Audiology**Online**

Tinnitus Assessment in Young Musicians

Presented by:

Frank Wartinger, Au.D.

Moderated by:

Brian Fligor, ScD Instructor, Otology and Laryngology, Harvard Medical School Director of Diagnostic Audiology, Children's Hospital Boston

AudiologyOnline

Tech Support: 800.753.2160

Tech Support: 800.753.2160

TECHNICAL SUPPORT

Need technical support during event? Please contact us for technical support at 800-753-2160

CEUs

CEU Total Access members can earn continuing education credit for participation in this course. Be sure to take the outcome measure following course completion to earn your CEUs, or contact us for more information or assistance: **800-753-2160**

Expert e-Seminar

AudiologyOnline

Tech Support: 800.753.2160

Noise-Induced Hearing Loss Webinar Series 2013

Acceptable Strategies for Prevention of Noise- and Music-Induced Hearing Loss Brian J. Fligor, ScD

Tinnitus Assessment in Young Musicians Frank Wartinger, AuD

Food for Thought: Nutrition and Noise Christopher Spankovich, AuD, PhD, MPH

Otoprotective Agents for Prevention of Acquired Hearing Loss in Humans

Colleen G. Le Prell, PhD

www.audiologyonline.com/nihl2013

Tinnitus Assessment in Young Musicians

Frank Wartinger, Au.D. All Children's Hospital Tampa, Florida

Young Musicians

Musicians who are also young...

1) 'Young' – under 18 years

2) 'Musician' - one who participates in music

Young Musicians

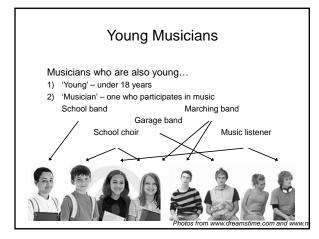
Musicians who are also young...

1) 'Young' - under 18 years

- 2) 'Musician' one who participates in music
- School band Marching band

Garage band School choir Music listener

Photos from www.dreamstime.com and www.n





Why talk about youth?

- Tinnitus in youth is under reported and poorly understood
- Children are at high risk for intense and sustained sound exposure
- · Medical-legal issues with minors
- Limited education/exposure
- Psychosocial aspects
- Invincible youth



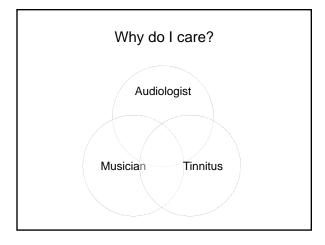
Why talk about musicians?

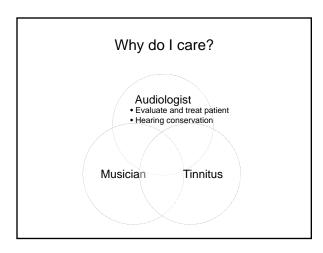
- Cultural sensitivity training for musicians
- Emphasis on hearing/listening acuity
- Musicians are at high risk for intense and sustained sound exposure
- Unregulated industryLimited education



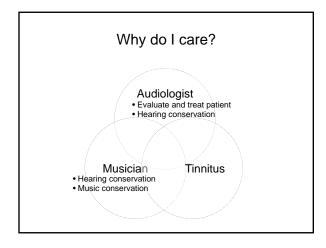




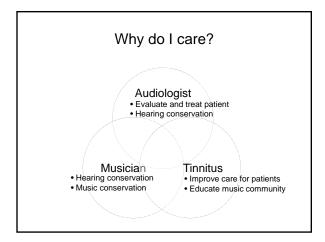


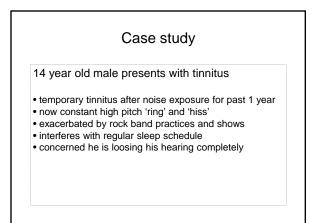












5

Case study

14 year old male presents with tinnitus

- First Audiology visit: Hearing "within normal limits"
- Musician's Earplugs recommended
 Impressions taken and plugs mailed home
- return if issues with plugs

Case study

Discussion points:

No measurement of patient distress
 "Within normal limit" hearing is NOT a sufficient answer for a young aspiring musician

Discussion points:

- 1. No measurement of patient distress
- 2. "Within normal limit" hearing is NOT a sufficient answer for a young aspiring musician

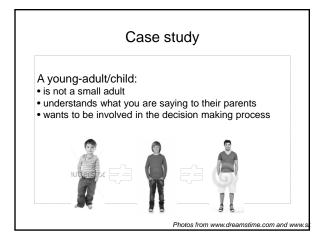
Case study



Case study

Discussion points:

- No measurement of patient distress
 "Within normal limit" hearing is NOT a sufficient
- answer for a young aspiring musician 3. Hearing conservation does not START with ear
- Plugs, especially for musicians
 No fitting verification or instructions for attenuation use (plugs mailed home)



Tinnitus

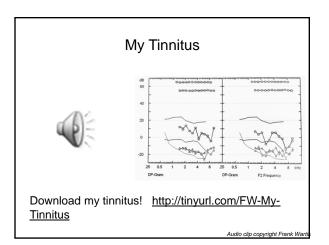
A perceived sound (ringing, buzzing, hissing, etc) that cannot be attributed to an external stimuli

- Phantom auditory perception (Jastreboff, 1990)
- Commonly perceived in sustained quiet
 - 94% (Heller and Bergman, 1953)
 - 64% (Tucker et al, 2005)
- 10-25% report clinical significant tinnitus (dependent on age, location, and clinical definition)
- · Noise exposure is the most common cause

Presentations of Tinnitus

- Transient "spontaneous" tinnitus (TST)
- Temporary & TTS (Temporary Threshold Shift)
- Chronic
 - High pitched ringing (tonal)

 - Buzzing (multi-tonal)
- Medically significant
 - Unilateral, pulsatile, low pitched, correlated symptoms



Tinnitus Effects

Emotional distress – tinnitus perceived as threat to health, career, quality of life, etc (Hallam et al, 1988)

Cognition – reduced capacity for voluntary, conscious, effortful, and strategic control (Rossiter et al, 2006)

Attention – impaired selective and divided attention (Stevens et al, 2007; Eronlein et al, 2007)

Sleep disturbances – direct response to perception of tinnitus or unrelated stress-induced insomnia (Ramkumar and Rangasayee, 2010)

Neurophysiologic origins

- Jastreboff, Hazell and Graham (1994) described a neurophysiologic model of tinnitus pathogenesis involving reorganization of central auditory pathways and changes to sensory-modulated parts of the limbic system
- Peripheral hearing loss causes reorganization of cortical tonotopic map (overrepresentation of edge frequencies) (Rajan and Irvine, 1998)
- Muhlau (2006) demonstrated structural brain changes on MRI in patients with tinnitus
 - Gray-matter decrease in subcallosal area
 - Gray-matter increase in the auditory thalamus
- Roberts, et al (2010). Ringing Ears: The Neuroscience of Tinnitus. J. Neurosci. 30(45)

HYPERACOUSIS

Discomfort when exposed to a sound that would not evoke a similar reaction in an average listener. Physical characteristics of the sound are the only modulating factor.

MISOPHONIA A "hatred of sound" modulated by the patient's previous experience and the presentation context.

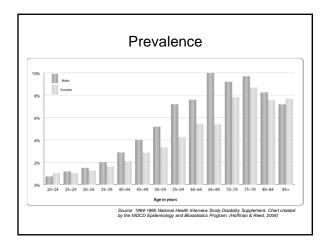
- Commonly concurrent with tinnitus
- Exacerbation of tinnitus is a common reason for avoidance of loud noises or specific sounds
- May limit a musician's enjoyment of certain musical situations

Jastreboff , M., Jastreboff , P.J. (2002). Decreased sound tolerance and Tinnitus Retraining Therapy (TRT). Australian a New Zealand Journal of Audiology, 24(2): 74-84

AURAL DISTORTIONS

Artifact, distortion of intensity growth, or 'frequency splatter'. Usually heard with high inputs and often unilateral.

- Commonly reported concern by musicians, particularly mixing engineers
- Motivation for softer music situations (quieter mixing levels or switching to an acoustic setup)





| | Tinnitus in Children |
|---------|---|
| 97% | 3rd graders self-reported hazardous sound exposure (n=273) (Blair et al, 1996) |
| 60%-85% | young people report tinnitus after loud music exposure without other audiologic complaints (Gilles 2012) |
| 79% | children with tinnitus reported sleep difficulties (Kentish et al, 2000) |
| 17.1% | 13 - 19 year olds have noise sensitivity (Widen & Erlandsson 2004) |
| 16.7% | 12-18 year olds with noise-induced threshold shift (Henderson et al 2011) |
| 16% | 12 – 18 year olds listen to music players at levels >NIOSH (Martin et al 2008) |
| 8.7% | 13 – 19 year olds have permanent tinnitus (Widen & Erlandsson 2004) |
| | |

Tinnitus in Children

- 6% 55% of normal hearing children and 25% 66% of hearing impaired children have tinnitus, depending on study (Nodar and Lezak, 1984; Graham and Butler, 1984; Stouffer et al, 1992; Baguley and McFerran, 1999)
- Common concern for parents and children is that tinnitus perception is a sign of hearing loss, worsening of established hearing loss, sign of mental health or catastrophic health problem (Sketye and Kennedy, 2009)
- Children complain less and are more tolerant of ailments
- Neural plasticity and natural coping methods may cancel out limited cognitive habituation ability





Assessment of Tinnitus

IMPAIRMENT - dysfunction of auditory system – Audiological testing (thresholds, loudness discomfort, etc) – Psychoacoustic measures (pitch, loudness, masking, etc)

DISABILITY - reduced abilities (activity limitation) on an individual to function in normal manner as a consequence of the tinnitus impairment – Iowa Tinnitus Questionnaire

- Beck Depression Inventory

- Beck Youth Inventory

HANDICAP - psychosocial manifestations of impairment and disability that result in the need for extra effort and reduced independence – THI, TRQ, TFI

Assessment of Tinnitus

Interview

Time and nature of onset Progression of severity Aural description Lateralization Perceived cause Emotional impact Exacerbating factors Relieving factors Noise history Medications Familial history Effect on sleep Effect on hearing Effect on concentration Effect on relationships

Adapted from AAA Audiologic Guidelines for the Diagnosis & Management of Tinnitus Patients (2000)

Assessment of Tinnitus

Interview

- Different wording for youth
 - » Do you ever hear noises or sounds in your ears? » What do you call them?

 - » What makes them go away, or get better? » What do you do when you hear them?
 - » How do the sounds make you feel?
- Draw me a picture of your tinnitus
- · Identify parental worries as well as patient worries » How is tinnitus affecting life at home and at school

Clinical evaluation of tinnitus

Audiologic Evaluation

- Comprehensive audio
- Thresholds, Speech discrim., MCL, LDL, QuickSIN Otoacoustic Emissions •
- Transient Evoked and Distortion Product (at least to 8k Hz) Psychoacoustic measures
 - Pitch matching
 - Loudness matching
 - Minimum masking level
 - Residual inhibition

Clinical evaluation of tinnitus

TRQ - Tinnitus Reaction Questionnaire - Wilson et al, 1991

Screening instrument that distinguish tinnitus sufferers who cope with the problem from those who do not cope well, and as a measure of psychological distress before and after treatment.

- » 25 items in one total score (no subcategories)
- » responses on 5 point scale

| Name | | Don | e Complet | led. | | |
|--|------------------------|----------------------------|------------------------|--------------------------|-------------------------|------------------------------------|
| This questionnaire is designed to find out what sor your lifestyle, general well-being, etc. Some of the some may not. Please answer <u>all</u> questions by cir <u>reflects</u> how your tinnitus has affected you <u>over 1</u> | effects i cling the | below ma number | ay apply | to you, | _ | unhappy. |
| / | Not as | A little of the time | Some of the time | A good deal of the | Almost all of the | feel tense. |
| 1. My timitus has made no unhoppy. | 0 | 1 | 2 | 3 | time 4 | feel irritable |
| 2. My tinnitus has made no feel tonse. | 0 | 1 | 2 | 3 | 4 | idel intable. |
| 3. My tranitus has made no losi initiable. | 0 | 1 | 2 | 3 | 4 | |
| 4. My truthus has made no losi angry. | 0 | 1 | 2 | 3 | 4 | feel angry. |
| 5. My tinnitus has led me to cry. | 0 | 1 | 2 | 3 | 4 | ioor angry. |
| 6. My tinnitus has led me to avoid quiet situations: | 0 | 1 | 2 | 3 | 4 | |
| My tinnitus has made me feel less interested in going out. | 0 | | | 3 | 4 | cry. |
| 8. My tinnitus has made me feel depressed. | 0 | 1 | 2 | 3 | 4 | |
| 9. My tinnitus has made me feel annoyed. | 0 | 1 | 2 | 3 | 4 | |
| 10. My tinnitus has made me feel confused. | 0 | 1 | 2 | 3 | 4 | |
| 11. My tinnitus has "driven me crazy". | 0 | 1 | 2 | 3 | 4 | / |
| 12. My tinnitus has interfered with my enjoyment of life. | 0 | 1 | 2 | 3 | 4 | |
| 13. My tineitus has made it hard for me to concentrate. | 0 | 1 | 2 | 3 | ~ | interfered with my ability to work |
| 14. My tinnitus has made it hard for me to relax. | 0 | 1 | 2 | | 4 | interiored with my dointy to work |
| 15. My trinitus has made me feel distressed. | 0 | | \sim | 3 | 4 | |
| 16. My trivitus has made me feel helpless. | 0 | ~ | 2 | 3 | _ | |
| 17. My timitus has made mo feel hash also alth Pinge. | | | سفسها | - , | 4 | |
| 18. My tinnihus has interfaced with my ability to work. | 0 | | 2 | 3 | 4 | |
| 19. My tinnitus has led me to despair. | 0 | 1 | 2 | 3 | 4 | |
| 20 My trivitus has led me to avoid noisy situations. | 0 | 1 | 2 | 2 | - | |
| 21. My tinnitus has led me to avoid social situations. | 0 | 1 | 2 | F 3 | 4 | led me to think about suicide |
| My tinnitus has made me feel hopeless about the future. | 0 | | 2 | 3 | 4 | iou nio to think about Saloide |
| 23. My trinitus har interfered with my slong. | 0 | 1 | 2 | 3 | 4 | 1 |
| 24. My tinnitus has last me to think about succide | 0 | | 17 | 3 | 4 | |
| 25. My trivitus has made me feel panicky. | 0 | 1 | 2 | 3 | 4 | |
| 26. My tranitus has made me feel tormented. | 0 | 1 | 2 | 3 | 4 | |
| Total | | | William et | | | |

| |
|------|
| |
| |
| |
| |
| |
| |

Questionnaires with Youth

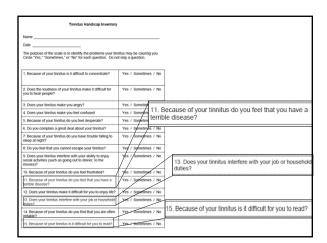
- Discussion of Suicide
 - TRQ specifically addresses
 - Appropriate referrals must be ready
 - Legal implications of answer from a minor
 - Parental access to medical records
 - HIPAA Privacy Rule <u>www.hhs.gov/hipaafaq/personal/index.html</u>
 - Negative ideation / power of suggestion

Clinical evaluation of tinnitus

THI – Tinnitus Handicap Inventory – Newman, Jacobson & Spitzer, 1996

> Self-report tinnitus handicap measure that can be used in a busy clinical practice to quantify the impact of tinnitus on daily living.

- » 25 items in 3 subcategories:
- functional, emotional, and catastrophic
- » Response in three levels
- yes = 4 sometimes = 2 no = 0



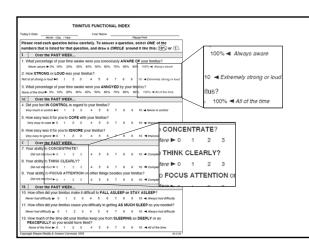
TFI - Tinnitus Functional Index – University of Oregon, 2008; Meikle et al., 2011

> Systematic focus on responsiveness resulting in larger effect size for detecting change in severity rating.

 Items relating to the THI Catastrophic subscale (suicide, despair, and fear of having a terrible disease) were omitted as these negative ideations may create feelings of negativity prior to treatment or evaluation. (*TFI 2013 Starkey Blog*)

» 25 items in 8 subcategories

» Response of 0 - 10 (0% - 100% in some sections)





| | NITUS FUNCTIONAL INDE | _ | _ | _ | | Ē | | | | | | | | | | | | 4.04 | 2 |
|--|--|---|---|---|---|--|---|--------------|--------------------------------|-------------------------------|---------------------------|---------------------|--|------------------|------------|------------------|---------------|------------------|----------|
| | ease read each quest umbers that is listed for | | | | | | | | | | | | | | | | | 1 | |
| A | Over the PAST WEF | | | | | Ę | Die | _ | _ | | | ~~~~ | | - | | | Com | | H |
| ^ | your tinnitus interfe | | | | nas | | | a no erfe | | | | | | | | | | rfer | |
| 1 | . Your ability to HEAR | CLE | ARL | r? | | | 0 | | < | 2 | 3 | 4 | 5 | | 6 7 | | 5 5 | | 10 |
| 14 | . Your ability to UNDER are talking? | RSTA | ND | PEO | PLE | who | 0 | , | 1 | Го | a | ns | we | er | a | que | est | lo | n, |
| 1 | Your ability to FOLLO in a group or at me | | | ERS | ATIC | NS | 0 | 1 | 1 | d | ra | W | a (| CI | RC | LE | 5 a | ro | u |
| R | Over the PAST WEE your tinnitus interference | | | | has | | | d no erfe | | | | | | | | | Com inte | pleti rfer | |
| 1 | . Your QUIET RESTIN | G AC | TIVI | TIES | ? | | ò | , | 1 | 2 | 3 | 4 | 5 | | 6 7 | 8 | 5 5 | | 10 |
| 1 | . Your ability to RELAX | (? | | | | | 0 | , | 1 | 2 | 3 | 4 | 5 | , | 6 7 | | | | 10 |
| 11 | 8. Your ability to enjoy " | PEAG | CE A | ND (| UIE | T "? | 0 | , | 1 | 2 | з | 4 | 5 | , | 5 7 | | | | 10 |
| 0 | Over the PAST WEE | | | | | - | 0 | 4 | | - | - | | | - | | | | | _ |
| | | | | | | | | | | | | | | | _ | | <u></u> | | |
| × | your tinnitus interfe | | | tir | ni | tu | s (| 22 | au | IS | e | vc | bu | t | o I | na | ve | C | lif |
| | | red v | vith | | | | | | | | | | | | 0 1 | | | | |
| 11 | your tinnitus interfer | ocia | vith L A | | | | | | | | | | | | o I sc | | | | |
| 11 | your tinnitus interfer | DCIA | vith L A FE? | 10 | m | e 1 | | | | | | | | | | | | ١v | |
| 11 22 2 | your tinnitus interfei 2. Your enjoyment of SC 3. Your ENJOYMENT C 1. Your RELATIONSHIE and other people? 2. How often did your tar | ocia DCIA DF LII PS w | vith L A FE? In fa | nily, | friend | e I ds | na ° | uin uin | nt , | 2 2 | na 3 | | 00 5 11 W |), 08 | SC K OF | h(| 00 | ١v | V |
| 11 22 2 | your tinnitus interfei 9. Your enjoyment of SC 9. Your ENJOYMENT O 1. Your ERLATIONSHIP and other people? 2. How often did yout the TASKS, such as ho | ocia of Li PS with me n | vith L A FE? In fa | nily, nily, nan | friend | e I ds | na ° | uin uin | nt , | 2 2 | na 3 | | 5 5 27 W 21 W | 9, 08 | SC s | h(| DO HER | V | vc ° |
| 11 22 22 | your tinnitus interfei 9. Your enjoyment of SC 9. Your ENJOYMENT C 1. Your RELATIONSHII and other people? 2. How often did your tir TASKS, such as ho Never had difficulty | ocia of Li PS with me m 0 | vith L A FE? In fa | nily, | friend | e I ds | na ° | uin uin | nt , | 2 2 | na 3 | | 5 5 27 W 21 W | 9, 08 | SC K OF | h(| DO HER | V | vc ° |
| 11 22 22 E | your tinnitus interfet 9. Your enjoyment of SC 9. Your ENJOYMENT C 1. Your RELATIONSHIP and other people? 1. How often did your tit TASKS, such as Never had difficulty Over the PAST WEE | red v DCIA DF LII PS v Initus mo n 0 K | vith L A FE 7 th fa L cau value | nily, nan | friend to to to ce, co | ds have have | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2010 2010 | nt 1 y pe ar ca | e 2 setor sting 7 | 3 mine tor | | 5 5 27 W 21 W | 9, 08 | SC s | h(| DO HER | V | vc ° |
| 11 21 2 2 E | your tinnitus interfet 9. Your enjoyment of SC 9. Your ENJOYMENT C 1. Your RELATIONSHIE and other people? 1. How often did your tie TASKS, such as Never had difficulty Cover the PAST WEE 8. How ANXIOUS or W Net al al anxiese or b | ocia of Li PS w mentus mentus ocia | vith L A FE 7 th fa L cau value | nily, nan | friend to to to ce, co | ds have have | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 2010 2010 | nt 1 y pe ar ca | e 2 setor sting 7 | 3 mine tor | | 5 5 27 W 21 W | 0R 0F | | | HER | Tour | vc ° |
| 11 2 2 2 2 2 | your tinnitus interfet). Your enjoyment of SC). Your ENJOYMENT O). Your RELATIONSHIE and other people? 2. How often did your bit TASKS, such as how Never had difficulty b Over the PAST WEE 8. How ANXOUS or WU Not at all anxious or b worred | ored v DCIA DF LII PS where and a me a o iK ORRI 0 | vith L A FE : in fa i cau vainte 1 ED I 1 | nily. 10 10 10 10 10 10 10 10 10 10 10 10 10 | friend to to to ce, co 3 | ds have shool 4 nnitu 4 | o diffice s ma s | | y pe or ca 6 you 6 | 2 setor rinc 7 | na mine p for #? | 4 g you chike | s with Without | 0R 0F | | h(| HER | Tour | vc ° |
| 11 2 2 2 2 2 | your tinnitus interfet Vour enjoyment of SC Vour ENJOYMENT C Vour ELLATIONSHIT And Other people? El How And Court TASKS, such as its Never had filted by Never had filted by Cover the PAST WEE Over the PAST WEE Cover | red v DCIA DF LI PS w me n 0 IK 0 RRI 0 UPSI | vith L A FE : in fa i cau vainte 1 ED I 1 | nily, mily, inan 2 nas y 2 xve y | friend to to to ce, co 3 | ds have shool 4 nnitu 4 | o diffice s ma s | | y pe or ca 6 you 6 | 2 setor rinc 7 | na mine p for #? | 4 g you chike | s with Without | 0R 0F 0 10 | | | | ficul ficul | v(|
| 11 22 22 22 22 22 22 22 22 22 22 22 22 2 | your tinnitus interfet Vour enjoyment of SC Vour ENJOYMENT C Vour ENJOYMENT C Vour ENLATIONSHIT How of the dd you the New hard attitude New hard attitude New hard attitude Net at all answards How BOTHERED of Not at all otherward or search New BOTHERED of Not at all otherward or Search | red v DCIA DF LI PS w me n 0 XK 0 UPSI 0 | vith L A FE 7 in fa i cau vainté 1 ED 1 1 ET hé 1 | nity, se yc, snan 2 as y 2 xve y 2 | friend au to 1 20, 50 3 our ti 3 ou be 3 | e f ds have shool 4 en t 4 | o diffic work 5 s ma 5 ecau 5 | de ise | y pe of you of y | 2 setor rinc 7 | na mine p for #? | 4 g you chik | s with the second secon | 0R 0F 0 10 | | h(a) aya/ | | ficul ficul | v(|
| 11 22 22 22 22 22 22 22 22 22 22 22 22 2 | your tinnitus interfet Vour enjoyment of SC Vour ENJOYMENT C Vour ELLATIONSHIT And Other people? El How And Court TASKS, such as its Never had filted by Never had filted by Cover the PAST WEE Over the PAST WEE Cover | red v DCIA DF LI PS w men n 0 IK 0 RRI 0 VPSI 0 0 VPSI 0 0 | vith L A FE 7 in fa i cau vainté 1 ED 1 1 ET hé 1 | nity, se yc, snan 2 as y 2 xve y 2 | friend au to 1 20, 50 3 our ti 3 ou be 3 | e f ds have shool 4 en t 4 | o diffic work 5 s ma 5 ecau 5 | de ise | y pe of you of y | 2 setor rinc 7 | na mine p for #? | 4 g you chik | s with the second secon | 0R 010 10 | | | HER Not of | ficual invest | vc ,, |



| Clinical evaluation of tinnitus | | | | | | | | | | | |
|---------------------------------|-------------------------------|---------------|---|--|--|--|--|--|--|--|--|
| Survey | Responses | Subscal es | Scoring | | | | | | | | |
| TRQ | 0 - 4 scale | 0 | Total score 0 – 104 > 17 = Significant 60 = 90 th percentile 72 = 95 th percentile | | | | | | | | |
| THI | 3 tiers | 3 | Total score 0 - 100 0 - 16 = no handicap 18 - 36 = mild handicap 38 - 56 = moderate handicap 58 - 100 = severe handicap | | | | | | | | |
| TFI | 0 – 10 scale (variable) | 8 | Total score 0 - 100 < 25 = mild tinnitus 25 - 50 = significant problems > 50 = severe | | | | | | | | |



Using questionnaires with Youth

- No child/youth specific questionnaire developed
- Normative data may not translate to children
- Not valid for pre-treatment/post-treatment outcomes?
- Test-taking mentality
 - Not a quiz

 - Won't be graded
 No right or wrong answers

Youth Attitude Toward Noise Scale (YANS)

- Gilles et al, 2012
 - influence of permanent/transient tinnitus after loud music
 - attitudes toward noise
 - influence of peers
 - ability to manipulate hearing protection (HP)

Gilles, et al. (2012). Prevalence of leisure noise-induced tinnitus and the attitude toward noise in university students. Otology & Neurotology. 33:899-906

Clinical evaluation of tinnitus

Questionnaires with Youth

- "Negative Affect"
 - influence the results on all self-report measures (Watson & Pennebacker, 1989)
 Pure measures of negative affect (Beck Youth Inventory) may help explain
- the patient's self-reported tinnitus distress score. (Baguley, 2003)

 Allure of disaster
- Longing for tragedy or excitement (heroicism, risk taking)
- Teenager "-tude"
 - 'I'm bored' 'school sucks, life sucks' 'whatever'

Conclusions

- TFI most kid appropriate, but most complicated form

 consider going 'off form' and verbally asking questions
 - If using questionnaires with catastrophic (suicide, depression, despair) questions, be ready with referrals ad legal action plan
- Not treating an adult, treating patient and family
- Hearing conservation for musicians
 - Starts with education, not ear plugs
 - Meet them half way and respect the culture
- Music conservation for Audiologists
 Save the musician and save the music

Thank You!

Time for questions?

References

Baguley, D.M., Andersson, G. (2003). Factor analysis of the Tinnitus Handicap Inventory. Am J Audiol. 12:31-34.

Filior, B.J., Cox, L.C. (2004). Output levels of commercially available portable compact disc players and the potential risk to hearing. Ear Hear. 25(6): 513-527.
Galster, J., Stevens, K. (2013). The Trinute structional Index (TFI): A new and improved way to evaluate tinnitis. StarkeyPro.com. Published 2/1/13 on Starkey Evidence Blog. Accessed on 5/20/13. •Gilles, et al. (2012). Prevalence of leisure noise-induced tinnitus and the attitude toward noise in university students. Otology & Neurotology. 33:899-906 .

Heller, M., Bergman, M. (1953). Tinnius aurium in normally hearing persons. Ann Otol. 62: 73-83.
 Holgers, K. & Juul, J. (2006). The suffering of tinnitus in childhood and adolescence. Int J Audiol. 45:267-272.

Jastreboff, M., Jastreboff, P.J. (2002). Decreased sound tolerance and Tinnitus Retraining Therapy (TRT). Australian and New Zealand Journal of Audiology. 24(2): 74-84.

Australia and refer Zealand Sources of Roundings (24): 14-04. Mastrebolf, PJ, 1990). Phantom audiony perception (tinnitus): mechanisms of generation and perception. Neuroscience Research. 8(4):221-254. •Jastrebolf PJ, Hazell J, WP, Graham R,L. (1994). Neurophysiological model of tinnitus: Dependence of the minimal masking level on treatment outcome. Hearing Research. 80 (2).

Kentish, R.C., Crocker, S.R., McKenna, L. (2000). Children's experience of tinnitus: a preliminary survey of children presenting to a psychology department. British J Audiol. 34:355:340.
Martin, et al. (2013). Randomized trial of four noise-induced hearing loss and tinnitus prevention interventions for children. Int J Audiol. 52:341-549.

References

•Meikle, et al. (2011). The Tinnitus Function Index: Development of a new clinical measure for chronic, intrusive tinnitus. Ear & Hearing, 32

Newman, C.W., Jacobson, G.P. & Spitzer, J.B. (1996). Development of the Tinnius Handicap Inventory. Archives of Otolaryngology Head and Neck Surgery. 122, 143-148.
Rejain, R., Invino, D.R. (1998). Neuroant responses across contical field A1 in plasticity induced by peripheral auditory organ damage. Audiol Neuroctol. 3:123-144.

•Ramkumar, V., and Rangasayee, R. (2010). Studying tinnitus in the ICF framework. Int J Audiol. 49:645-650.

Roberts, et al. (2010). Ringing ears: The neuroscience of tinnitus. The Journal of Neuroscience. 30(45). •Salvial, et al. (2013). The Tinnitus Handicap Inventory (THI) as a screening test for psychiatric comorbility in patiens with tinnitus. Psychosomatics. 54:248-256

 Shetye, A., Kennedy, V. (2009). Tinnitus in children: an uncommon symptom? Arch Dis Child. 95:645-648.
 Snow J., ed. (2004). Tinnitus: Theory and Management. Hamilton, Canada: BC Decker. Turker, D.A., Pullings, S.L., Ruth, R.A., Clayton, W.A., Royster, E., Todd, A.D. (2005). The effect of silence on tinnitus perception. Otolaryngology-Head & Neck Surgery. 132(1), 20-24
 Tyler R. S., e. (2000). Tinnitus handbook. San Diego (CA): Singular

•Wilson, et al. (1991). Tinnitus Reaction Questionnaire: Psychometric properties of a measure of distress associated with tinnitus. J Speech Hear Res 34: 197-201

•Zhao, et al. (2010). Music exposure and hearing disorders: An overview. Int J Audiol. 49:54-64

AudiologyOnline

Tech Support: 800.753.2160

Noise-Induced Hearing Loss Webinar Series 2013

Acceptable Strategies for Prevention of Noise- and Music-Induced Hearing Loss Brian J. Fligor, ScD

Tinnitus Assessment in Young Musicians Frank Wartinger, AuD

Food for Thought: Nutrition and Noise Christopher Spankovich, AuD, PhD, MPH

Otoprotective Agents for Prevention of Acquired Hearing Loss in Humans Colleen G. Le Prell, PhD

www.audiologyonline.com/nihl2013