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# Auditory/Vestibular/TBI Mini-Series: Effects of TBI on Auditory Processing, Vestibular Function, and Tinnitus

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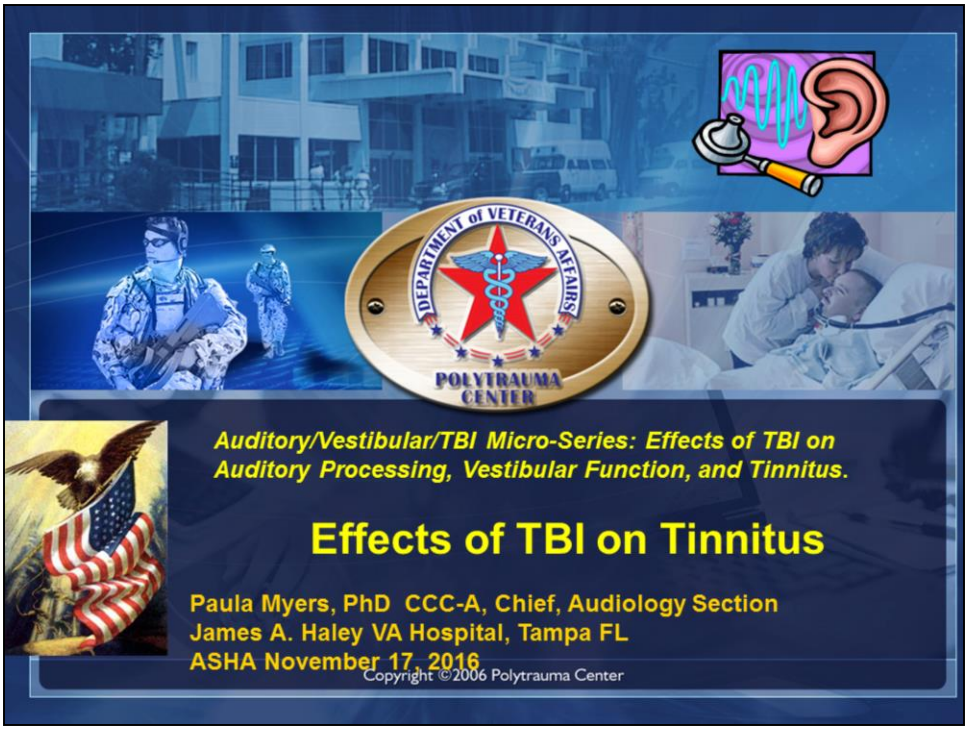


*Auditory/Vestibular/TBI Micro-Series: Effects of TBI on Auditory Processing, Vestibular Function, and Tinnitus.*

# Effects of TBI on Tinnitus

**Paula Myers, PhD CCC-A, Chief, Audiology Section**
**James A. Haley VA Hospital, Tampa FL**
**ASHA November 17, 2016**

# Disclaimer

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James A. Haley VA Hospital Polytrauma Center, Tampa FL

New facility features 56 private inpatient rooms and an aquatic center with a treadmill therapy pool.

This 170,000 square foot VA Rehabilitation Center for inpatient and outpatient care features modern award winning architecture, natural light, 56 private inpatient rooms, day rooms, a relaxing lobby and deck, and state of the art therapy areas. The new and enhanced family-oriented spaces, such as a family living room, multipurpose room, kitchen, and laundry are organized around an open "Town Center" atrium which also includes dining areas, children's area and computer lounge. The hospital is designed to support physical and emotional rehabilitation to assist patients' return to society in the wake of often traumatic experiences.

Polytrauma patient rooms will have televisions programmed with interactive software. Patients can access health information and watch movies, television or surf the Internet, all part of a move toward patient-centered care. Tracks are set into the ceilings that can lift and carry patients from their beds to an adjacent bathroom. Other rooms are designated to treat blind patients, a common result of blast injuries. Glass-walled community rooms overlook a basketball court and the putting green. The first floor of the facility has two

swimming pools. The smaller one has a treadmill and the larger one is big enough to roll in wheelchairs and float kayaks, with a wall of windows that can collapse to the outdoors.

Tampa, the nation's busiest polytrauma unit, has treated more than 1,000 such veterans since the program started there in 2004.

The James A. Haley Veterans' Hospital Polytrauma and Rehabilitation Center is the first stop on the road to recovery for many of our nation's wounded warriors, from injuries classified as polytrauma. One of only five facilities of its type in the U.S., it is designed to help veterans and service members readjust to society and reintegrate into the community in a patient-and family-focused facility that combines all of their rehabilitation needs in one place. The two-story addition was constructed on top of the existing Spinal Cord Injury Center (SCI) at the Tampa Veterans' Affairs Medical Center campus.

An integral part of the holistic rehabilitation and recovery process, the interior environment fosters healing by including features such as abundant light, natural vegetation and water features in a soothing  pallet—a design inspired by the colors and textures of the Florida landscape, representing freedom, strength and renewal.

Responding to a new type of patient requires new care models and a special facility adapted for this severely injured patient—forever transforming this care for our nation's heroes. In the inpatient unit, home-like, private patient rooms mimic the warmth and comfort of a house, while also including the extra room and patient lifts needed, and are grouped together in "neighborhoods" with "porches." Bringing the outdoors inside, patient and family spaces are designed to feel more residential and less institutional with light-filled day rooms, an atrium "town center" with storefronts and outdoor café seating, a "main street," complete with palm trees, and an exterior deck for patients and their families to socialize and relax.

The center helps veterans recover by providing inpatient and outpatient services, smaller staff-to-patient ratios with open and accessible nurse stations in each six-room patient neighborhood, and family and recreation spaces to ensure families are intimately involved in the patient's recovery. To make it convenient for the patient, doctors come together in the neighborhood to collaborate on treatment, rather than requiring wounded veterans to travel around the hospital for each treatment.

The Polytrauma Center includes 56 private inpatient rooms, a therapeutic climbing wall, an aquatic center including a treadmill therapy pool, a virtual reality simulation center and a private outdoor recreational courtyard that includes a multi-surface mobility training area, basketball court, and a putting green.


SATION & PENSION / AUDIOLOGY

# Magnitude of TBI & Tinnitus

## TBI Incidence

- 1.7 million Americans sustain TBIs every year with most having mild TBI

Centers for Disease Control and Prevention. (2014). *Traumatic brain injury in the United States: Fact sheet.* Retrieved from www.cdc.gov/traumaticbraininjury/get_the_facts.html.


McCrea MA. Mild traumatic brain injury and postconcussion syndrome. The new evidence base for diagnosis and treatment. New York (NY): Oxford University Press; 2008.

Centers for Disease Control and Prevention. (2014*). Traumatic brain injury in the United States: Fact sheet.* Retrieved from www.cdc.gov/traumaticbraininjury/get_the_facts.html.

## Tinnitus and TBI

http://leader.pubs.asha.org/article.aspx?articleid=2541708
Ortiz, C. (2016). The Tinnitus-Traumatic Brain Injury Link. The ASHA Leader, 21(8), 16-17

- Many people with TBI report a new & heightened awareness of "noise" …
- The healing process of TBI can lead to increased spontaneous firing rates in the auditory cortex, increased bursting events, & elevated activity within the inferior colliculus—all of which can exacerbate tinnitus perception.

..It may be more difficult for the brain to desensitize itself to auditory symptoms because of the reorganization occurring within the CNS. **Many people with TBI report a new & heightened awareness of "noise" & report new difficulties ignoring input.**

# Prevalence of Tinnitus

- 10-15% of all adults experience chronic tinnitus (ear related and non-ear related causes)

## Estimated Prevalence of TBI and Tinnitus in Veterans

- Estimates of 20% OIF/OEF/OND experienced a TBI (majority mTBI)
- 24.5 million Veterans
  - 3-4 million Veterans have tinnitus (or greater?)

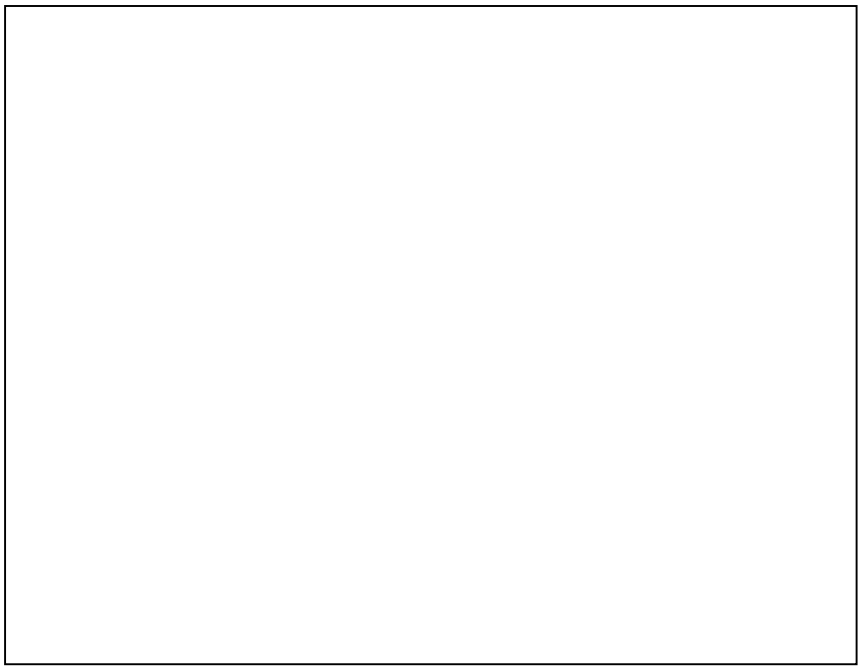
## TBI* is a Risk Factor for Tinnitus

**Common causes of TBI:**

- Motor vehicle crashes
- Sports
- Assaults
- Falls
- Gun shot wounds
- **Blasts**

**Tinnitus can occur not only as a consequence of the injury causing TBI, but also as a side effect of medications used to treat symptoms of TBI.*


In both civilians and Veterans, TBI is often associated with concurrent trauma to the auditory system. Clinical and epidemiological studies confirm that TBI is strongly associated with tinnitus. Medications add to the risk.



total of 839 titles/abstracts were reviewed for relevance by investigators trained in critical analysis of literature; 14 studies met inclusion criteria. Of these, 13 studies presented data on prevalence and 4 on risk/protective factors, respectively.

There were no included studies reporting on outcomes. Findings from this systematic review will help inform clinicians, researchers, and policy makers on future resource and research needs pertaining to hearing impairment and tinnitus in this newest generation of veterans.

| First Author, Year | Study Design/N | Rate Estimates |
|---|---|---|
| ***Population sample***<br><br>Helfer, 2005 | Retrospective medical records review of OIF Soldiers n=806 (2003-2004) (ICD-9-CM codes and V-codes from encounter data) | PTS 29.3%<br><br>Moderate or greater HL 15.8%<br><br>**Tinnitus 30.8%** |
| ***Restricted Samples (Injured SMs):***<br><br>Cave, 2007 | Retrospective review of **258 blast injured** tx at 1 facility (self-report and audiometric data) | HL 58%<br><br>**Tinnitus 49%** |
| Dougerty, 2013 | Retrospective review of **3,981 blast-injured** OIF personnel (ICD-9-CM codes) | HL 11.6%<br><br>**Tinnitus 6.1% new-onset**<br><br>*Hearing protection reduced the odds of ear injury involving tinnitus* |
| MacGregor, 2013 | Retrospective review of 992 PDHA of **injured Iraq SMs** | **Tinnitus 34.7% w/ mTBI**<br>**Tinnitus 17.9% no TBI** |

It is important to note that inner/middle ear injury involving tinnitus could be diagnosed based only on the presence of tinnitus following blast exposure. Given that tinnitus can occur from other causes, such as head injury or as a side effect of ototoxic medications [33–34], and that it can occur in conjunction with other ear injuries that may be difficult to diagnose in theater, some individuals may have been misclassified. Nevertheless, symptoms of tinnitus are one of the most commonly reported auditory complaints following blast exposure in both military and civilian populations [17,27,29], and because tinnitus may adversely affect hearing acuity and operational readiness [21], servicemembers presenting with tinnitus in theater should be periodically monitored for symptom persistence and improvement with audiometric measurements and clinical tinnitus assessments such as the Tinnitus Handicap Inventory [35] and the Tinnitus Handicap Questionnaire [36]. http://www.rehab.research.va.gov/jour/2013/506/dougherty506.html

| First Author, Year | Study Design/N | Rate Estimates |
|---|---|---|
| *Restricted Samples (injured SMs):*<br><br>Oleksiak, 2012 | Retrospective review of 240 **Veterans with mTBI** and hearing problems at 1 VA site. (questionnaire and audiograms) | Hearing problem self report of sample 87%<br><br>HL 32.4%<br><br>**Tinnitus 75.7%** |
| Ritenour, 2008 | Retrospective review of 436 **OEF/OIF SM WIA**, tx at 1 site(self-report of symptoms related to TM ruptures) | Self-reported HL 77%<br><br>**Tinnitus 50%** |
| Sayer, 2008 | Retrospective review of 188 **OEF/OIF pts tx at 4 PRC** (ICD-9-CM codes; FIM) | HL / Blast injury 48%<br>**Tinnitus/Blast injury 26%**<br>HL/No Blast 33%<br>**Tinnitus/No Blast 12%** |
| Wilk, 2010 | Retrospective medical record review of 4,383 OIF (06-07) AD and NG 3-6 mos postdeployment (**blast questionnaire**) | **Tinnitus/mTBI 34.4%**<br>Tinnitus/Blast LOC 15%<br>Tinnitus/No Blast LOC 22%<br>Tinnitus/Blast Altered state 17% |

**Prospective Associations Between Traumatic Brain Injury and Postdeployment Tinnitus in Active-Duty Marines**

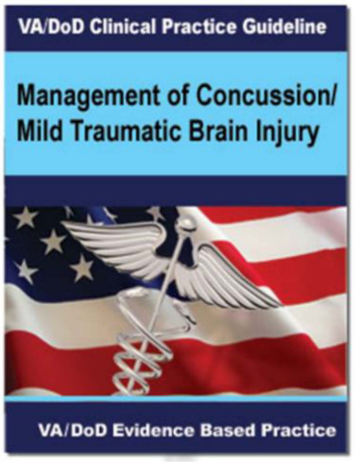
Yurgil, KA et J Head Trauma Rehabil. 2016 Jan-Feb;31(1):30-9.

- 1,647 active duty USMC & Navy SM completed pre & postdeployment assessments of Marine Resiliency Study.
- Conclusions: Participants who were blast-exposed, sustained multiple TBIs, & reported moderate-severe TBI symptoms were most at risk for new-onset tinnitus.

## VA/DoD Clinical Practice Guideline for the Management of Concussion-Mild TBI

Management of Concussion-Mild Traumatic Brain Injury Working Group. (2016)

- Update (2016) of VA/DoD 2009 Clinical Practice Guidelines on concussion & mTBI.

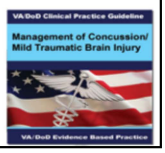



http://www.healthquality.va.gov/guidelines/Rehab/mtbi

The key questions investigated were specific to patients within the DoD/VA clinical setting; however, the evidence included patients managed outside these systems.

## …Tinnitus

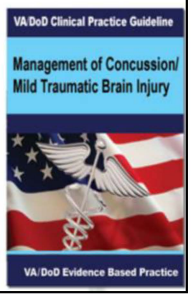
- **Tinnitus is a common problem among** the OIF, OEF and OND **Veterans & Service Members who have sustained an mTBI.** *Tinnitus can occur as a direct consequence of mTBI, but can also occur from other causes such as a side effect from medications used to treat other common symptoms associated with mTBI.*
- Recommendations: No evidence to suggest for or against the use of any particular modality for the treatment of tinnitus after mTBI.



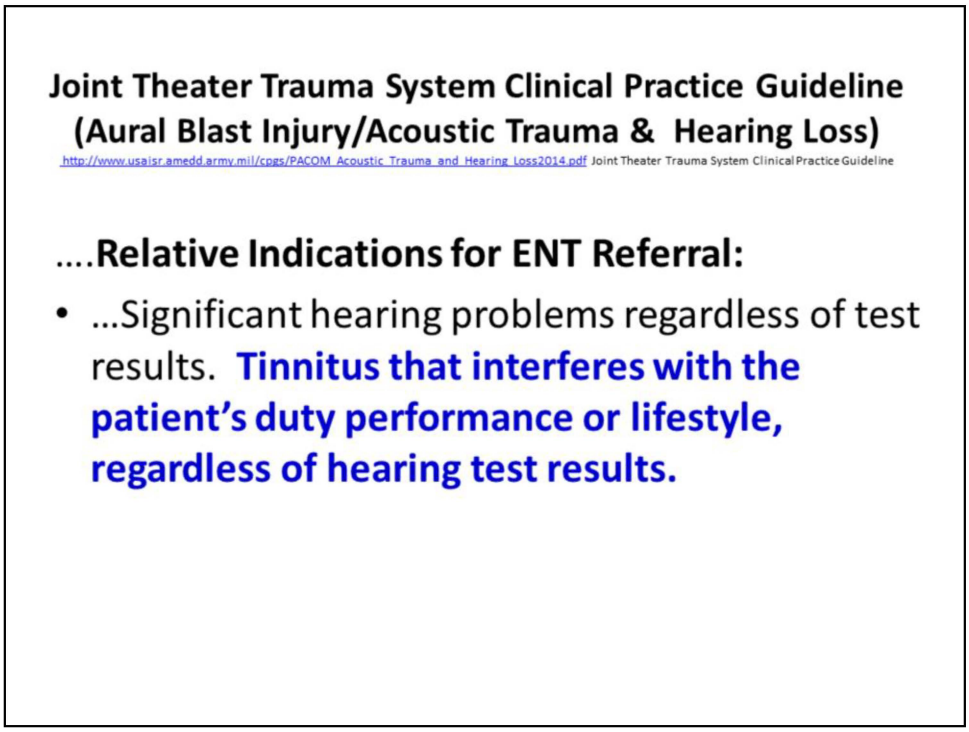

Oleksiak, 2012

## Tinnitus Discussion

- As a guide to treatment, there is no evidence to support or refute differentiating tinnitus after mTBI from tinnitus from other etiologies. However, the Work Group suggests short-term trial of tinnitus management (e.g., white noise generator, relaxation therapy) to assess individual's responsiveness to treatment.
- Refer to an audiologist as appropriate.

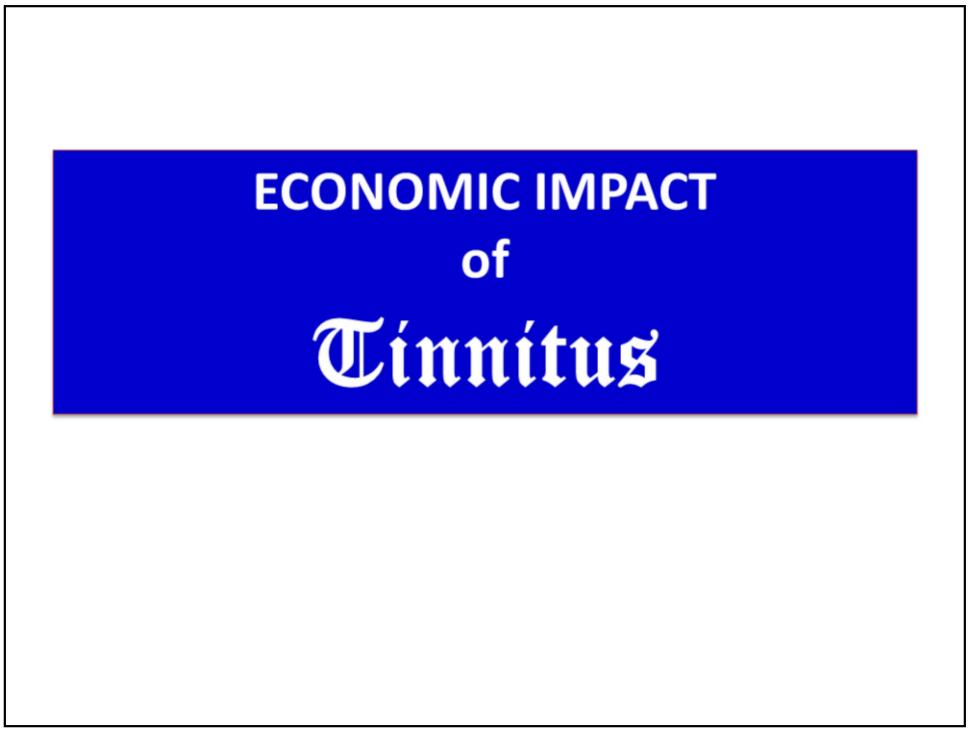



*"A prolonged course of therapy in the absence of patient improvement is strongly discouraged*." PTM recommends stepped approach and provide as much intervention as Veteran needs.




March 2012 made changes and Approved for PACOM DEC 2014

http://www.usaisr.amedd.army.mil/cpgs/PACOM_Acoustic_Trauma_and_Hearing_Loss2014.pdf



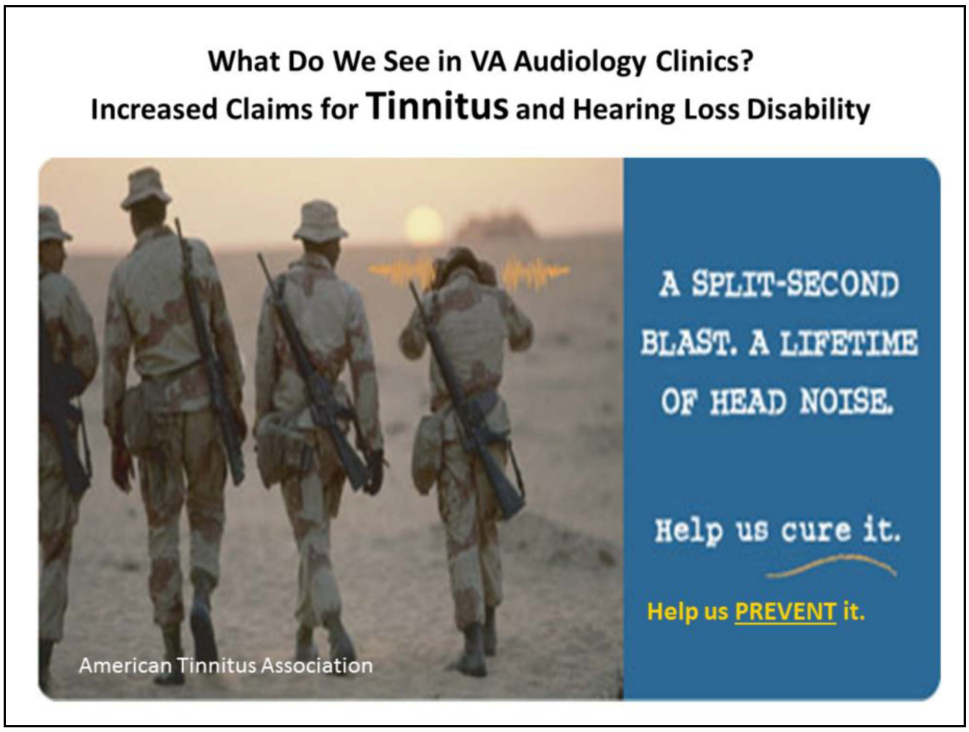

Tinnitus is a big problem for patients and the VA

**The Economic Impact Of Tinnitus**

The financial consequences of tinnitus are significant. Personal economic loss to an individual with tinnitus--including lost earnings, productivity, and health expenses--can be up to $30,000 annually. The cost to society as a whole has been estimated at upwards of $26 billion annually.

Some of the most accurate accounting of tinnitus monetary costs comes from the U.S. Veterans Administration.

The annual aggregate cost of these disability payments is over $1.5 billion. The estimated costs for delivering tinnitus-related healthcare services to these patients is much higher.




What Do I see Everyday in my clinic? Increased claims for tinnitus and HL disability. When you go on the ATA website you will see this image. I wrote in yellow “Help us Prevent It” as hearing conservation compliance efforts are still needed

## Tinnitus is #1 – *unfortunately*

- Tinnitus was the most prevalent service-connected (SC) disability for all Veterans receiving compensation. At the end of Fiscal Year (FY) 2015 **1,450,462** Veterans were SC for tinnitus.
- Tinnitus was also the most prevalent SC disability for Veterans who began receiving compensation during FY15 (**157,848** Veterans began receiving compensation for tinnitus during FY15).

http://www.benefits.va.gov/REPORTS/abr/ABR-Compensation-FY15-05092016.pdf

$0.5 B 2008

$1.0 B 2011

$2.0 B 2020

# HUMAN IMPACT
## of
## Tinnitus

## Tinnitus In The News (Military)…

33 year old Marine vividly recalls the incident that took both his legs while on combat patrol led by members of the Iraqi Army. "It was surreal. **The blast was so loud I couldn't hear anything except for the ringing in my ears.** My legs were literally blown off below my knee-I saw them lying on the road about 30 feet away from me."

Source: JAHVA Forum 2006 Year in Review

Even more so than the cost to government and our taxes, the cost of tinnitus on the QOL of Veterans can be profound. This patient was bothered more by his tinnitus than his loss of lower limbs.

## War Vets: Heroes and Hearing

Former Staff Sgt. Ryan Kelly, 27, **still carries the sounds of war with him even four years after his return home.**

*He experienced the concussive force of three IEDs exploding simultaneously in Baghdad.*

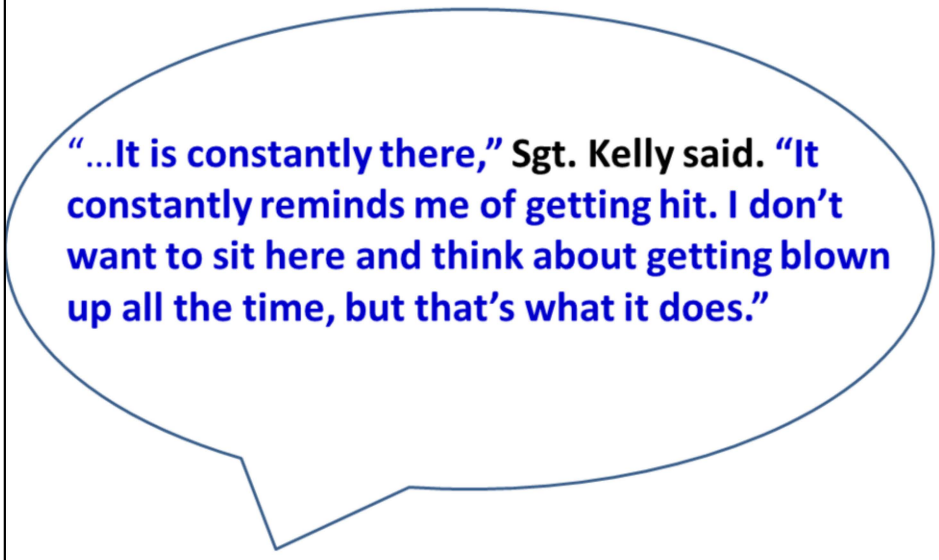
**"It's funny, you know, when it happened, I didn't feel my leg gone.** *[Kelly lost his leg below the knee]*

**...What I remember is my ears ringing.** Today, Staff Sgt. Kelly wears a prosthetic leg, but the **ringing in his ears [tinnitus] is still present. ..**

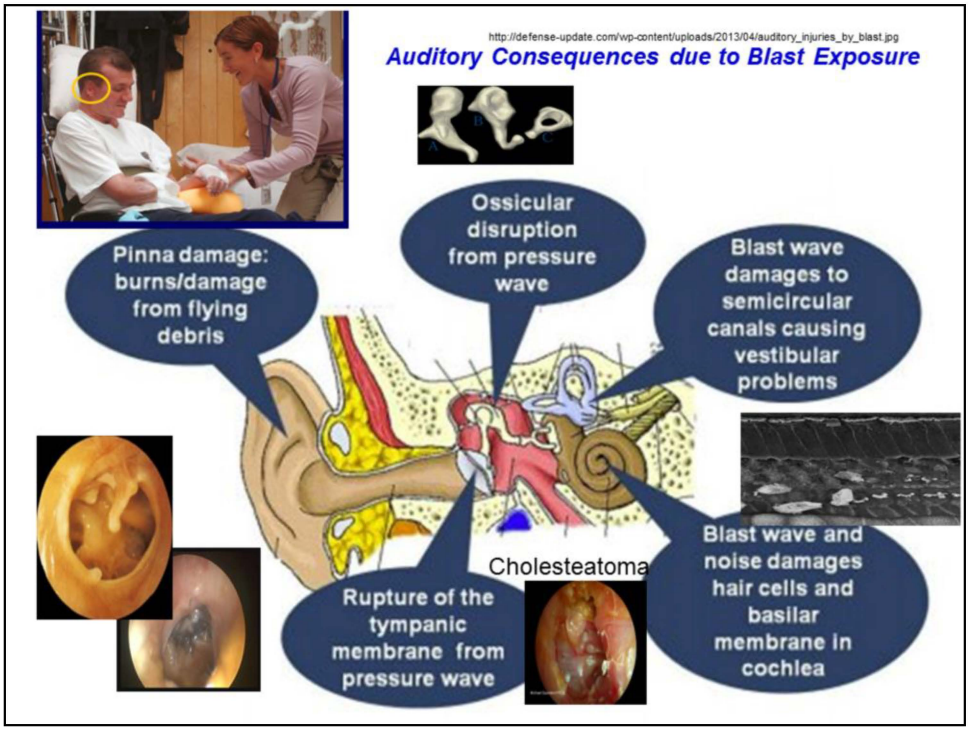
Source: 7/4/2008 HealthyHearing

This Healthy Hearing On Line Journal cited this Veteran who still carries the sounds of war with him even 4 years….

## War Vets: Heroes and Hearing (con't)




Source: 7/4/2008 www.healthyhearing.com


http://defense-update.com/wp-content/uploads/2013/04/auditory_injuries_by_blast.jpg
Auditory Consequences due to Blast Exposure
Pinna damage: burns/damage from flying debris
Ossicular disruption from pressure wave
Blast wave damages to semicircular canals causing vestibular problems
Cholesteatoma
Rupture of the tympanic membrane from pressure wave
Blast wave and noise damages hair cells and basilar membrane in cochlea


When TBI is blast-induced the onset of tinnitus is even more likely that tinnitus is typically under reported in these cases. A couple of studies support this statement. For blast injured patients at the Walter Reed Army Medical Center 49 percent reported tinnitus. In another group of blast injured patients at the Palo Alto VA Polytrauma Rehabilitation Center 38 percent reported tinnitus.

The issue of blast-induced tinnitus is so important that a special meeting was held in November of 2011 to address the subject, called the International State of Science Meeting on Blast-Induced Tinnitus. The meeting involved collaboration between the DoD Blast Injury Research Program Coordinating Office, the DoD Hearing Center of Excellence, and the Department of Veterans Affairs. There were 107 participants from 8 countries representing the DoD, VA, NIH, academia, medicine, and industry.

The objectives of the meeting were to assess current knowledge regarding cause, diagnosis and treatment of tinnitus, identify research gaps for further identification, or for further investigation, foster collaboration among researchers, and inform DoD research investment strategies. Proceedings from the meeting were published, which included major findings and priority recommendations for research.

Key research questions on blast-induced tinnitus were developed including, “What

are the clinical characteristics and co-morbidities of blast-induced tinnitus? Are there different sub forms of blast-induced tinnitus? How is blast-induced tinnitus associated with hyperacusis headache, depression, anxiety, and somatic modulation of tinnitus? How is blast-induced tinnitus related to other blast-induced symptoms? For example, migraines, memory impairment, or PTSD?"

Here's more questions, and these are only about half of the questions that were published. I'm not going to read through each one of these. There's many more, and they are available to read in the proceedings.

The final conclusion of the meeting was continued research and development are needed to resolve key barriers in the ability to effectively diagnosis and treat tinnitus, and thereby reduce the impact of tinnitus on the DoD and the VA.

## International State-of-the- Science Meeting on Blast-Induced Tinnitus

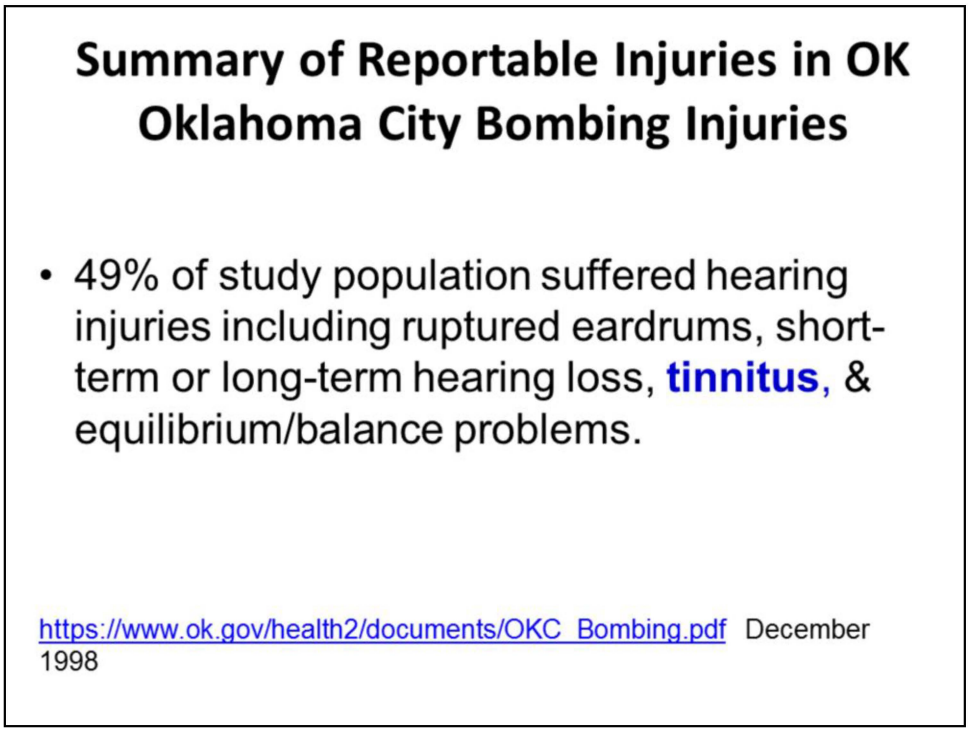
- Objectives : Assess current knowledge re: tinnitus, research gaps, & foster collaboration.
- Conclusion: **Continued research & development are needed to resolve key barriers in the ability to effectively diagnosis & treat tinnitus**, and thereby reduce the impact of tinnitus on DoD & VA.
- Proceedings published with findings & research priorities.

https://blastinjuryresearch.amedd.army.mil/docs/sos_tinnitus/01_Mr_Leggieri_SoS.pdf

Blast Injury And Auditory Dysfunction

# CIVILIAN IMPACT

## Alfred P. Murrah Federal Building
4/19/95




On April 19, 1995, the worst terrorist bombing in United States history occurred in Oklahoma when the Alfred P. Murrah Federal Building was bombed. On April 21, 1995, bombing injuries were declared reportable conditions for special study. The Injury Prevention Service (IPS) conducted an investigation of physical injuries associated with the bombing. As a result of this investigation, an OSDH registry was compiled that included information for 1,259 injured and uninjured persons who were *directly* exposed to the bombing. Persons involved in search and rescue efforts were excluded. Additionally, in October 1996, the IPS began a follow-up study of Oklahoma City bombing survivors to collect further information about the causes of bombing injuries, long-term health problems, and medical costs associated with the bombing.

## Lessons Learned from Oklahoma

One-Year Audiologic Monitoring of Individuals Exposed to the 1995 Oklahoma City Bombing (Van Campen et al; J Am Acad Audiol 10 : 231-247 (1999)

- **Averaging across quarters to summarize the year of 55 subjects, 68 % reported post blast tinnitus.**
- Counsel patients recovery is *limited after months*.
- Advance discussion about possibility of management devices can enhance later acceptance.
- 1 year f/u advised.

Luann E. Van Campen,
J. Michael Dennist
Renee C. R. Hanlin'
Sandra B. King'
Amy M. Velderman'-

55 subjects (67%) had tinnitus (99 ears).

Auditory status of the group was significantly compromised and unchanged at the end of 1-year postblast .

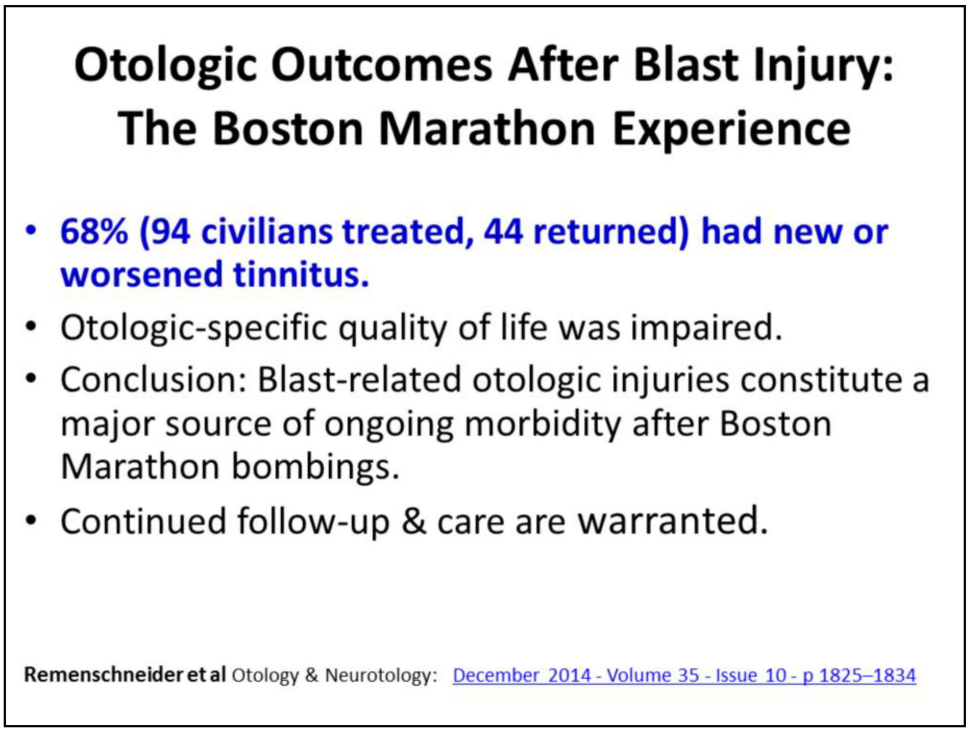

Second explosion
About 12 seconds after the first explosion, 50-100 yards away
First explosion
Approx. 2:49 p.m. near the Boston Marathon finish line
FINISH LINE
Course direction
Boston
Boston MA Bombing 4/15/13

# Tinnitus In The News (Civilians)…


Source: http://news.wgbh.org/post/boston-marathon-bombing-survivors-deal-lingering-invisible-injury-tinnitus (accessed 10/31/16)

4/15/13 Boston Bombing; WACO 4/17/13; Oklahoma bombings 4/19/95


In order for music therapy to work, he had to get the software to identify the sound he hears.




Remenschneider et al (2014)

94 civilians; 44 returned both initial and 6 month f/u evals

**90% hospitalized had TM perfs**

**--38% spontaneously healed**

**80% decreased hearing**

**30% immediate hyperacusis**

**18% delayed dizziness at 6 mo f/u**

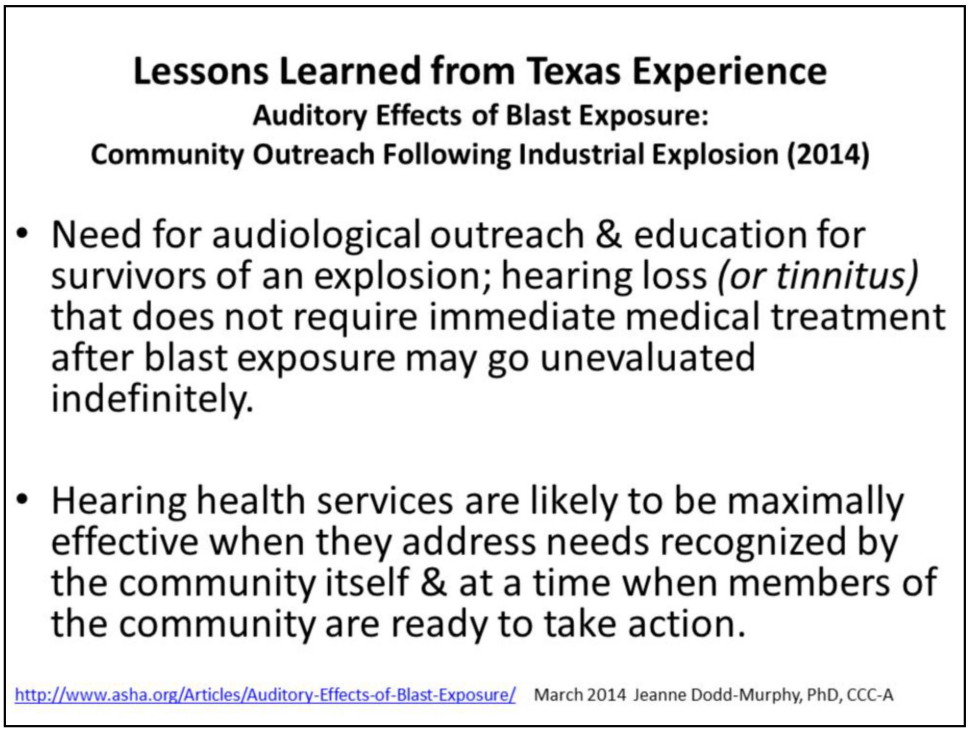
**68% new or worsened tinnitus**


http://www.nydailynews.com/news/national/explosion-hits-fertilizer-plant-north-waco-texas-article-1.1319844

## Dallas Morning News 4/12/14
## (West Fertilizer Company, Waco TX)

- "We need to know about all the injuries & not just the ones that showed up at the ER," said Dr. B. Holland, ENT. "No one's given really any structure to be able to report that."

- His practice treated 50 blast survivors. "About half did not go to a hospital after the blast. **"Some have tinnitus, or ringing in their ears**".




This article briefly reviews blast injuries to the auditory system and describes clinical insights gained by faculty and students from Baylor University while they were providing hearing health services in the wake of the industrial explosion in West.

# TINNITUS MANAGEMENT of Persons with TBI

## Understand Your Patient


We are not Your Father's VA anymore...

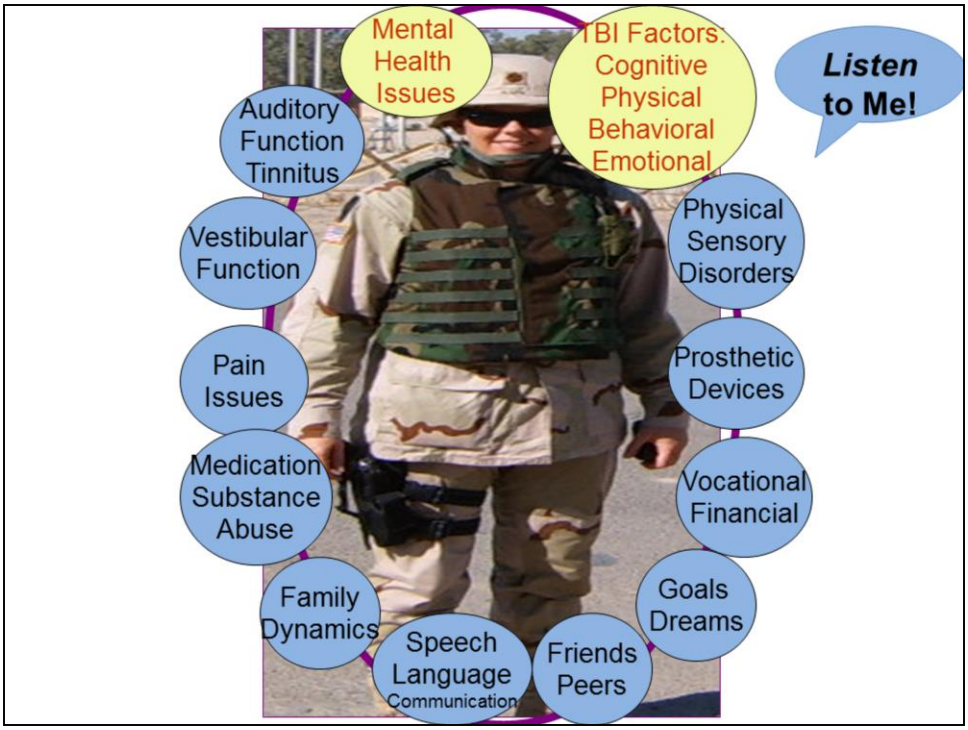
**Tinnitus Assessment & Management**

- Treatment & rehab requires interdisciplinary approach
- **Type of auditory deficit & severity of TBI will determine assessment & management options**
- Learn about your patient's injuries & present needs and take cognitive/emotional and other factors into account



Be mindful that when tx pts with TBI, the way the pt thinks, moves, feels and responds to auditory stimuli goes through the injured brain first. TBI is often the impairment that dictates the course of rehabilitation due to the nature of the cognitive, emotional, and behavioral deficits related to TBI.

Get your focus off the singular symptoms of auditory dysfunctions




And treat your whole patient. Your patient is the sum of ALL of these experiences and more….

## Current Scope Of Problem

- Transformation of military & mission *LONG WAR*
- Multiple deployments= multiple blast exposures=multiple ear & other sensory injuries= multiple levels of audiologic and other sensory management
- Prevalence of **TBI /PTSD /Pain /Substance Abuse**



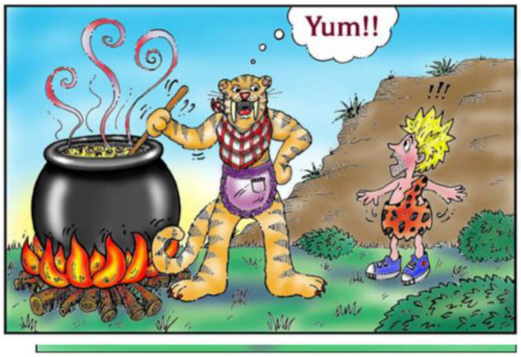
## PTSD and Tinnitus (and TBI)

Blast Injury Conference Findings 11/15/11-11/17/11:

- There is insufficient evidence to define a contributory linkage between tinnitus & PTSD in either direction.
- An indirect relationship may exist through an association of PTSD & tinnitus with brain injury.

# Understanding PTSD

A *normal* response to an abnormal situation




…. perpetuated

Presented by Jennifer Vasterling, Ph.D Boston VA August 2007

# PTSD & Tinnitus

- "**Many of the same neurological mechanisms that appear to be influenced by PTSD are also implicated in levels of tinnitus annoyance**," Dr. Fagelson said. "Those neural mechanisms would include the limbic system & chronic autonomic nervous system hyperarousal. This strongly suggested that there was a potential for these two conditions to be mutually reinforcing."

Coleman, M. Hearing Journal: January 2013 - Volume 66 - Issue 1 - [no page #]doi: 10.1097/01.HJ.0000425799.26569.fa

## What Can You Do?
## Awareness / Screen / Brochures / Poster

## What *Can* be Done About Tinnitus?

- Tinnitus itself is not the problem—**reactions to tinnitus are the problem**
- Patients can be helped ***if*** they learn to **manage their reactions** to tinnitus

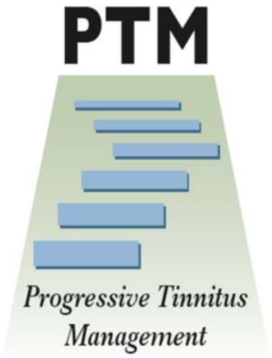
## *How* Can Patients Learn How to Manage Their Reactions to Tinnitus?

- Bottom line: They need to learn how to regulate their stress and emotions by:
  - Using sound
  - Using relaxation techniques
  - Using distraction strategies
  - Changing negative thoughts
- All of this requires **education leading to skill building**

## Which Method is the Most Effective?

- No evidence proving any one method is more effective than any other
- Much more research is needed to determine which specific components of intervention are most effective
- In the meantime, use a method that involves **education, therapeutic sound, and behavioral and cognitive based coping skill techniques**

# Management of Tinnitus in VA : Progressive Tinnitus Management *Interdisciplinary Approach*



## PTM Developers:

Jim Henry PhD  Tara Zaugg, AuD

Paula Myers, PhD  Caroline Kendall-Schmidt PhD

# Development of PTM

Research data supporting PTM come primarily from 10+ controlled clinic trials from NCRAR (Henry et al) & VA RR&D, but also from other studies that have documented the effectiveness of using **therapeutic sound in different ways & CBT coping techniques** for tinnitus management.

- ***AAO-HNS Tinnitus Clinical Practice Guideline (2014)***

http://otosage.pub.com/content/151/2_suppl/S1.full.pdf

- ***Cochrane Review (2010)***

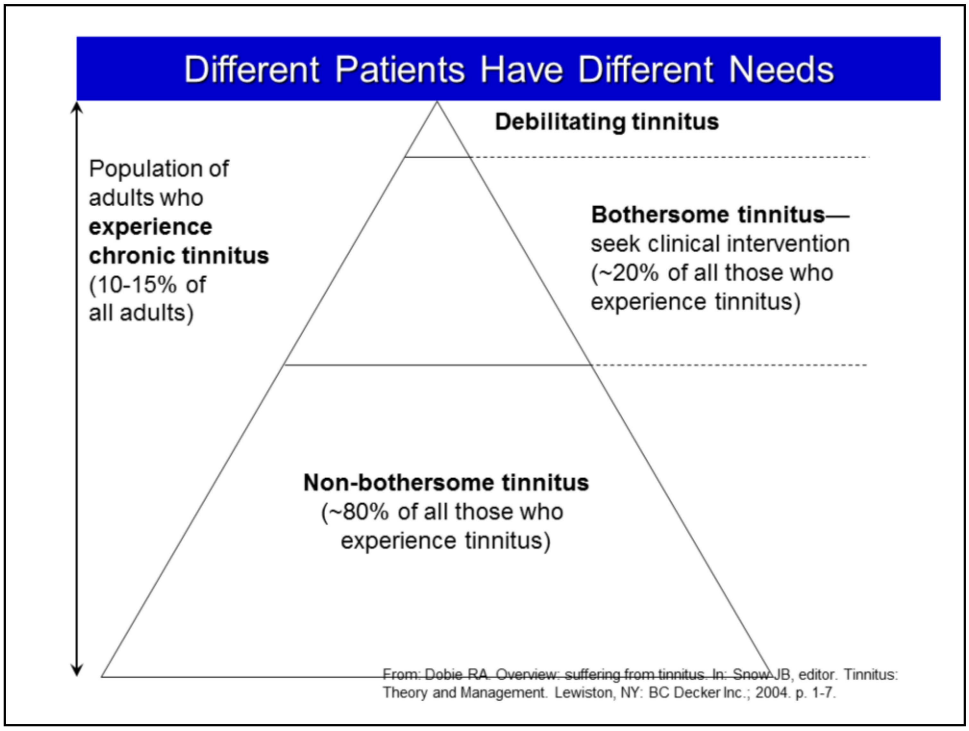
http://www.cochrane.org/cochrane-reviews

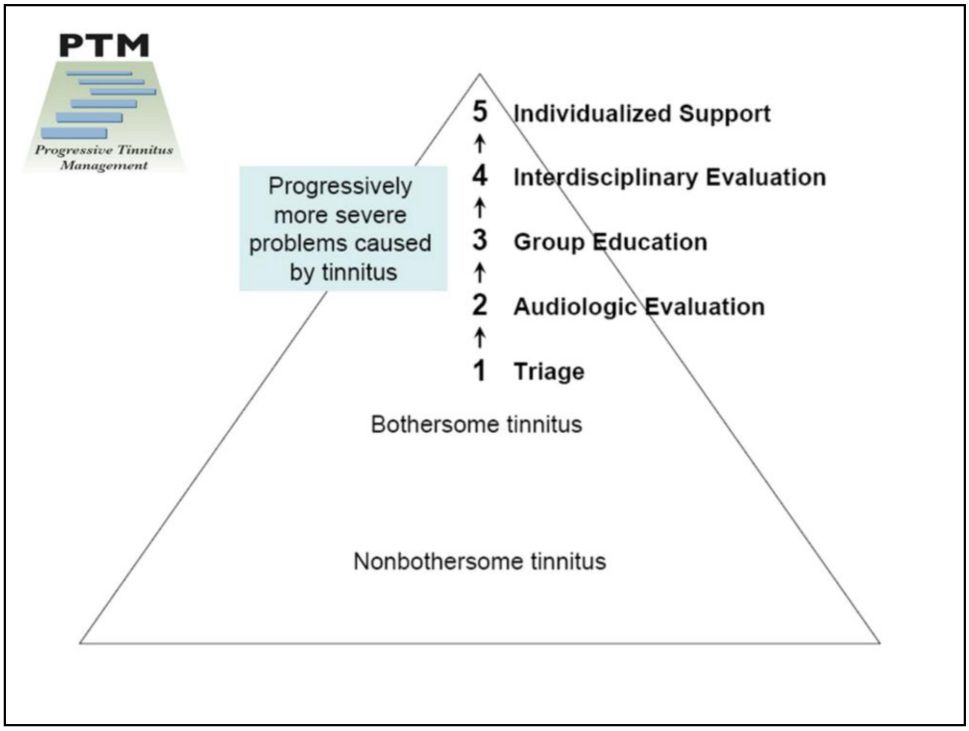
- ***AHRQ Comparative Effectiveness Review (2013)***

http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0060209/


***--Adult Tinnitus Management Clinical Practice Recommendation (2014)***
***http://www.ncrar.research.va.gov/Education/Documents/TinnitusDocuments/Index.asp***

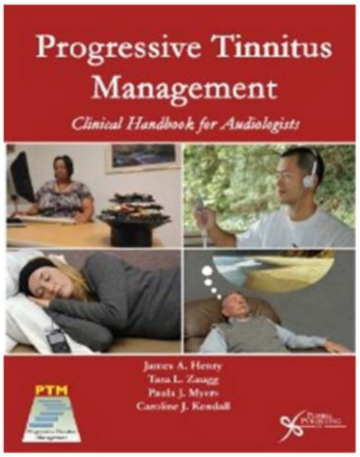
# PTM Overview: Five Hierarchical Levels of Clinical Services with PTM


Different Patients Have Different Needs
Debilitating tinnitus
Population of adults who **experience chronic tinnitus** (10-15% of all adults)
**Bothersome tinnitus**— seek clinical intervention (~20% of all those who experience tinnitus)
**Non-bothersome tinnitus** (~80% of all those who experience tinnitus)
From: Dobie RA. Overview: suffering from tinnitus. In: Snow JB, editor. Tinnitus: Theory and Management. Lewiston, NY: BC Decker Inc.; 2004. p. 1-7.


PTM
Progressive Tinnitus Management
Progressively more severe problems caused by tinnitus
5 Individualized Support
4 Interdisciplinary Evaluation
3 Group Education
2 Audiologic Evaluation
1 Triage
Bothersome tinnitus
Nonbothersome tinnitus

# *Progressive Tinnitus Management: Clinical Handbook for Audiologists*

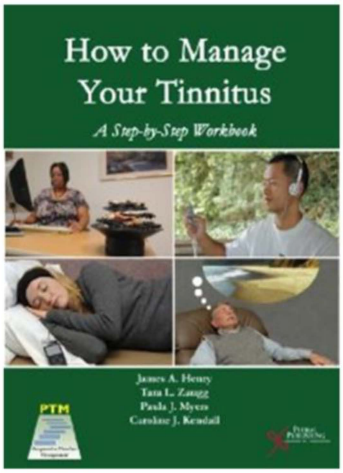
- Includes forms, questionnaires, handouts, & clinical guidelines
- Videos of two Level 3 workshops by audiologists (to be viewed by *groups*)
- Videos demonstrating deep breathing & imagery techniques
- CD containing PowerPoint presentations for Level 3 workshops by audiologists




Henry, JA, Zaugg, TL, Myers, PJ, Kendall, CJ. (2010). Progressive Tinnitus Management: Clinical Handbook for Audiologists. San Diego: Plural Publishing.

# How to Manage Your Tinnitus: A Step-by-Step Workbook

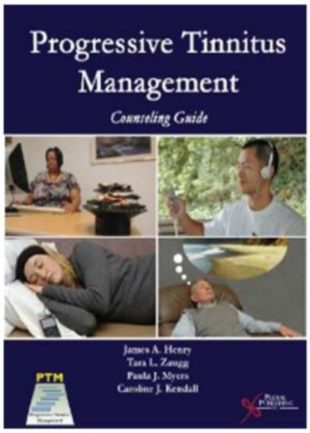
- Workbook for <u>patients</u> – self-help guide
  - Corresponds with Level 3 workshops by audiologists & psychologists
- Videos of two Level 3 workshops by audiologists (to be viewed by *individuals*)
- Videos demonstrating deep breathing & imagery techniques
- 75-minute CD describing & demonstrating therapeutic sound




Henry, JA, Zaugg, TL, Myers, PJ, Kendall, CJ. (2010). Progressive Tinnitus Management: How to Manage Your Tinnitus: A Step-by-Step Workbook. San Diego: Plural Publishing

# *Progressive Tinnitus Management: Counseling Guide*

- Intended for one-on-one counseling by audiologists
  - Corresponds with Level 3 workshops by audiologists
  - – Special section for hyperacusis counseling
- 75-minute CD describing and demonstrating therapeutic sound




Henry, JA, Zaugg, TL, Myers, PJ, Kendall, CJ. (2010). Progressive Tinnitus Management: Counseling Guide. San Diego: Plural Publishing.

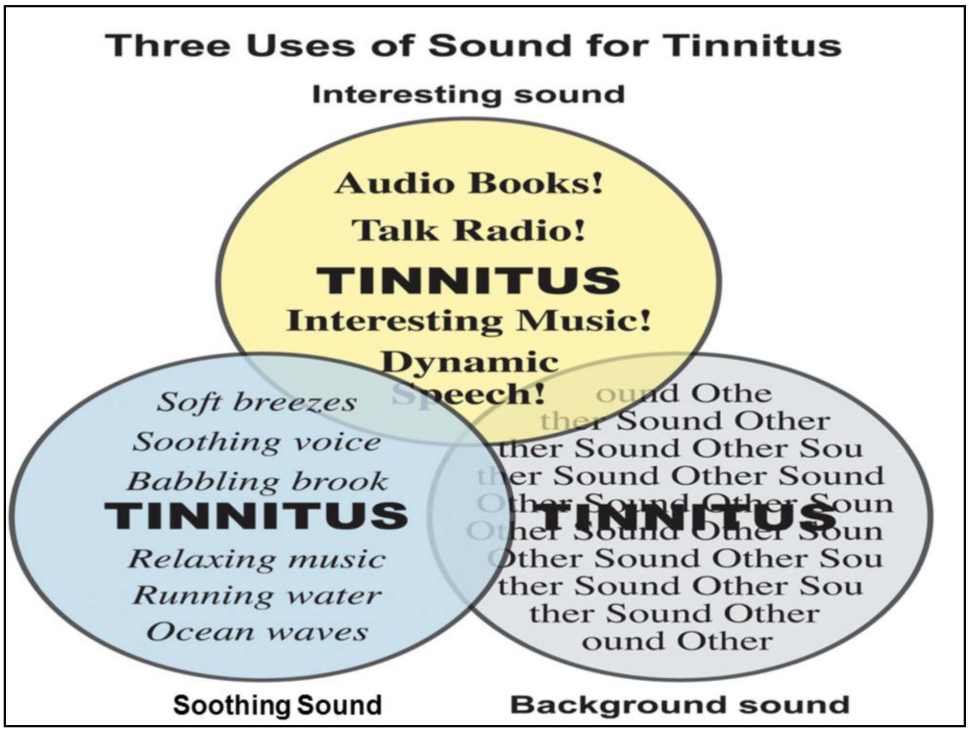
Visit this website for Clinical Handbook, Patient Workbook, PowerPoint curriculum for 5 PTM workshops taught by audiologist and mental health provider, Questionnaires, and PTM research articles.

http://www.ncrar.research.va.gov/Education/Documents/TinnitusDocuments/Index.asp


Progressive Tinnitus Management provides structured education only to the degree the patient requires

## Tinnitus Management-Education

- Tinnitus management Interdisciplinary class weekly (telehealth co-taught by psychologist and audiologist)
- Progressive Tinnitus Management (PTM) workshops (2 led by audiologist, 3 by Mental Health provider)
- Individual education for patients with TBI usually advised



Three Uses of Sound for Tinnitus
Interesting sound
Audio Books!
Talk Radio!
TINNITUS
Interesting Music!
Dynamic
Soft breezes
Soothing voice
Babbling brook
TINNITUS
Relaxing music
Running water
Ocean waves
TINNITUS
Soothing Sound
Background sound

Bob

## Sound Plan Worksheet

1. Write down one bothersome tinnitus situation: falling asleep at night

| 2. **Check one or more** of the three ways to use sound to manage the situation | 3. **Write down the sounds** that you will try | 4. **Write down the devices** you will use | 5. Use your sound plan **over the next week. How helpful** was each sound after using it for 1 week? (Not at all / A little / Moderately / Very much / Extremely) | 6. **Comments** When you find something that works well (or not so well) please comment. You do not need to wait 1 week to write your comments. |
|---|---|---|---|---|
| ☐ Soothing sound   | | | ☐ ☐ ☐ ☐ ☐ | |
| ☑ Background sound   | fan | box fan | ☐ ☐ ☑ ☐ ☐ | adding fan noise helped me get to sleep and helped me stay asleep |
| ☑ Interesting sound   | television<br>talk radio<br>books on CD | TV in bedroom<br>radio with earbuds<br>CD player by bed with earbuds | ☐ ☑ ☐ ☐ ☐<br>☐ ☐ ☐ ☑ ☐<br>☑ ☐ ☐ ☐ ☐ | talk radio helped me get to sleep, but I still wake up in the night |

EXAMPLE

A AR&D NCRAR

A Few Tinnitus Management Sound Devices
There are Many!

## A Few Customized Tinnitus Management Devices…

## There are many!

**Hearing Aid or Tinnitus Masker: Which one is the best treatment for blast-induced tinnitus? The results of a long-term study on 974 patients.**

- 974 Iran-Iraq war Veterans with tinnitus 2+ years.
- 1, 6, 12 & 24 month satisfaction outcomes
- 84% preferred hearing aid only. 3% chose noise generator & others preferred to use both devices.
- **Compared with a noise generator, the most long-lasting treatment for blast-induced tinnitus is a hearing aid. A cause for such a performance is probably recovery of the auditory function & neuroplasticity through the aid.**

Jalivand H et al Audiol Neurootol. 2015;20(3):195-201. doi: 10.1159/000377617. Epub 2015 Apr 25

No significant hearing differences between the 3 groups.

Satisfaction for hearing aid & combined devices increased by time, but decreased for noise generator. No correlation between satisfaction & parameters such as hearing thresholds, audiogram configuration & tinnitus pitch.

# Sleep Problems with TBI / Tinnitus

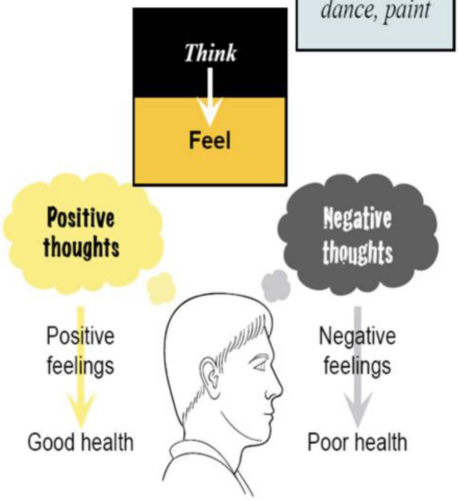
# Interdisciplinary Team for Management-Mental Health

- Cognitive-behavioral therapy (CBT) is the leading psychological method of tinnitus management
- All patients with clinically bothersome tinnitus should learn basic CBT based (or other) coping skills

## Three Components of CBT Level 3 Workshops Conducted by Mental Health Provider



1. Stress management
   - Skills: Relaxation exercises
2. Distraction
   - Skill: Planning pleasant activities
3. Cognitive restructuring
   - Skills: Mindfulness and changing thoughts step-by-step



Joe

## Changing Thoughts and Feelings Worksheet

1. From the Tinnitus Problem Checklist, write down one bothersome tinnitus situation My tinnitus makes it hard for me to concentrate at work

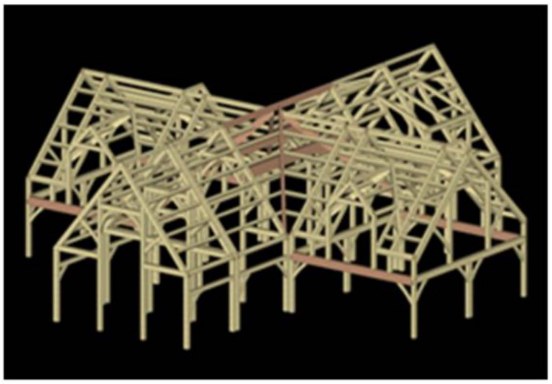
| 2. **Check one or more** of the three exercises you will practice | 3. **Write down how you feel** before you try the exercise | 4. **Write down how you feel** after the exercise | 5. **Use your plan** plan over the next week. **How helpful** was each exercise? (Not at all / A little / Moderately / Very much / Extremely) | 6. **Comments** When you find something that works well (or not so well) please comment. You do not need to wait 1 week to write your comments. |
|---|---|---|---|---|
| ☑ Deep breathing (inhale / Breathe / exhale) | Trial 1 frustrated | still stressed | ☑ | not helpful |
| | Trial 2 stressed | less stressed | ☑ | I still thought about it |
| | Trial 3 stressed | less stressed | ☑ | Today was better |
| ☑ Imagery (see, hear, touch / imagine / smell, taste) | Trial 1 frustrated | relaxed | ☑ | this was helpful |
| | Trial 2 angry | less frustrated | ☑ | it distracted me |
| | Trial 3 frustrated | relaxed | ☑ | practice helped |
| ☑ Changing thoughts (Think → Feel) | Trial 1 frustrated | in control | ☑ | this helped me |
| | Trial 2 helpless | happy | ☑ | I can do this! |
| | Trial 3 frustrated | confident | ☑ | I feel good |

EXAMPLE

NCRAR

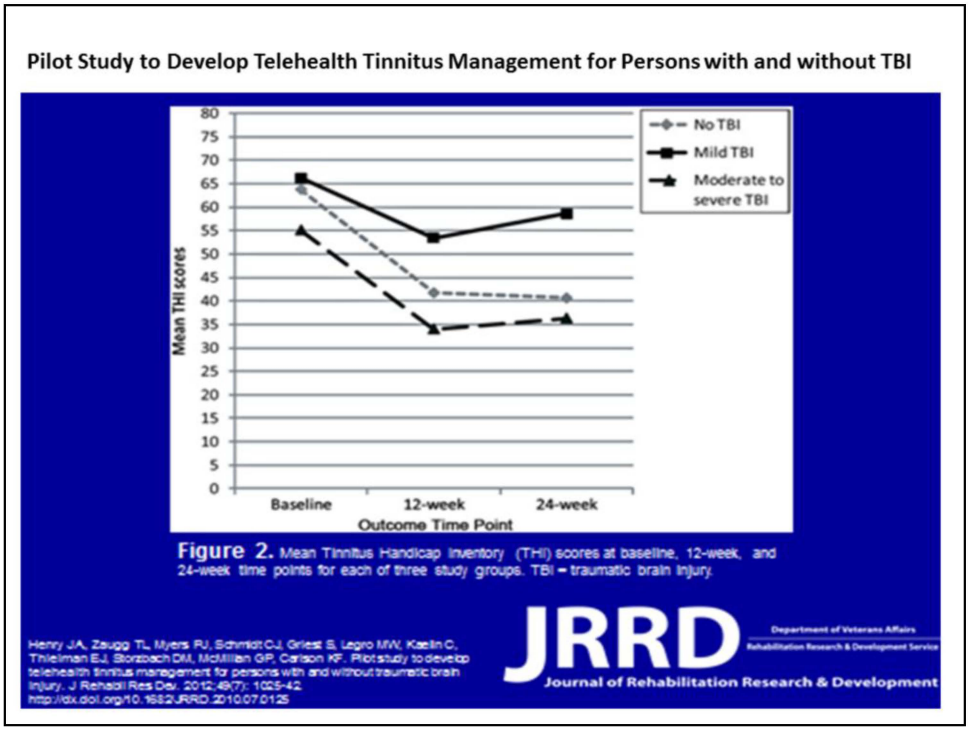
# Managing Tinnitus in TBI Patients

- Use basic framework of PTM



PTM

*Progressive Tinnitus Management*




Jim Henry, Tara Zaugg, Paula Myers, and Caroline Schmidt developed Progressive Tinnitus Management (PTM), which uses education and counseling to help patients learn how to self-manage their reactions to tinnitus. We adapted PTM by delivering the intervention via telephone and by adding cognitive-behavioral therapy. A pilot study was conducted to evaluate the feasibility and potential efficacy of this approach for individuals with and without TBI. Participants with clinically significant tinnitus were recruited into three groups: probable symptomatic mild TBI (n = 15), moderate to severe TBI (n = 9), and no symptomatic TBI (n = 12). Participants received telephone counseling (six sessions over 6 months) by an audiologist and a psychologist. Questionnaires were completed at baseline, 12 weeks, and 24 weeks. **All groups showed trends reflecting improvement in self-perceived functional limitations due to tinnitus. A follow-up randomized clinical study is underway.**

Study Findings

The purpose of this pilot study was to develop and test a prototype protocol for providing tinnitus-management services to Veterans who had experienced a TBI. The educational counseling that is used with PTM was enhanced with components of CBT, and the counseling was administered over the telephone to a limited number of participants located throughout the United States.

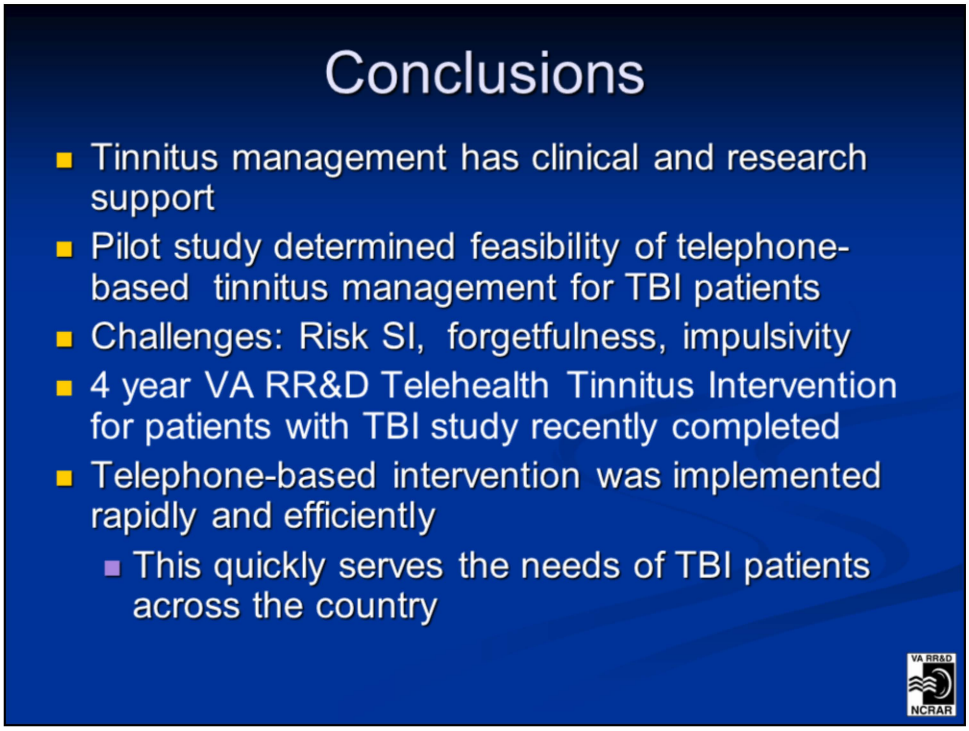
Participants were grouped with respect to their TBI history: mTBI, m-sTBI, and noTBI. All three groups showed similar improvement in their mean THI scores, resulting in moderate to large effect sizes. These data, and the experiences gained from conducting this study, have been used to design a randomized clinical trial to more definitively evaluate the efficacy of this telehealth methodology. This 4-year clinical trial is underway.

It is noteworthy that certain differences appeared with respect to the participants' baseline tinnitus characteristics. For example, almost half the m-sTBI group reported that their tinnitus was perceived "inside the head," while only 13 and 8 percent of the mTBI and noTBI groups, respectively, reported this same perception. If this finding is repeated in the larger follow-up trial, then this could imply that tinnitus is categorically different for individuals who have experienced a major head injury. This kind of information could have implications regarding underlying mechanisms of tinnitus generation. Further, we previously conducted a randomized clinical study that included 269 participants [49]. They all were asked "what is the location of your tinnitus" and only 25 (9% of 268 responses) reported that their tinnitus was located "inside the head." Almost all the remaining participants reported the perceived location of their tinnitus in one or both ears. This study group is typical of patients who complain of tinnitus, of which the majority report that their tinnitus was caused by noise exposure.

It was also noted that, compared with the noTBI group, both TBI groups (mTBI and m-sTBI) reported not getting enough sleep and a greater prevalence of anxiety and probable PTSD. These findings might be expected given the brain trauma experienced by these individuals. Most of the participants in this study screened negative for depression, although it was noted that the mTBI group screened positive for depression most often. These findings are consistent with the literature that provides substantial evidence that TBI is associated with sleep disturbance, anxiety, PTSD, and depression [50-55].

Based on this study's experiences with expressed suicidal ideation, we have revised our protocol to exclude any candidates on this basis. We now will require all candidates to undergo screening for suicidal ideation. The screening will be conducted by the psychologist as part of the initial assessment. If the candidate indicates current, active suicidal ideation, then the psychologist will contact local emergency responders to ensure safety [56]. The candidate will be considered a "screen failure" and excluded from study participation.

http://www.rehab.research.va.gov/jour/2012/497/henry497.html




For our next study we did specifically look at TBIs, and completed it. Subjects were recruited nationwide primarily from VA and military hospitals. Callers passed screening, consented, and scheduled with the study psychologist to determine TBI status and to screen for mental health disorders. The qualified candidates are either randomized to TelePTM immediate or six-month wait list control.

We modified PTM for patients with TBIs in this study and the pilot that led up to this study. We modified the PTM for patients with TBI by delivering the protocol via telephone into participants' homes. We assessed TBI symptoms at baseline and asked participants to describe their memory impairments, concentration issues, and any other cognitive limitations that may affect their participation. We incorporate these into our teaching style as needed. We have a organized method for helping participants keep a log of their telephone appointments. We do reminder calls the day before or prior to appointments. We also cater the session's, the between session homework, which is what we sometimes call it, to the individual so that they have some things to work on, specifically for them in between sessions. Lastly we utilize the participants' support system as much as possible encouraging participants to share information with others and have them join the calls if they would like.

Telehealth Tinnitus Intervention for patients with TBI, there are seven telephone appointments with each participant. These appointments are with the study psychologist or our audiologist at 1, 2, 3, 4, 5 weeks and then at 3 and 6 months follow-up. To date we've seen some great results with the quantitative analyses. There are the three measures, the three outcomes measures. The TelePTM group shows statistically significant improvement as a whole. Then the TelePTM immediate care group was improved significantly more than the wait list control, so we're seeing some great results. The qualitative analyses reveal that patients' comments are overwhelmingly positive.

# CASE STUDY

Fairly representative

Blast injury / mTBI

79

- **40 yo Active Duty Army Specialist with mTBI, PTSD, injuries s/p multiple IED blasts while deployed in Iraq**
- **DVBIC TBI screen +**
- ***Deployed for one year in Iraq. SM is 1.5 years post injury when seen at Tampa VA Hospital***

80

# Blast Experiences

- Blast #1 *April.* In Humvee hit by IED with LOC, once regained consciousness, did not seek tx but returned to job duties medic treating wounded.
- Blast #2 *Early June*. In Humvee when IED blast hit with LOC. Regained consciousness, Did not seek tx & returned to work -medic attending to wounded.
- Blast #3 *Later June*. In Humvee when an IED blast hit with LOC. Regained consciousness, did not seek tx & returned to job duties as medic.

81

# Blast Experiences (con't)

- Blast #4 *Mid July*. In Humvee when IED blast hit, with no LOC but felt dazed, did not seek tx & continued job duties as medic.
- Blast #5 *Later July.* Walking when IED hit, with LOC & flew 50 ft. Regained consciousness & did not seek tx. Returned to duties as medic.
- Blast #6 *September*. Ambushed by enemy fire while treating an Iraqi soldier. RPG hit 20 ft from where he was performing his duties. No LOC but felt dazed.

**Patient Questionnaire for blast injury was positive for the following symptoms:**

Blurred vision, **loss of hearing, ear pain, ringing in ears, dizziness,** shortness of breath (toxic and dust inhalation from burning vehicles, IED blasts), chest pain, nausea & vomiting, joint pain, joint swelling L foot & R knee, numbness in hands & legs, changes in speech, problems with walking, pain in head, neck, chest, knees, & L foot (pain 6 out of 10), feels depressed & anxious, difficulty sleeping, nightmares, hypervigilence & avoids social contact

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Remember this was 1.5 years post blast

## Neuropsychology-NSI Symptom Complaints

- Very severe difficulty with ha's, numbness, fatigue & sleep disturbance.
- Severe problems with hearing, *poor concentration,* forgetfulness, *slowed thinking*, anxiety, poor frustration tolerance & vision.
- Moderate difficulty with dizziness, poor coordination, nausea, sensitivity to light & noise, change in appetite, depression & irritability.
- Mild problems with change in taste or smell & decision making.

84

# Neuropsychology Assessment

- **Overall, majority of cognitive domains (attention, working memory, visual cognitive abilities, & fine motor speed) WNL.**

- Performed significantly lower than expected on measure of verbal memory. Functionally, appears to be performing better than these scores would reflect, as able to remember his schedule & recall previous evaluations in detail. **Likely performance was negatively impacted by anxiety and/or motivational factors.**

85

# Psychology Notes

- Sx's consistent with **PTSD, substance abuse, & mild anxiety/panic d/o.**
- Reports good progress in his psychological tx Ft. Jackson. Attends psychotherapy 3 x week, sees psychiatrist weekly, & attends PTSD/substance abuse dual diagnosis group.
- Plans to return to these services upon return. Encouraged to attend group here & seek out individual psychological help PRN during stay.
- Upcoming divorce & child custody.

86

## Speech Language Pathology Notes

- Normal language functions with mild deficits in immediate & delayed memory recall with anxiety as contributing factor.
- Hands on demonstration of Personal Digital Assistant.
- Will use Smartphone through current phone service.

87

## **Audiologic History** (At Tampa for 2 week mTBI evaluation)

CC:

1) difficulty understanding speech clearly, especially in noisy environments
2) bilateral intermittent tinnitus (rated #6 on an annoyance scale 0-10)

Denied significant dizziness

HHIA (S)= 32/40 =severe perceived hearing handicap

THI = 38/100 = moderate tinnitus handicap

FHQ = 28 /36 = significant functional hearing difficulties (>2 SD of cut off score of 18)

88

## Audiometric Test Results

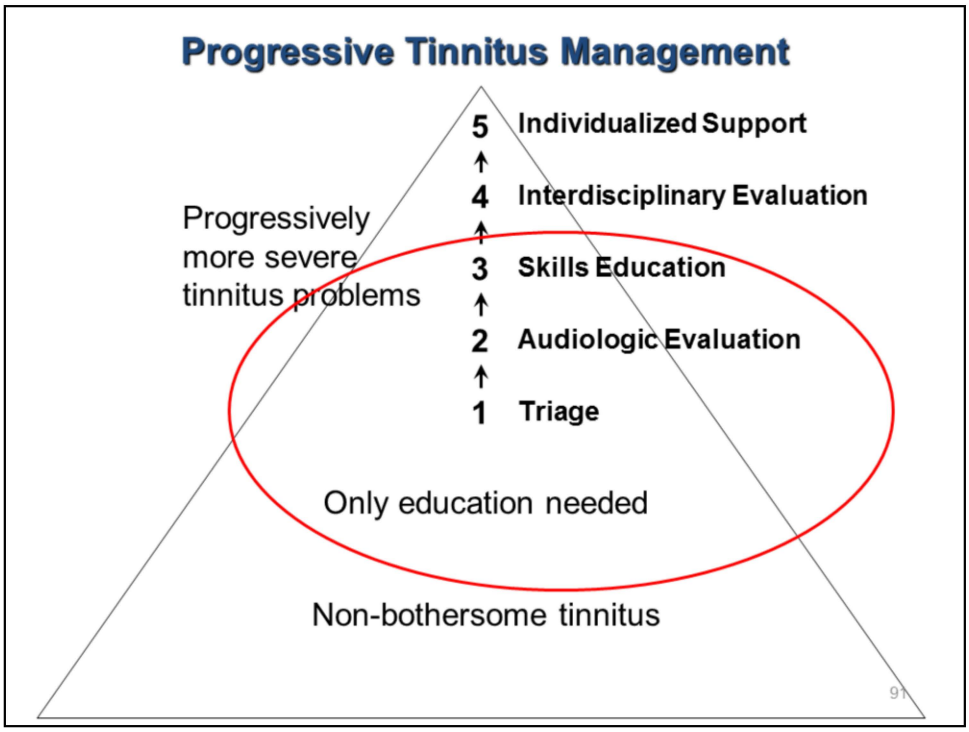
- Hearing WNL au (thresholds 10 dBHL)
- Speech recognition-96% au
- Immittance-normal au
- OAEs present au
- Dichotic Digits-normal au
- WIN / Quick SIN-normal au

89

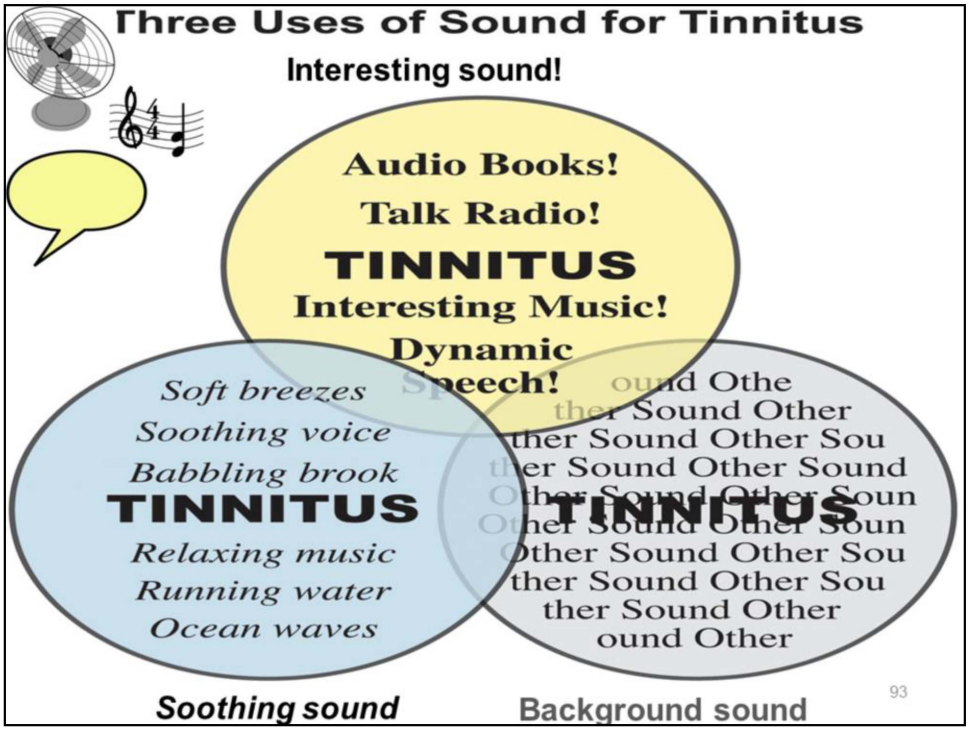
**Audiologic Recommendations/Management**

- PTM individual education provided (declined Group PTM classes); uses MP3 player & smartphone. Free APPs reviewed with patient & downloaded onto his phone
- *How to Manage Your Tinnitus: A Step-by-Step Workbook* provided & discussed (detailed instructions for creating a personalized self-management program)
- Functional hearing difficulty complaints discussed & general communication strategies handout provided (declined auditory training lab or FM or remote mic/gentle amplification trial & will pursue when he returns home)

90


Progressive Tinnitus Management
5 Individualized Support
4 Interdisciplinary Evaluation
3 Skills Education
2 Audiologic Evaluation
1 Triage
Progressively more severe tinnitus problems
Only education needed
Non-bothersome tinnitus
91

## Progressive Tinnitus Management- Education


Three Uses of Sound for Tinnitus
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Dynamic
Speech!
Soft breezes
Soothing voice
Babbling brook
TINNITUS
Relaxing music
Running water
Ocean waves
TINNITUS
Soothing sound
Background sound
93

Apps Galore....


PTSD coach


CBT for insomnia


Relax Melodies


iZen Art of Meditation


Sleepmaker Storms Free


**Sleepmaker Rain Free**


Sleep Machine Lite

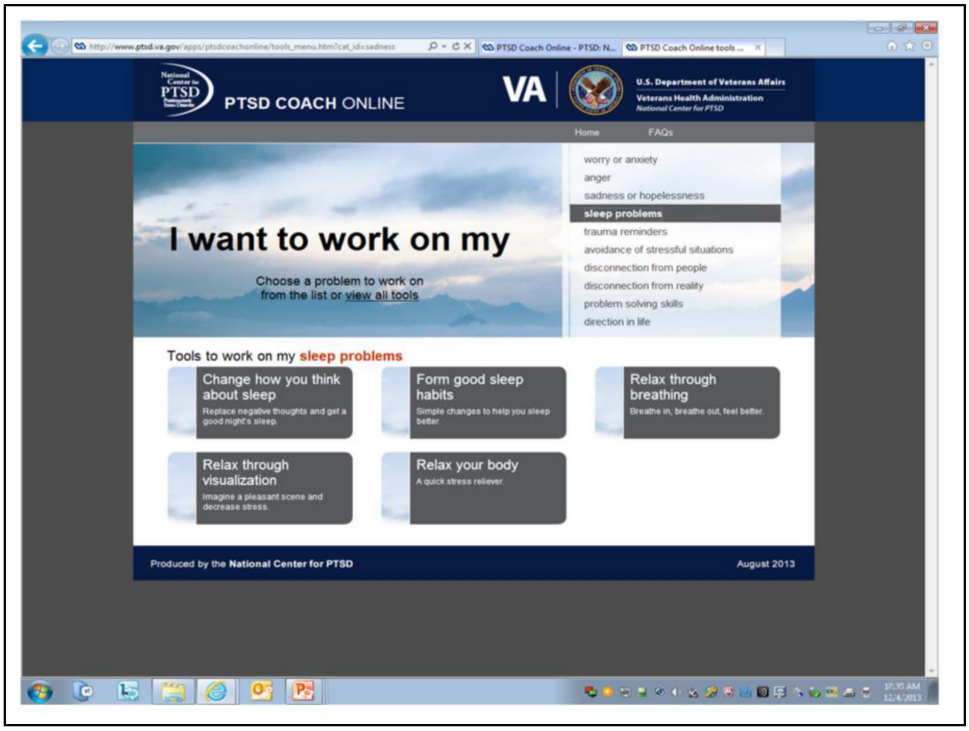

Sleepmaker Waves Free


Sleepmaker Streams Free


Sleepmaker Wildlife Free


Free Audiobooks


Guided Imagery UMHS Health System


PTSD COACH ONLINE
VA
U.S. Department of Veterans Affairs
Veterans Health Administration
National Center for PTSD
Home
FAQs
I want to work on my
Choose a problem to work on from the list or view all tools
worry or anxiety
anger
sadness or hopelessness
sleep problems
trauma reminders
avoidance of stressful situations
disconnection from people
disconnection from reality
problem solving skills
direction in life
Tools to work on my sleep problems
Change how you think about sleep
Replace negative thoughts and get a good night's sleep.
Form good sleep habits
Simple changes to help you sleep better.
Relax through breathing
Breathe in, breathe out, feel better.
Relax through visualization
Imagine a pleasant scene and decrease stress.
Relax your body
A quick stress reliever.
Produced by the National Center for PTSD
August 2013

## Functional Hearing Difficulty Complaints in light of Normal or Near Normal Hearing

Consider…

- Peripheral change in hearing from baseline?
- Hypervigilence / PTSD / emotional, attention PPCS factors?
- Central auditory processing difficulties?
- Combination of factors?
- Other?

96

## FUNCTIONAL HEARING QUESTIONNAIRE

English is my native language: Yes No

I had reading and/or learning problems in school: Yes No

Read each item carefully and put a check in the box that is best for you.

| Question | True or false scale | | | |
|---|---|---|---|---|
| | False, not at all true | Slightly True | Mostly True | Very True |
| I am able to understand what others are saying even when there is background noise. | 4 | 3 | 2 | 1 |
| I have no difficulty understanding what is being said on the phone. | 4 | 3 | 2 | 1 |
| I can understand rapid speech with no real difficulty. | 4 | 3 | 2 | 1 |
| I have problems understanding what is being said in rooms that have an echo. | 1 | 2 | 3 | 4 |
| I have problems following spoken instructions; need to hear only one instruction at a time. | 1 | 2 | 3 | 4 |
| I have problems following long conversations; tend to miss things that were said. | 1 | 2 | 3 | 4 |
| I need more time than others to process spoken information. | 1 | 2 | 3 | 4 |
| I have problems paying attention when people talk to me. | 1 | 2 | 3 | 4 |
| I have problems understanding when I look at the speaker and listen at the same time. | 1 | 2 | 3 | 4 |

| FUNCTIONAL HEARING QUESTIONNAIRE (FHQ) (n= 50 each group) | NH + mTBI | NH | HFHL |
|---|---|---|---|
| I am able to understand what others are saying even when there is background noise. | 33% | 95% | 39% |
| I have no difficulty understanding what is being said on the phone. | 22% | 98% | 30% |
| I can understand rapid speech with no real difficulty. | 22% | 93% | 52% |
| I have problems understanding what is being said in rooms that have an echo. | 78% | 43% | 86% |
| I have problems following spoken instructions; need to hear only one instruction at a time. | 89% | 50% | 86% |
| I have problems following long conversations; tend to miss things that were said. | 67% | 36% | 84% |
| I need more time than others to process spoken information. | 78% | 36% | 84% |
| I have problems paying attention when people talk to me. | 67% | 29% | 60% |
| I have problems understanding when I look at the speaker and listen at the same time. | 67% | 14% | 54% |

*NH=normal hearing, HFHL= high frequency hearing loss (percent who endorsed items as very true or mostly true)*

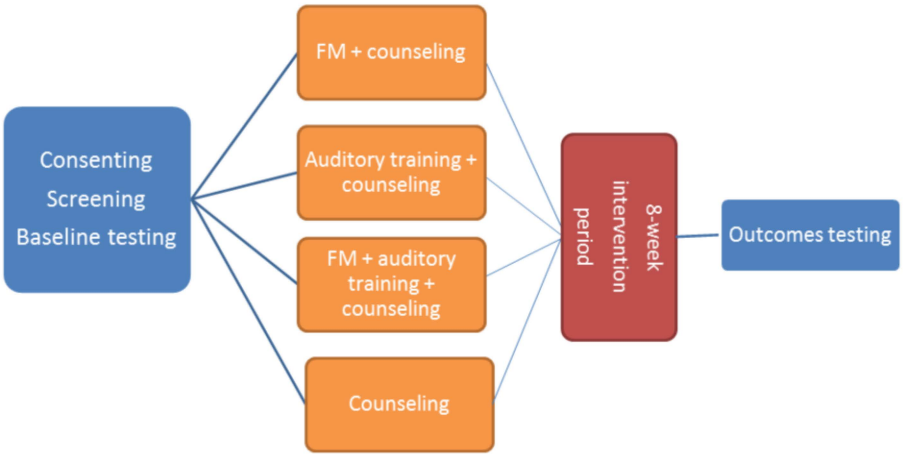
## Evaluation of Approaches to Auditory Rehabilitation for mTBI

## VA RR&D study recently completed…

Gabrielle Saunders, PI
Theresa Chisholm, Paula Myers, Co-Investigators
http://www.rehab.research.va.gov/jour/2015/523/pdf/jrrd-2014-11-0275.pdf

99

Multi-site, randomized controlled trial completed at Tampa VA and Portland VA… Article in submission

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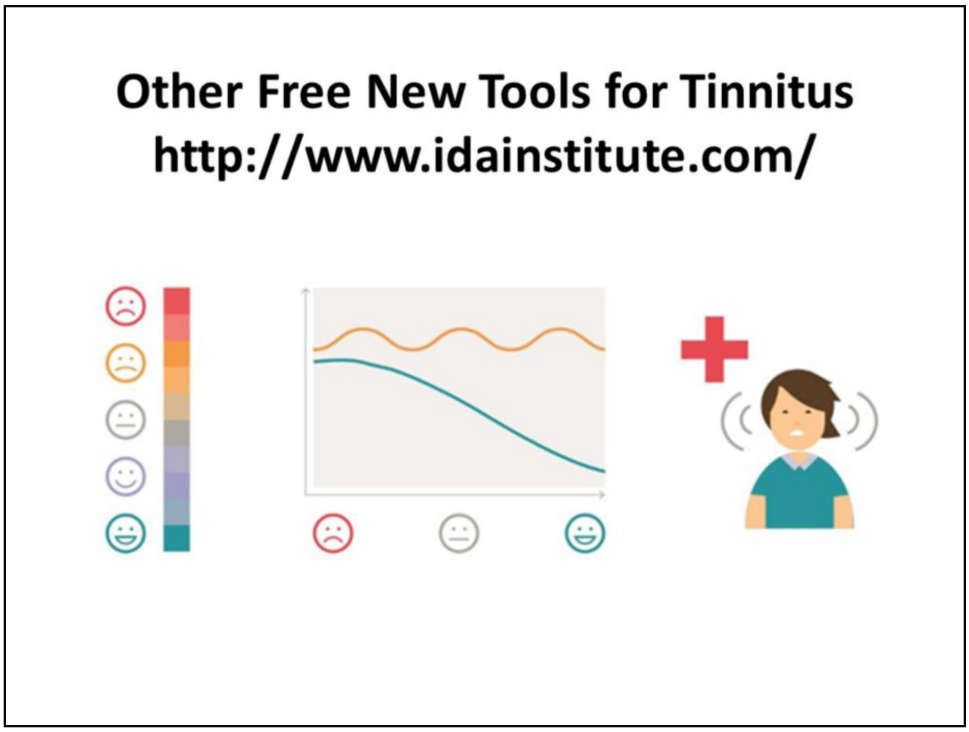
## Some Resources for TBI and Tinnitus

- ASHA offers a Practice Portal page on TBI that includes discussion of signs and symptoms, assessment and treatment. A page on tinnitus is on the portal as well. Patient education handouts on tinnitus are available for downloading.
- http://www.asha.org/aud/articles/TinnitusTBI/
- NCRAR PTM Resources

http://www.ncrar.research.va.gov/Education/Documents/TinnitusDocuments/Index.asp




**New Tools for Tinnitus**

Ida is launching three tools for tinnitus management. The first tool, the Tinnitus Thermometer, is designed to help patients articulate how they feel about their tinnitus on any given day. This allows the hearing care professional to tailor their counseling method and track their patient's progress.

The second tool, the Tinnitus Communication Guide, is a visual explanation of the difference between the presence of tinnitus and its intrusiveness. It illustrates to the patient that while they may always hear their tinnitus, how they are affected by it can change over time.

The last of the new tools is the Tinnitus First Aid Kit, which was developed in partnership with the British Tinnitus Association. The Tinnitus First Aid Kit is a resource for new tinnitus patients to help them understand and deal with their condition.

All of the tools aim to offer hearing care professionals a way to address their patients' concerns and to help ease patient anxiety regarding tinnitus, allowing them to manage their condition and live well with it. The tools are a product of the Ida mini-seminar, "Tinnitus Challenge: Moving Forward with Person Centered Care," which was held in December, 2015. Fifteen participants from eight countries met over a day

and a half to discuss how hearing healthcare professionals and tinnitus patients manage tinnitus.

The PTM studies discussed were funded by the Veteran's Administration Office of Rehabilitative Research & Development.

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DVD produced by EES: Ringing in the Ears: What Can I do About It? 2006 updated 2013 (email James.Henry@va.gov for a copy or view on NCRAR website)