

Monitoring for Ototoxicity- Induced Tinnitus

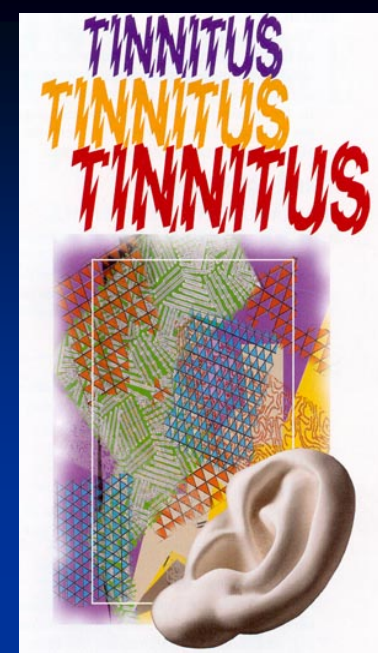
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Chronic Tinnitus vs. Transient “Ear Noise”

- “Ear noise” = whistling sound accompanying sudden sensation of hearing loss—quickly resolves
- “Tinnitus” = head noise lasting at least 5 min. that occurs >once/week
- When tinnitus sound becomes extended in duration, on a persistent basis, it is considered chronic, pathological tinnitus



Tinnitus vs. Somatosounds

- Generation of tinnitus can be:
 - Neurophysiologic (sensorineural tinnitus)
 - Somatic (somatosounds)

Somatosounds

- Internally-generated body or head sounds perceived by patient
 - Muscular, vascular, respiratory, TMJ sounds
- Pulsatile vs. non-pulsatile
 - Pulsatile (most common): caused by perception of bloodflow (“venous hum” or “vascular noise”)
 - Non-pulsatile: e.g., muscular flutters or spasms, patulous eustachian tube
- Somatosounds require medical evaluation

Subjective vs. Objective Tinnitus

- Somatosounds can be *subjective* (heard only by patient) or *objective* (heard by patient and examiner)
- Objective tinnitus is relatively rare and usually indicates underlying medical condition warranting medical evaluation
 - e.g., eustachian tube dysfunction, palatal myoclonic or muscular contractions of tensor tympani, tensor or levator palati, or vascular disorders such as carotid body tumors

Permanent vs. Temporary Tinnitus

- “Permanent” tinnitus = minimum 6-12 mo. duration (Vernon: min. = 2 yr.)
- *What about sudden-onset tinnitus?*
 - First, rule out acoustic tumor
 - Explain to patient lability of tinnitus during first 3-6 mo—don’t assume permanence unless persistent for about 6-12 mo
 - Counsel to take precautions to minimize tinnitus
 - Critical to allay fears
 - Don’t say “nothing can be done—learn to live with it”
 - Full treatment may not be necessary
 - Close monitoring is necessary

Epidemiology and Demographics of Tinnitus

- Many epidemiologic studies conducted to describe factors associated w/tinnitus
 - Hoffman HJ, Reed GW. (2004) Epidemiology of tinnitus. In Snow JB (Ed.), Tinnitus: Theory and Management. Lewiston, NY: BC Decker Inc, 16-41.
- Oregon Tinnitus Clinic, located at OHSU has developed Tinnitus Data Registry—a large database containing data from 1,630 patients
 - <http://www.tinnitusarchive.org/>

“Definite” Risk Factors (Hoffman & Reed, 2004)

- Acoustic neuroma
- Age
- Cardiovascular & cerebrovascular disease
- **Drugs or medications**
- Ear infections/inflammation
- Head/neck trauma and injury
- Hyper- & hypothyroidism
- Loud noise exposure
- Meniere’s disease
- Otosclerosis
- Presbycusis
- Sudden deafness

General Categories of Tinnitus Etiology

- Data from Oregon Tinnitus Clinic
- 40% indicated no known events associated with their tinnitus
- When causes were reported, they fell into four categories
 1. Noise-related
 2. Head and neck trauma
 3. Head and neck illness
 4. **Other medical conditions**

4. Other Medical Conditions

- Other illnesses (2%)
- **Drugs, medications (2%)**
- Stress (1%)
- Surgery (1%)
- Possible TMJ syndrome (1%)
- Barotrauma (1%)

- Total other medical conditions (7% as single cause; 13% as one of multiple causes)

(Data from Oregon Tinnitus Clinic)

Prevalence of Tinnitus

- Prevalence estimates from numerous epidemiologic studies: 10-15% (adults)
- Vernon estimates up to 40 million Americans have tinnitus “to a minor degree,” and that 5-13 million Americans have “severe, quality-of-life-disruptive” tinnitus

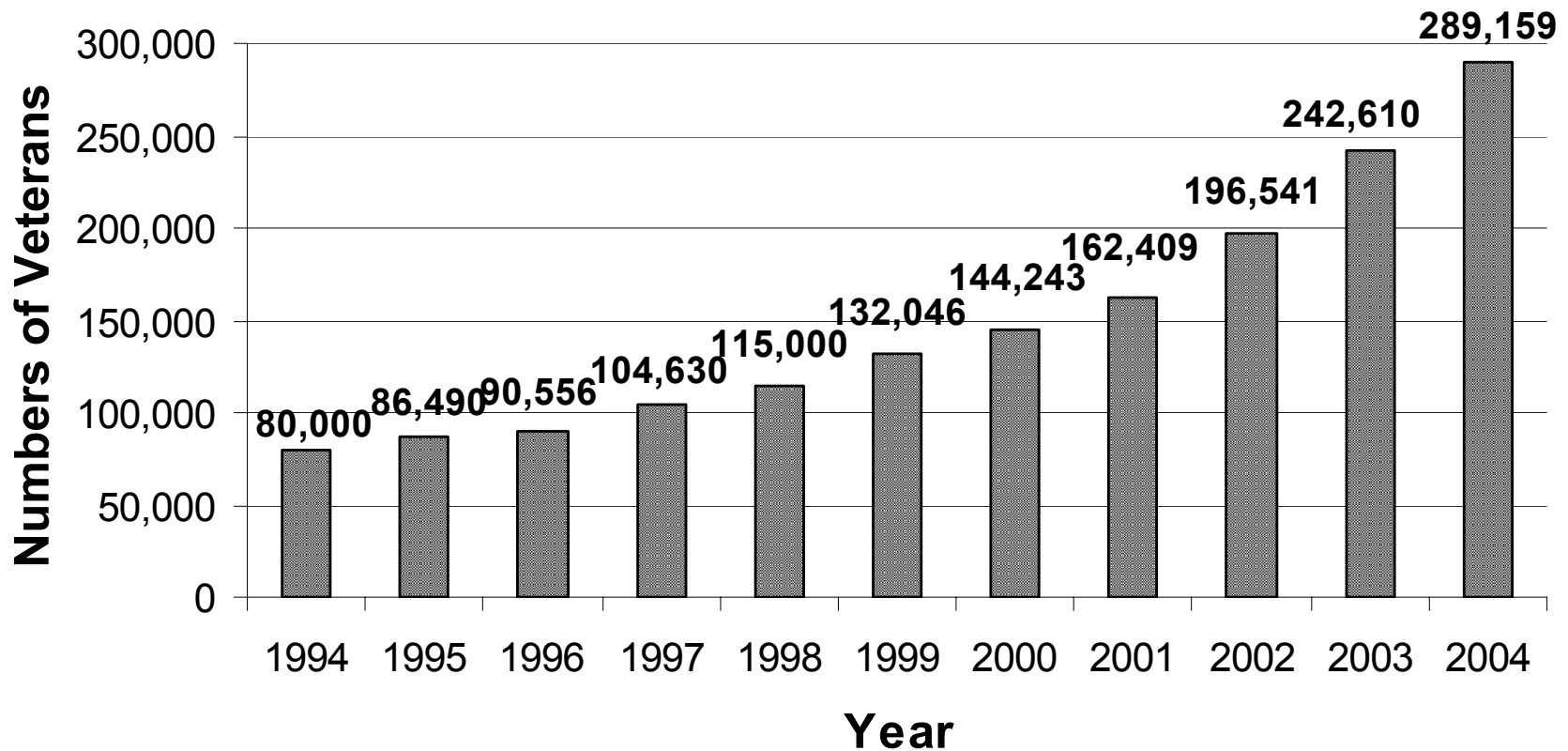
Prevalence Estimates (ATA)

- Estimates of tinnitus prevalence by American Tinnitus Association (ATA) often referred to in literature
 - 40-50 million Americans experience tinnitus as a chronic condition
 - 10-12 million seek some form of medical help
 - 2.5 million “debilitated” by tinnitus

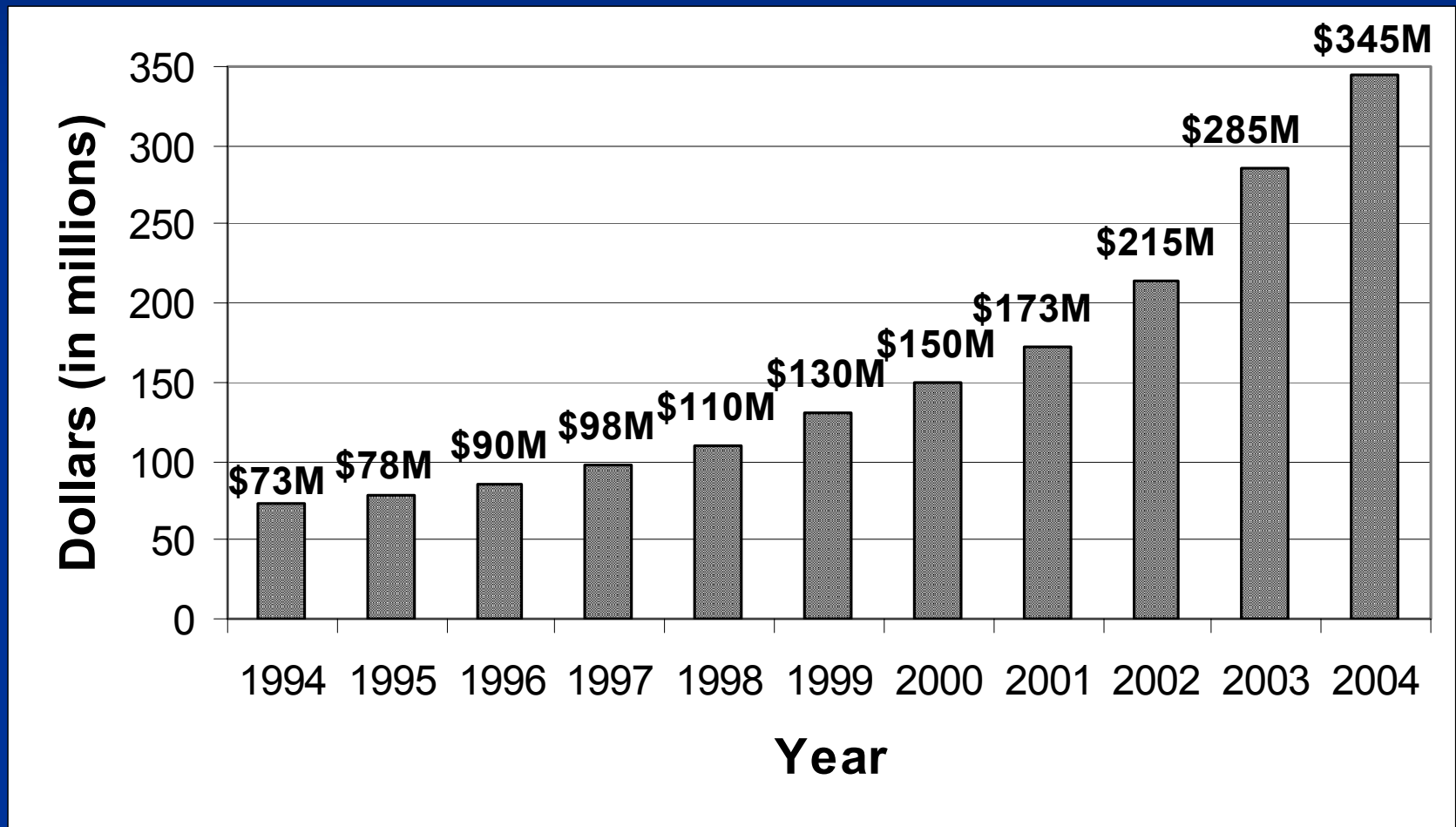
Prevalence of Tinnitus in Veterans

- 24.7 million veterans
- 3-4 million vets have tinnitus
 - Based on estimated tinnitus prevalence in general population (10-15% of adults)
- Vets are older than general population
 - 36% of vets vs. 17% of general population are ≥ 65 years
 - Oldest cohort of vets will increase over 500% in next 15 years
- Actual prevalence thus may be higher

Numbers of Vets Service-Connected for Tinnitus



Yearly Total Compensation for Tinnitus Disability



Tinnitus Severity

- “Severity” in clinical context = impact of a health condition on quality of life
- Tinnitus severity = impact of tinnitus on quality of life

Effects of Tinnitus on Quality of Life

- Highly individualized—based on:
 1. Personality characteristics
 2. Daily lifestyle
 3. Acoustic environment
 4. Characteristics of tinnitus

“Problem” vs. “No-Problem” Tinnitus

- Tinnitus is not a significant problem for about 80% of those who have it
- What makes tinnitus a problem for some and not for others?
 1. Personality characteristics
 2. Daily lifestyle
 3. Acoustic environment
 4. Characteristics of tinnitus

Personality Characteristics Affect Tinnitus Severity

LESS SEVERE ←————→ MORE SEVERE

Calm ←————→ Anxious

Content ←————→ Depressed

Peaceful ←————→ Angry

“Coper” ←————→ “Non-coper”

- The same tinnitus will affect different people differently, depending on their personality characteristics

Daily Lifestyle Affects Tinnitus Severity

LESS SEVERE ←————→ MORE SEVERE

Active ←————→ Sedentary

Working ←————→ Retired

Interested ←————→ Bored

Social ←————→ Isolated

- People who are actively involved in meaningful activities tend to be less bothered by their tinnitus

Acoustic Environment Affects Tinnitus Severity

LESS SEVERE ←————→ MORE SEVERE

Enjoy sound ←————→ Enjoy quiet

Noisy workplace ←————→ Quiet workplace

Children at home ←————→ No children

Social ←————→ Isolated

- More environmental sound tends to reduce awareness/intrusiveness of tinnitus

Characteristics of Tinnitus Affect Tinnitus Severity

LESS SEVERE ←————→ MORE SEVERE

Softer ←————→ Louder

Low pitched ←————→ High pitched

Single sound ←————→ Multiple sounds

Nonfluctuating ←————→ Fluctuating

- These are educated guesses—there are no supporting data

Is “Louder” Tinnitus More Bothersome?

- Two ways to “measure” tinnitus loudness
 1. Patient reports subjective loudness on 1-10 scale (ratings correlate with severity)
 2. Patient matches loudness of tinnitus to loudness of external tones (matches do not correlate with severity)
- We thus don’t know to what extent acoustic correlates of tinnitus are a factor affecting tinnitus severity

Assessing Tinnitus Severity

- Proper methodology for assessing tinnitus severity has been debated for years
- At least 12 published outcome instruments are used to obtain tinnitus severity ratings
 - No consensus regarding their use across tinnitus treatment centers

Tinnitus Questionnaires

- Subjective Tinnitus Severity Scale
- Tinnitus Cognitions Questionnaire
- Tinnitus Coping Style Questionnaire
- Tinnitus Handicap Inventory
- Tinnitus Handicap Questionnaire
- Tinnitus Handicap/Support Scale
- Tinnitus Questionnaire
- Tinnitus Reaction Questionnaire
- Tinnitus Severity Scale
- Tinnitus Severity Index

Don't Rely on Index Scores for Tinnitus Severity

- e.g., Tinnitus Severity Index (possible range 0-48): 123 research subjects who qualified for long-term treatment had index scores ranging from 9 to 48
- Similar results with Tinnitus Handicap Inventory and Tinnitus Handicap Questionnaire

Limitations of Written Questionnaires

- Provide only a general estimate of tinnitus severity
- Usually fairly accurate, but sometimes not
- Not documented for sensitivity to change over time
- However, they are still useful, and essential

Guidelines for Selecting Tinnitus Questionnaires

- Use questionnaires that:
 - Are efficient for clinical use
 - Have been validated
 - Are well accepted
 - Allow comparison to clinical data

Suggested Questionnaires

- Tinnitus Handicap Inventory
- Tinnitus Handicap Questionnaire
- Tinnitus Severity Index

Tinnitus Interviews

- Much more informative to clinician
- Dialogue also useful to patient
- Can be brief or extensive
- Absolutely necessary for making a clinical judgment of severity

Suggested Interviews

- TRT Initial and Follow-up Interviews (extensive)
- Tinnitus-Impact Screening Interview (brief)

Tinnitus Ototoxicity Monitoring Interview (TOMI)

- 13 questions
- Question 1 asked only at initial visit
- Questions 3-13 asked only if pt reports presence of tinnitus
- Questions 10-13 asked only if tinnitus:
 1. Existed prior to treatment, or
 2. Reported at prior visit

TOMI: Patient Instructions

- “You are being treated with a medication that has the potential to affect the auditory system. One possible effect is tinnitus, which is ringing, humming, buzzing, or other noises in your ears or head. Almost everyone hears noises in the ears or head that are brief and fade away—these sounds are normal. I am going to ask you about *persistent* tinnitus that lasts at least 5 minutes, and occurs at least twice a week.”

Question 1

- *[Clinician: ask only at first visit]*
- Did you have **persistent** tinnitus before the start of treatment?
 - No
 - Yes
- 1a. IF YES: How long have you had tinnitus?
 - < 1 year
 - 1-2 years
 - 3-5 years
 - 6-10 years
 - 11-20 years
 - > 20 years
 - Not sure

<i>Duration (years)</i>	N	%
Less than/equal to 1	350	21.7
More than 1, less than/equal to 2	176	10.9
More than 2, less than/equal to 5	311	19.3
More than 5, less than/equal to 10	226	14.0
More than 10, less than/equal to 20	266	16.5
More than 20	275	17.0
Other answer*	9	0.5
Total	1613	100.0

(Data from Oregon Tinnitus Clinic)

Question 2

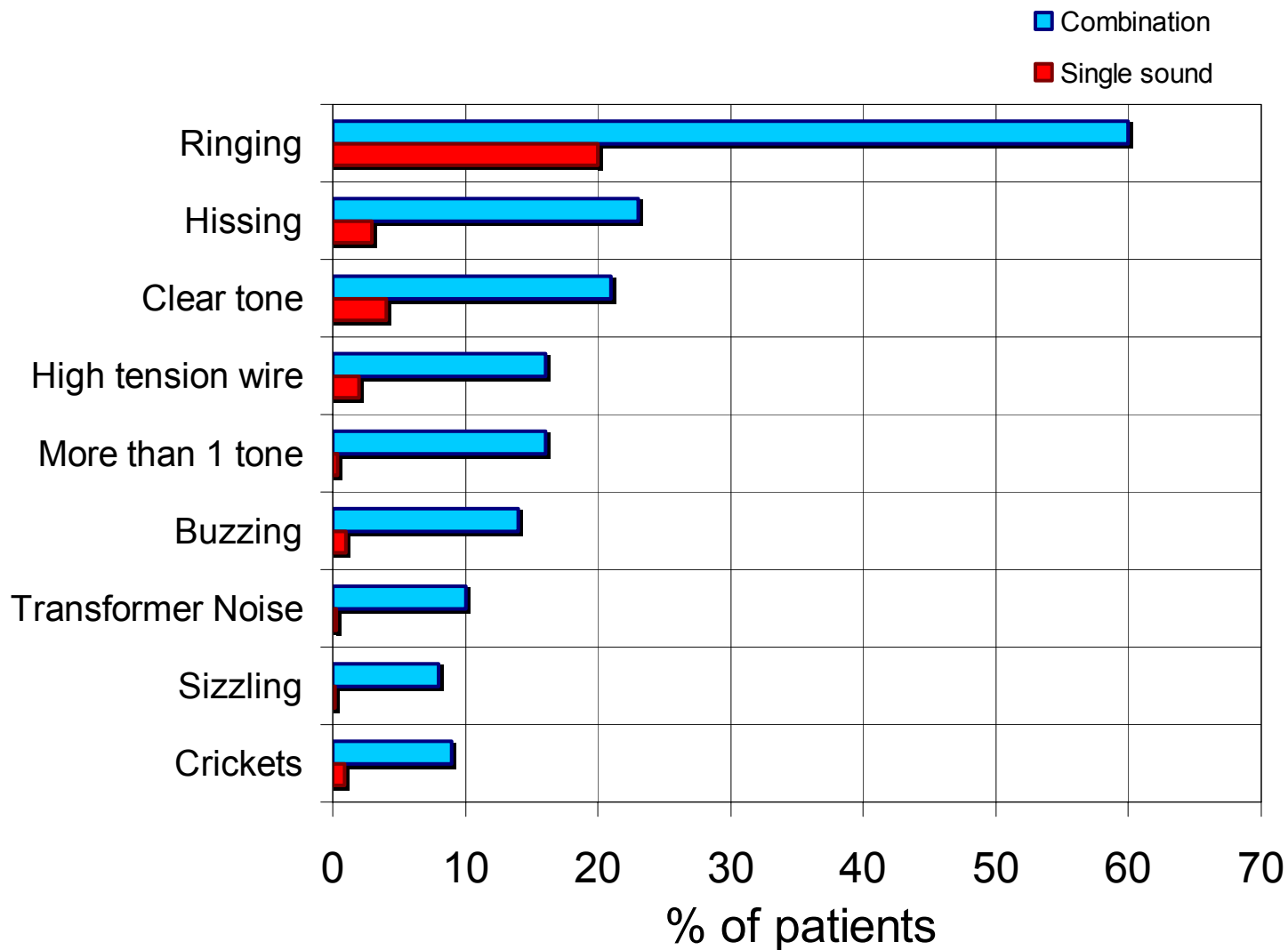
- Have you noticed any **persistent** tinnitus since you started the treatment?
 - No
 - Yes
- IF NO: *The interview is complete. No further questions are required.*
- IF YES:

Question 3

- What does your tinnitus sound like? (mark all that apply)
 - Ringing
 - Hissing
 - Buzzing
 - Sizzling
 - Crickets
 - Whistle
 - Hum
 - Other: _____

Predominant Tinnitus Sound

n = 2369

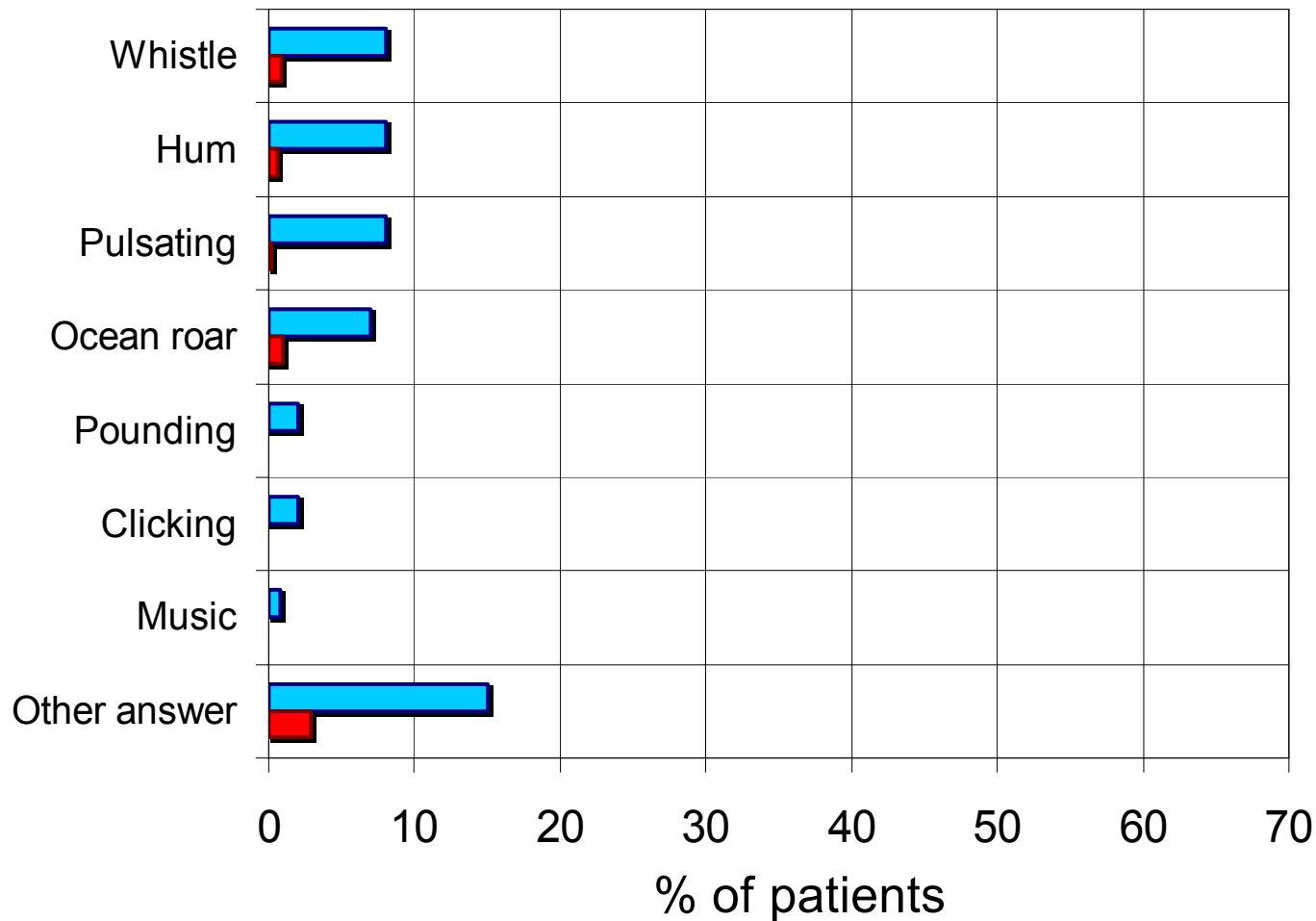


(Data from Oregon Tinnitus Clinic)

Predominant Tinnitus Sound

n = 2369

■ Combination
■ Single sound



(Data from Oregon Tinnitus Clinic)

Question 4

- Does your tinnitus have a pulsing quality to it?
 - No
 - Yes

(6% of Oregon Tinnitus Clinic pts reported that their tinnitus has a pulsing quality)

Question 5

- Where is your tinnitus located?
 - Left ear only
 - Right ear only
 - Both ears
 - Inside head
 - Other (describe) _____

	N	% of 1629
Both ears	1026	63.0
Left ear	212	13.0
Inside head—left	91	5.6
Outside head—left	9	0.6
Not sure—left	2	0.1
Right ear	176	10.8
Inside head—right	80	4.9
Outside head—right	11	0.7
Fills head	186	11.4
Inside top of head	22	1.4
Outside top of head	3	0.2
Surrounds head	5	0.3
Back of head	49	3.0
Other answer	96	5.9

(Data from Oregon Tinnitus Clinic)

Question 6

- Is your tinnitus louder on one side of your head than the other?
 - Right louder than left
 - Left louder than right
 - Equal

TINNITUS LOCALIZATION: WHERE IS TINNITUS "WORST"

	N	%
Left ear or side	645	39.6
Right ear or side	525	32.2
Both ears or sides	281	17.2
Head (not lateralized)	123	7.6
Head + one or both ears	16	1.0
Variable location	22	1.4
Patient unsure	6	0.4
Other answer*	11	0.7
Total	1629	100.0

(Data from Oregon Tinnitus Clinic)

Question 7

- How loud is your tinnitus on average?
 - Not loud at all
 - Slightly loud
 - Moderately loud
 - Very loud
 - Extremely loud

LOUDNESS RATING (SUBJECTIVE)

<i>Scale Value</i>	N	%
0.0 - 2.0	20	1.8
2.1 - 4.0	151	13.8
4.1 - 6.0	328	30.0
6.1 - 8.0	377	34.5
8.1 - 10.0	209	19.1
Variable loudness	9	0.8
Total*	1094	100.

Question 8

- How much of the time do you think your tinnitus is present?
 - Occasionally
 - Some of the time
 - Most of the time
 - Always

Question 9

- On average, how much of a problem is your tinnitus?
 - Not a problem
 - Slight problem
 - Moderate problem
 - Big problem
 - Very big problem

Questions 10-13

- *[Clinician: Ask the following questions only if the patient: (1) had tinnitus before the start of treatment, or (2) reported tinnitus previously with this TOMI. The objective is to determine if the patient's tinnitus is being affected by the drug treatment. If the patient has previously responded to this interview, each response should reflect the period of time since the last interview. Otherwise, each response reflects the period of time since before the start of treatment.]*

Question 10

- Has the sound of your tinnitus changed?
 - No
 - Yes
 - Not sure
 - IF YES: How is it different?
-

Question 11

- Has the location of your tinnitus changed?
 - No
 - Yes
 - Not sure
 - IF YES: How is it different?
-

Question 12

- Has the loudness of your tinnitus changed?
 - No
 - Yes, louder now
 - Yes, quieter now
 - Not sure

Question 13

- Has the amount of time your tinnitus is present changed?
 - No
 - Yes, more often
 - Yes, less often
 - Not sure

Counseling the Patient Who Has Ototoxicity-Induced Tinnitus

- Counsel as for sudden-onset tinnitus
 - Explain to patient lability of tinnitus during first 3-6 mo—don't assume permanence unless persistent for about 6-12 mo
 - Counsel to take precautions to minimize tinnitus
 - Critical to allay fears
 - Don't say “nothing can be done—learn to live with it”
 - Full treatment may not be necessary
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If Treatment for Tinnitus Becomes Necessary

- Tinnitus Masking
- Tinnitus Retraining Therapy
- Cognitive-Behavioral Therapy
- Audiologic Tinnitus Management