

# **Auditory Findings in OEF/OIF Veterans at a Polytrauma Network Site**

**Katharine Fitzharris, Au.D., VA Boston Healthcare System**

**Terri K. Pogoda, Ph.D., VA Boston Healthcare System, COLMR, Boston University**

**Henry L. Lew, M.D., Ph.D., DVBIC, Virginia Commonwealth University**

# Disclosure

- The contents do not represent the views of the U.S. Department of Veterans Affairs or the United States Government



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# Background

- Nearly 2 million troops deployed during OEF/OIF
- TBI is a “signature injury” of OEF/OIF
- Up to 70-80% of combat injuries are associated with explosions



# TBI Secondary Level Evaluation

- Patients referred if positive screen
- Medical and deployment-related history
  - Exposure to blast or head trauma
  - Loss or alteration of consciousness, memory disruption
  - Current symptoms



# Neurobehavioral Symptoms Inventory (NSI-22)

- 22-item self-report measure
- Perceived impact of any cognitive, affective, somatic, or sensory symptoms on the patient's life in the 30 days prior to the appointment
- Symptoms rated 0 – 4 (very severe)

# NSI-22

1. Feeling dizzy
2. Loss of Balance
3. Poor coordination, clumsy
4. Headaches
5. Nausea
6. Vision problems, blurring, trouble seeing
7. Sensitivity to light
8. Hearing difficulty
9. Sensitivity to noise
10. Numbness or tingling on parts of my body
11. Change in taste or smell
12. Loss of appetite or increased appetite
13. Poor concentration, can't pay attention, easily distracted
14. Forgetfulness
15. Difficulty making decisions
16. Slowed thinking, difficulty getting organized, can't finish things
17. Fatigue, loss of energy, getting tired easily
18. Difficulty falling or staying asleep
19. Feeling anxious or tense
20. Feeling depressed or sad
21. Irritability, easily annoyed
22. Poor frustration tolerance; feeling easily overwhelmed by things

# Second Level Evaluation

- Boston team consists of:
  - Psychiatry
  - Neuropsychology
  - Social Work
  - Optometry
  - Audiology

# Current Study

- Retrospective chart review of patients seen in the TBI Secondary Level Evaluation Clinic at VA Boston
- Aims:
  - Characterize auditory findings
  - Relationships between patient factors, self-report measures, and evaluations

# Audiology Protocol

- Self-report measures
  - HHIE-S
  - THS
- Tympanometry
- DPOAEs
- Audiometry
- Dichotic Digits

## HHIE-S

Select *No*, *Sometimes*, or *Yes* in response to each question. If you do not engage in a particular activity, respond according to the way you feel you would respond in that situation.

	No	Sometimes	Yes
1. Does a hearing problem cause you to feel embarrassed when you meet new people?			
2. Does a hearing problem cause you to feel frustrated when talking to members of your family?			
3. Do you have difficulty hearing when someone speaks in a whisper?			
4. Do you feel handicapped by a hearing problem?			
5. Does a hearing problem cause you difficulty when visiting friends, relatives or neighbors?			
6. Does a hearing problem cause you difficulty in the movies or in the theater?			
7. Does a hearing problem cause you to have arguments with family members?			
8. Does a hearing problem cause you difficulty when listening to TV or radio?			
9. Do you feel that any difficulty with your hearing limits or hampers your personal or social life?			
10. Does a hearing problem cause you difficulty when in a restaurant with relatives or friends?			

# Tinnitus and Hearing Survey

Please circle your answer to each question

Add each column, then sum across columns

## A

My tinnitus makes it hard for me to sleep at night.

0    1    2    3    4

My tinnitus makes it hard for me to concentrate when I'm reading.

0    1    2    3    4

My tinnitus makes it hard for me to relax in a quiet room.

0    1    2    3    4

It is hard for me to focus my attention away from my tinnitus and onto other things.

0    1    2    3    4

\_\_\_\_\_ Total of each column

Grand Total

## B

It's hard for me to understand what others are saying in noisy or crowded places.

0    1    2    3    4

I have a hard time understanding what people are saying on television or in movies.

0    1    2    3    4

It's hard for me understand people with soft or high-pitched voices (some women and children).

0    1    2    3    4

It's hard for me to join in a group conversation because I can't understand what others are saying.

0    1    2    3    4

\_\_\_\_\_ Total of each column

Grand Total

## C

Are some sounds too loud for you when they seem normal to other people around you?\*

0    1    2    3    4

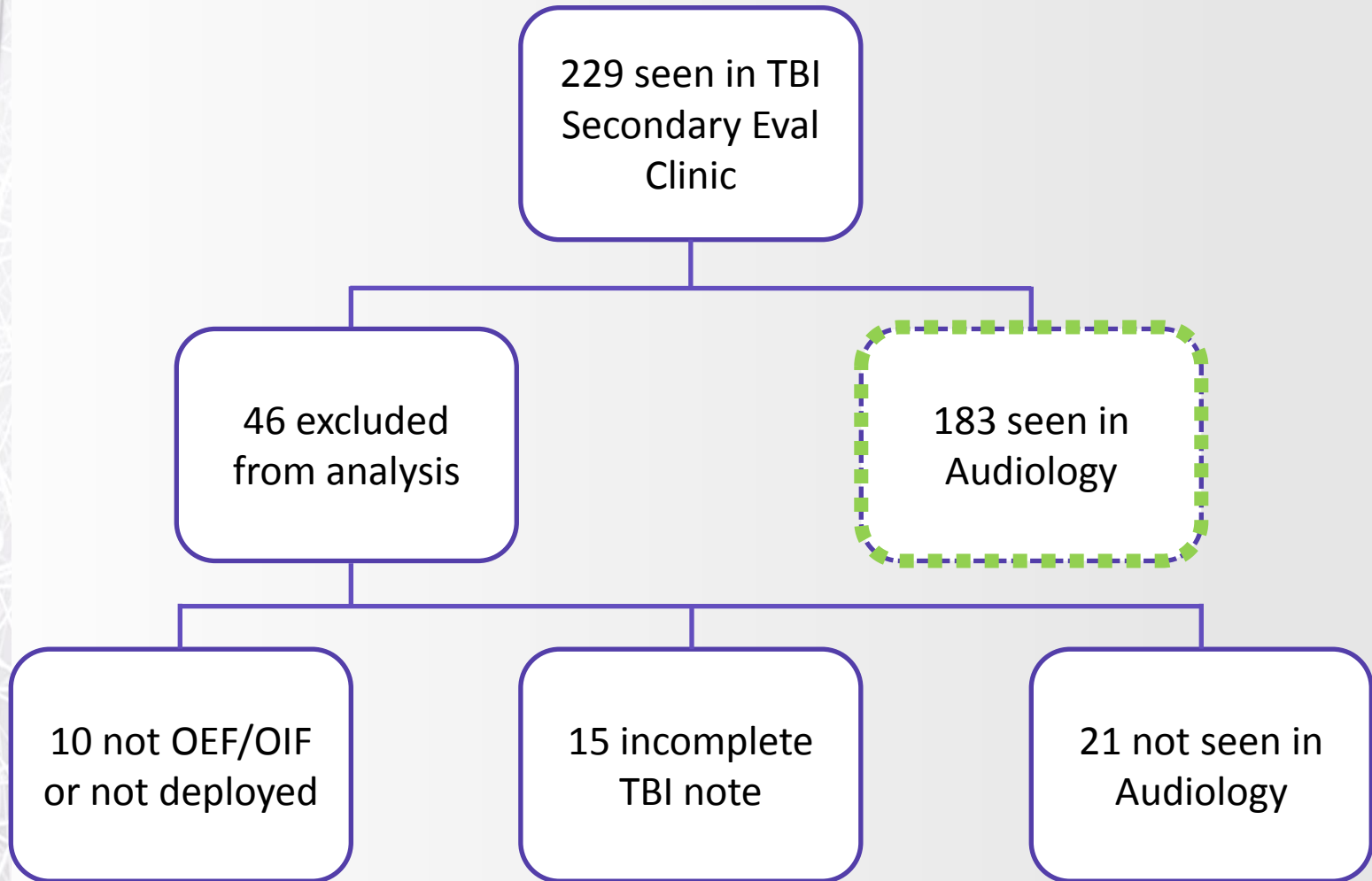
*If you answered 1, 2, 3 or 4 to the question above:*

Would a class about tinnitus be too loud for you?

0    1    2    3    4

\*If sounds are too loud for you when wearing hearing aids, please tell your audiologist

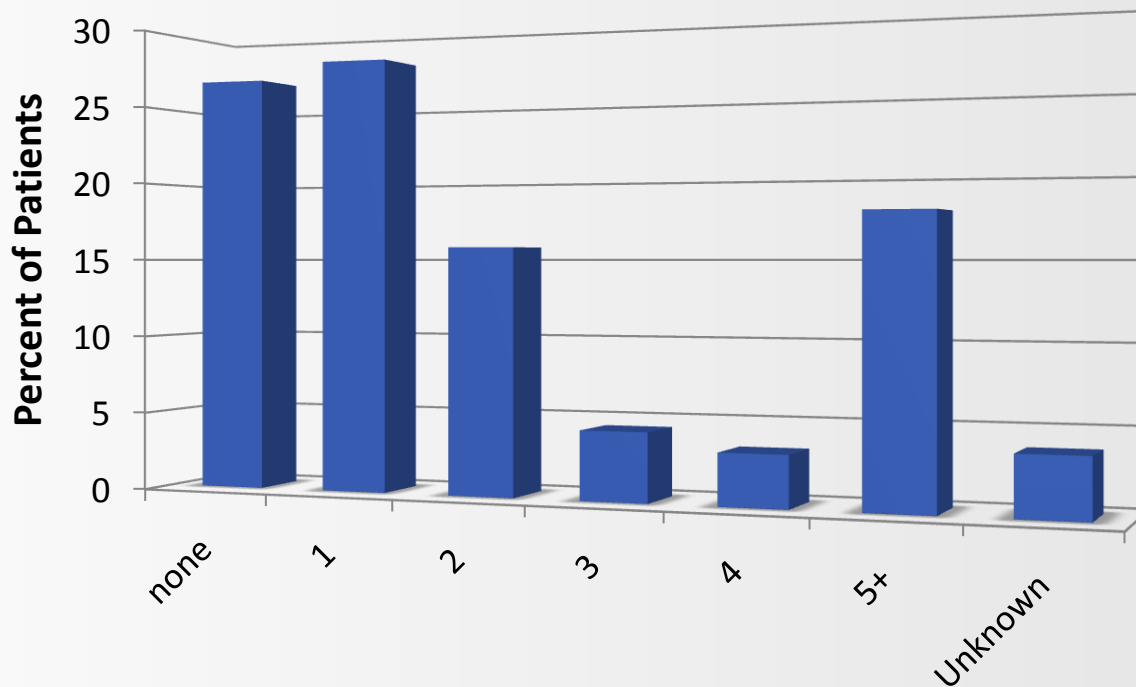
# Patients



# Patients

Age (years)	DOI to DOV (months)	Blast Exposed	TBI Diagnosed
30.21 ± 7.42	45.61 ± 23.75	73.2%	42.1%

### Blast Distribution

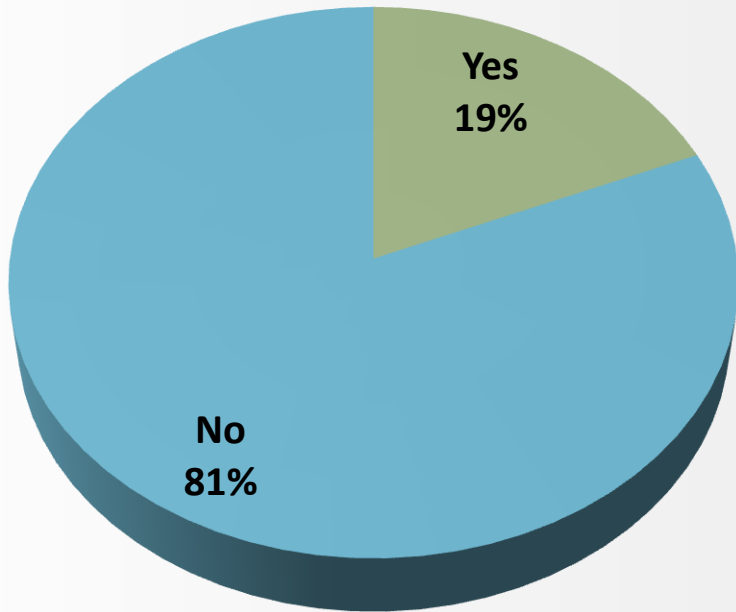


# Patients

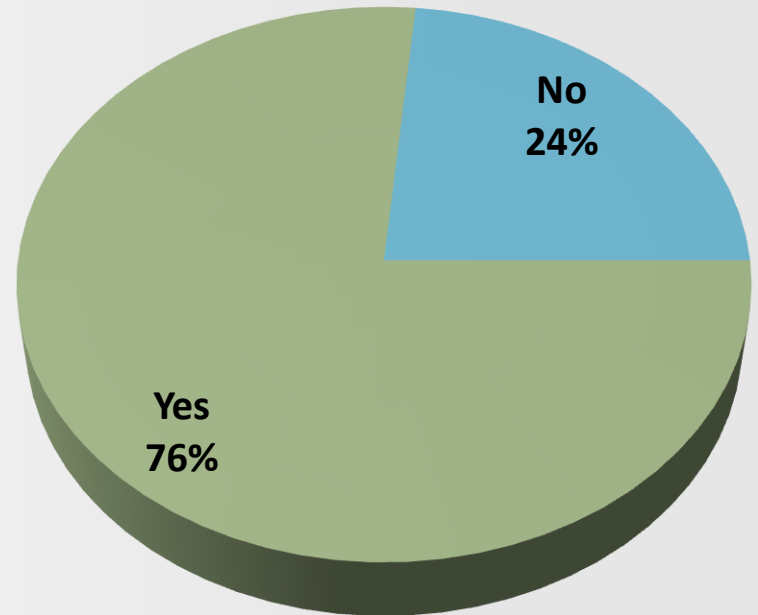
Hearing Measures	Mean (SD)	Range
NSI-22 (hearing)	1.91 ± 1.05	0– 4
HHIE-S	12.42 ± 11.08	0 – 40
THS (tinnitus)	4.62 ± 4.51	0 – 16
THS (hearing)	5.4 ± 4.23	0 – 16
PTA (dBHL)	9.98 ± 5.07	-1.67 – 25.83
HFPTA (dBHL)	14.98 ± 10.67	-1.67 – 60.84
Dichotic Digits (%)	92.19 ± 10.65	22.5 – 100

# Results

## Hearing Loss



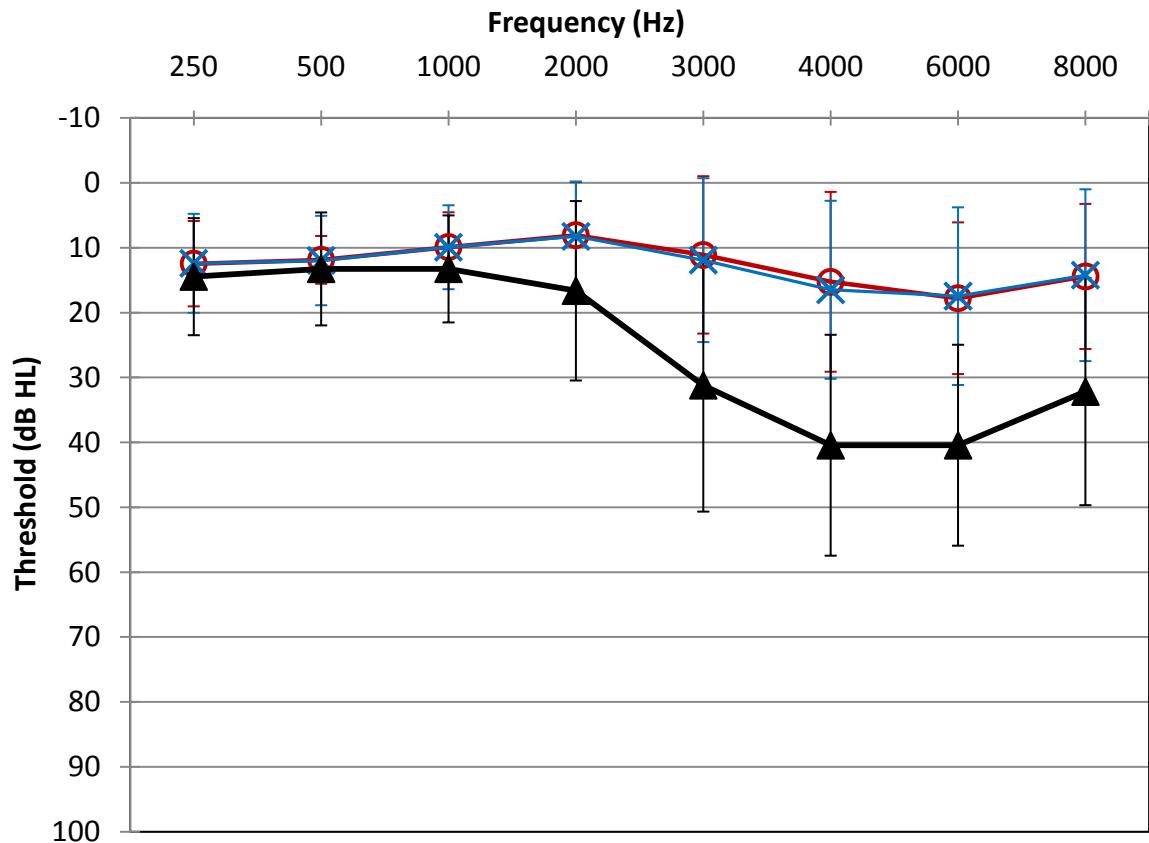
## Tinnitus



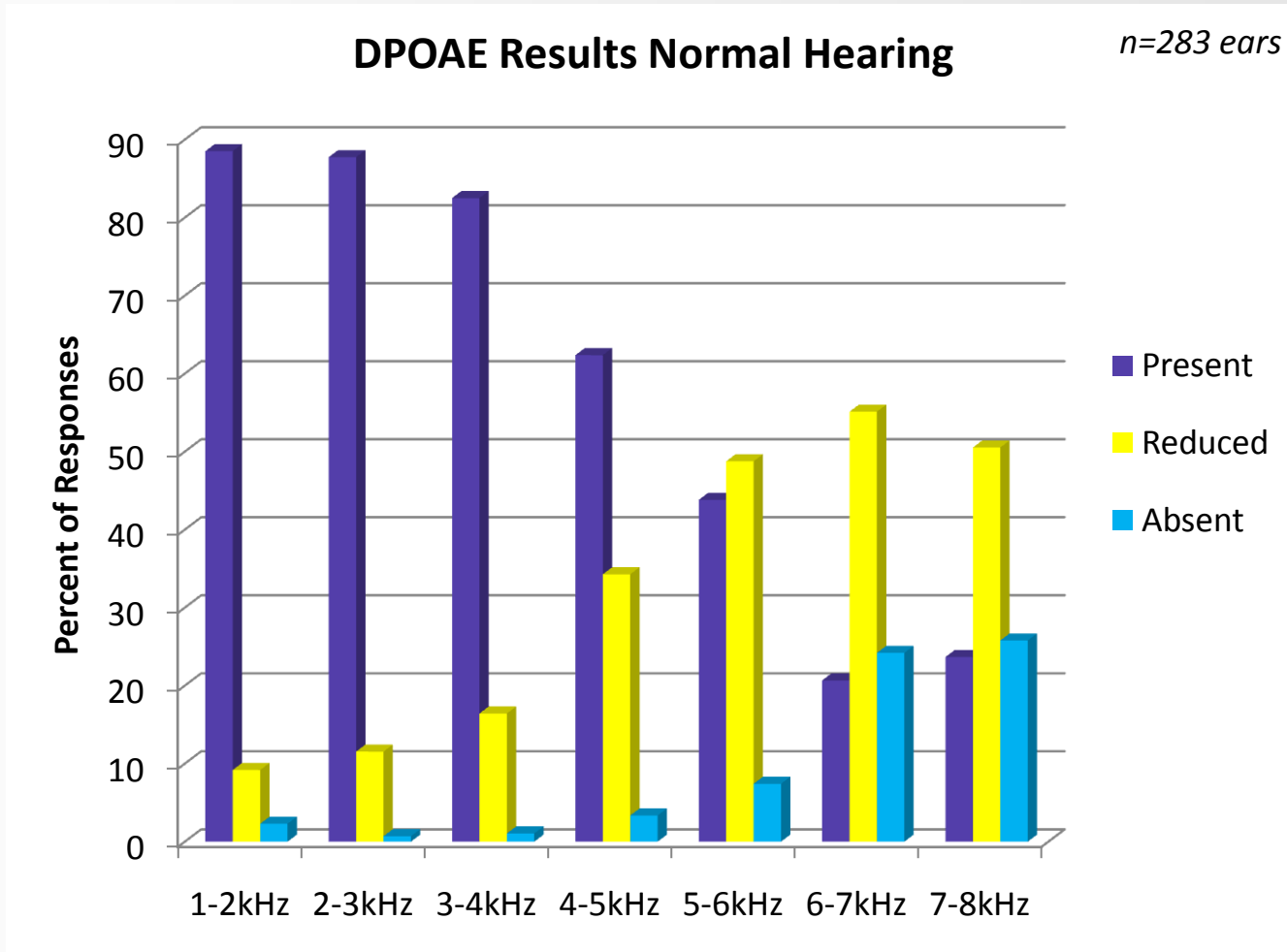
# Results: Audiometry

*n= 183 patients*

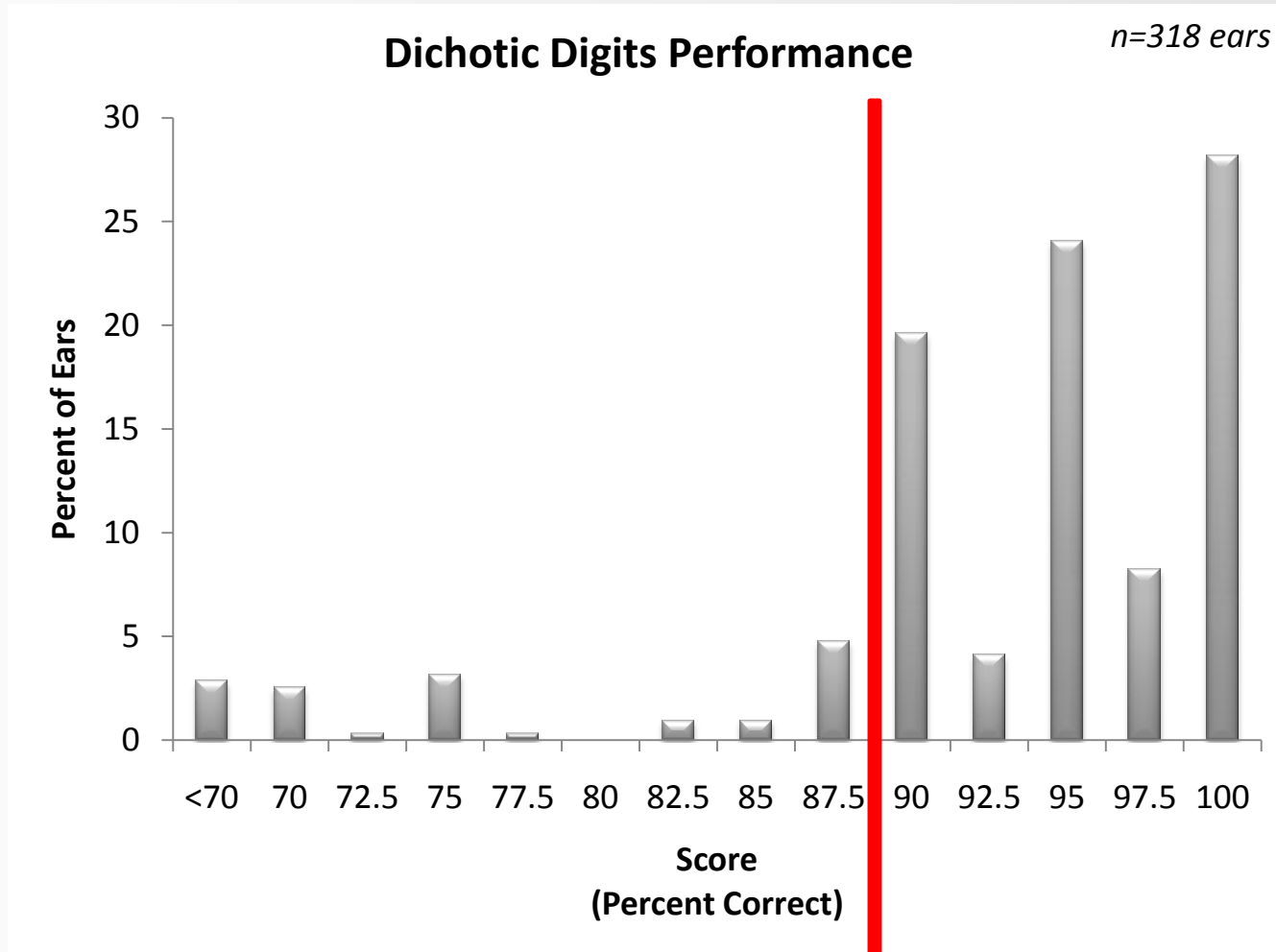
## Average Audiogram



# Results: DPOAEs



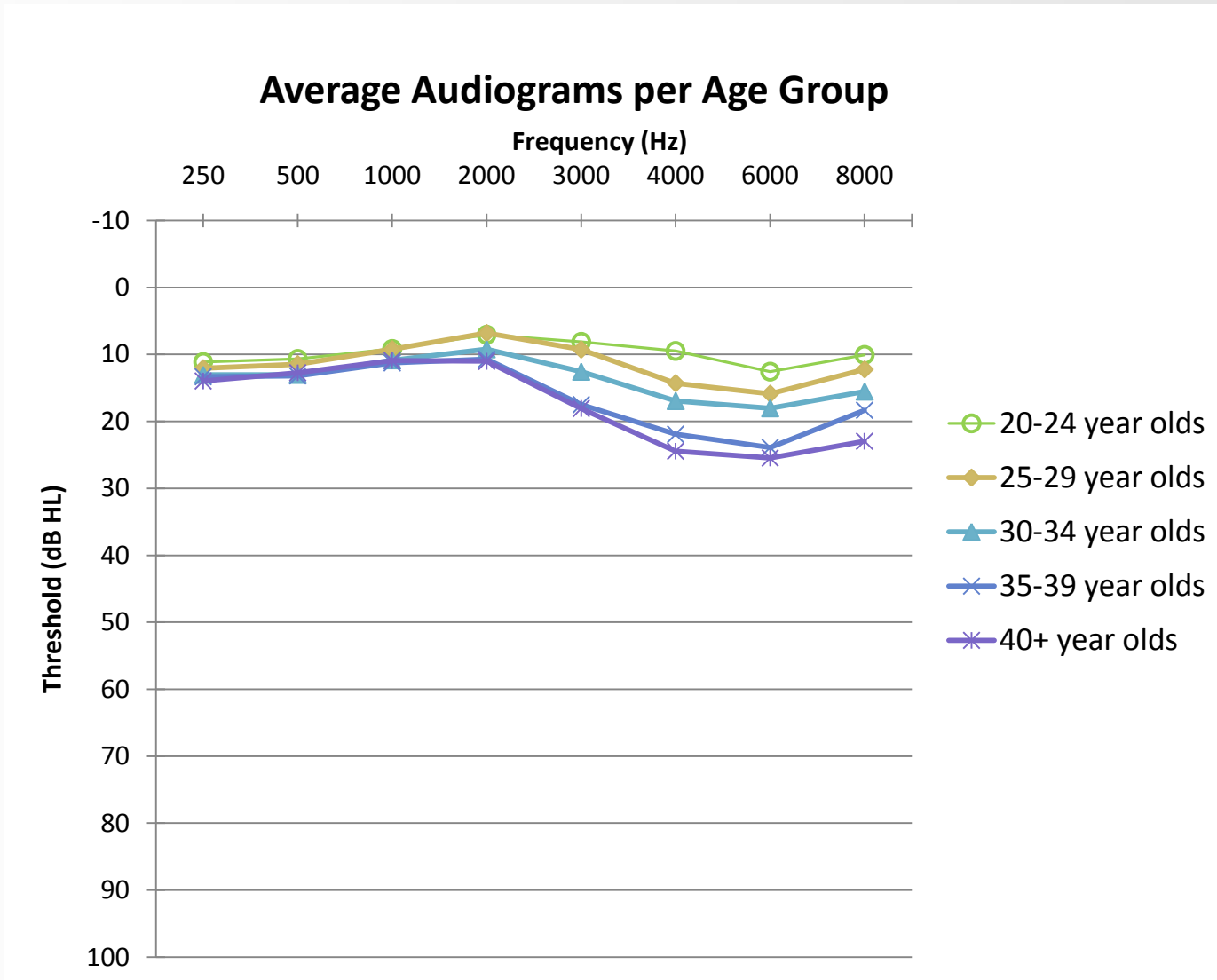
# Results: Dichotic Digits



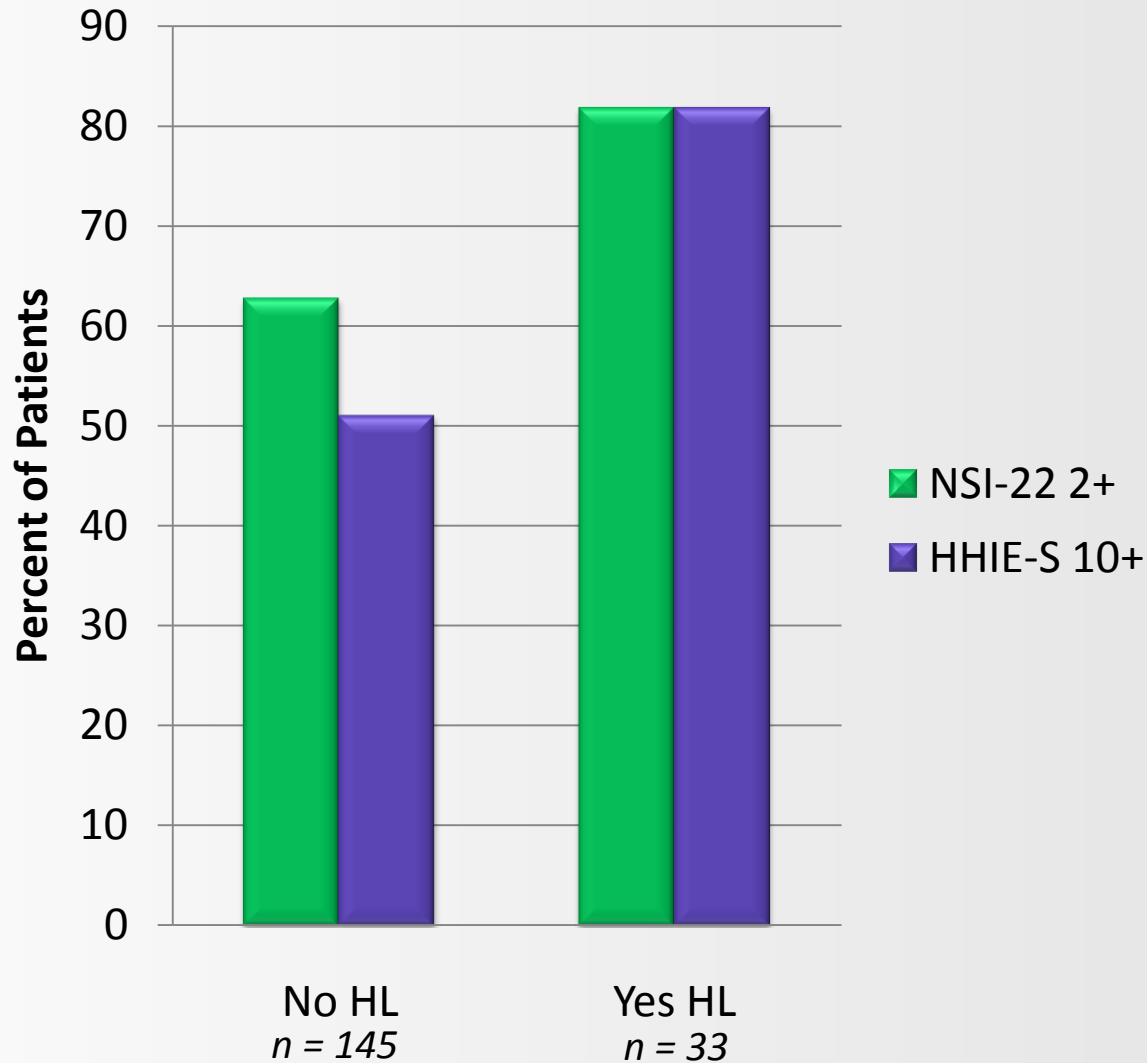
# Statistical Analyses

- Binary logistic model
  - Age (OR: 1.07, 95% CI = 1.00-1.15,  $p < .05$ )
  - HHIE-S score (OR: 1.10, 95% CI = 1.04-1.17,  $p < .05$ )
  - Number of blasts (OR: 1.34, 95% CI = .95-1.87,  $p < .10$ )
- Non-significant findings
  - Blast exposure (yes/no)
  - TBI
  - NSI-22

# Results: Audiograms and Age



# Results: Subjective Reports



# OEF/OIF and Beaver Dam

- Beaver Dam Offspring study
- Hearing loss defined as 500, 1000, 2000, and 4000 Hz PTA >25 dB HL

<b>Age Group</b>	<b>Beaver Dam Offspring (patients per age group)</b>	<b>Polytrauma OEF/OIF Veterans (patients per age group)</b>
21-34	2.9% (170)	3.5% (143)
35-44	6.4% (827)	10.3% (29)
45-54	10.9% (1057)	18.2% (11)

# Limitations

- Small sample size
- Patients may not be representative of other polytrauma clinics
- Time between injury and appointment
- Patients may not be representative of all OEF/OIF veterans

# Conclusions

- Higher rates of hearing loss (18.5%) and self-reported tinnitus (76.5%) as compared to the general population
- Presence of hearing loss is positively correlated with age and HHIE-S scores
  - Number of blasts was marginally predictive of hearing loss
- Implications

# Future Directions

- Larger sample
- Other test measures
- Longitudinal studies



Questions?

# References and Suggested Reading

- Cicerone KD, Kalmar K. Persistent postconcussion syndrome: The structure of subjective complaints after mild traumatic brain injury. *The Journal of Head Trauma Rehabilitation*. 1995;10(3):1-17.
- DVbic – available <http://dvbic.org>
- Echt, KV, Smith, SL, Burridge, AB, Spiro, A. Longitudinal changes in hearing sensitivity among men: The Veterans Affairs Normative Aging Study. *J. Acoust. Soc. Am.* 2010;128(4); 1992–2002
- Henry, JA, Zaugg, TL, Myers, PJ, Schechter, MA. The Role of Audiologic Evaluation in Progressive Audiologic Tinnitus Management. *Trends in Amplification*. 2008;12(3):170-187.
- Hoge CW, McGurk D, Thomas JL, Cox AL, Engel CC, Castro CA. Mild traumatic brain injury in U.S. Soldiers returning from Iraq. *N Engl J Med* 2008;358(5):453-63.
- Lew HL, Jerger JF, Guillory SB, Henry JA. Auditory dysfunction in traumatic brain injury. *Journal of Rehab Res & Dev*. 2007;44(7): 921-928.
- Lew HL, Pogoda TK, Baker E, Meterko M, Stolzmann KL, Cifu DX, Amara JH, Hendricks AM (*in press*). Prevalence of dual sensory impairment and its association with traumatic brain injury and blast exposure in OEF/OIF Veterans. *J Head Trauma Rehab*.
- Lew HL, Myers P, Weihing J, Pogoda T, Goodrich G: Dual sensory impairment (DSI) in traumatic brain injury (TBI) – An emerging interdisciplinary challenge. *Neurorehabilitation*: 2010 Jan 1;26(3):213-22

# References and Suggested Reading

- Myers PJ, Wilmington DJ, Gallun FJ, Henry JA, Fausti SA. Hearing Impairment and Traumatic Brain Injury among Soldiers: Special Considerations for the Audiologist. *Semin Hear* 2009;30:5–27.
- Nash SD, Cruickshanks KJ, Klein R, Klein BEK, Nieto FJ, Huang GH, Pankow, JS, Tweed, TS. The Prevalence of Hearing Impairment and Associated Risk Factors; The Beaver Dam Offspring Study. *Arch Otolaryngol Head Neck Surg*. Published online February 21, 2011. Available: <http://archotol.ama-assn.org/cgi/content/full/archoto.2011.15>
- Polusny, MA, Kehle, SM, Nelson, NW, Erbes, CR, Arbisi, PA, Thuras, P. Longitudinal Effects of Mild Traumatic Brain Injury and Posttraumatic Stress Disorder Comorbidity on Postdeployment Outcomes in National Guard Soldiers Deployed to Iraq. *Arch Gen Psychiatry*. 2011; 68(1):79-89.
- Weinstein, B.E. (1986). Validity of a screening protocol for identifying elderly people with hearing problems. *ASHA*, 28,41–45.
- Wilson, RH, Noe, CM, Cruickshanks, KJ, Wiley, TL, Nondahl, DM. Prevalence and degree of hearing loss among males in Beaver Dam cohort: Comparison of veterans and nonveterans. *Journal of Rehabilitation Research & Development*. 2010;47(6):505-520.