys available.
  - Tinnitus & Hearing Survey
  - Tinnitus Functional Index
  - Tinnitus Handicap Inventory
  - Tinnitus Reaction Questionnaire
  - Tinnitus Handicap Questionnaire

Case History

- Referral source
- Perception of Tinnitus
- Attitude and Beliefs about Tinnitus
- Previous management of Tinnitus
- Medical History
- Audiological History
- Support System

Audiological Assessment

- Otoscopy
- Acoustic Reflex*
- Audiometric Thresholds (Air & Bone)**
- Speech testing
- OAEs**
- Tinnitus Loudness & Pitch Matching
- Minimum masking level
- MCLs/UCLs*

Audiological Assessment

*Acoustic Reflexes and UCLs should be done only if the patient does not have loudness level issues.

These tests may exacerbate the tinnitus of the patient.

- Otoscopy
- Acoustic Reflex*
- Audiometric Thresholds (Air & Bone)**
- Speech testing
- OAEs**
- Tinnitus Loudness & Pitch Matching
- Minimum masking level
- MCLs/UCLs*

Audiological Assessment

*Acoustic Reflexes and UCLs should be done only if the patient does not have loudness level issues.

These tests may exacerbate the tinnitus of the patient.

**HF Audiometry and OAEs may be useful for diagnosing those with “normal” hearing sensitivity.

- Otoscopy
- Acoustic Reflex*
- Audiometric Thresholds (Air & Bone)**
- Speech testing
- OAEs**
- Tinnitus Loudness & Pitch Matching
- Minimum masking level
- MCLs/UCLs*

Audiological Assessment

Tinnitus Loudness & Pitch Matching

Presenting sounds/pitches similar to their tinnitus to help identify the patient's specific perception of their tinnitus.

- Otoscopy
- Acoustic Reflex*
- Audiometric Thresholds (Air & Bone)**
- Speech testing
- OAEs**
- Tinnitus Loudness & Pitch Matching
- Minimum masking level
- MCLs/UCLs*

Audiological Assessment

Minimum Masking Level

Minimum intensity of a stimulus to totally mask the tinnitus

- Otoscopy
- Acoustic Reflex*
- Audiometric Thresholds (Air & Bone)**
- Speech testing
- OAEs**
- Tinnitus Loudness & Pitch Matching
- Minimum masking level
- MCLs/UCLs*

Never tell a patient there is nothing that can be done to help with their tinnitus.

There are options to help the patient with their tinnitus!

Counseling and Treatment

- Explain what tinnitus is and why it may be happening
- Discuss different options for treatment
- Create goals for treatment
  - Lessen impact of tinnitus on daily life

Hearing Technology

It can help reduce the awareness and disturbance and manage tinnitus symptoms

Sound Therapy

Tinnitus sound therapy uses a process known as **habituation** to retrain the way the brain interprets tinnitus.

Lifestyle Changes

- Quit Smoking
- Diet Change
- Getting a better night’s rest
- Relaxation
- Exercise

Relaxation/Meditation

- Relaxing
- Meditation
- Diet

Well-Known Protocols

- Tinnitus Retraining Therapy
  Dr. Pawell Jastreboff
- Progressive Tinnitus Management
  National Center for Rehabilitative Auditory Research
- Tinnitus Activities Treatment
  Dr. Richard Tyler at the University of Iowa

Support Groups

- In-person
- Virtual

Tinnitus Resources

American Tinnitus Association
www.ata.org

Tinnitus Research Initiative
www.tinnitusresearch.net

National Center for Rehabilitative Auditory Research (NCRAR)
www.ncrar.research.va.gov/Education/Documents/TinnitusDocuments

American Academy of Audiology
www.audiology.org

Tinnitus Retraining Therapy
www.tinnitus-pjj.com

University of Iowa Tinnitus & Hyperacusis Research
www.medicine.uiowa.edu/oto/research/tinnitus-and-hyperacusis

Learn More

Tinnitus Management

Like No Other, From No-One Else

Ring! Buzz! Chirp!

Part 2: Evaluating and Treating
the Tinnitus Patient

April 20, 2021

Thank you

Starkey