

The Big Picture: The Scope Of Sensory Deficits Associated With Traumatic Brain Injury

Mary Jo Pugh

Research Career Scientist
Salt Lake City Veterans Health Care System
and

Alicia A. Swan

Assistant Professor in Psychology
The University of Texas at San Antonio



Disclosures

- **The presented work has been supported by:**
 - The Chronic Effects of Neurotrauma Consortium (CENC), by joint U.S. Department of Defense or the U.S. Department of Veterans Affairs funds, I01 CX001246 (Dr. Pugh PI).
- **Our current work in this area is also supported by:**
 - The Department of Defense Congressionally Directed Medical Research Program grant W81XWH-17-1-0691 (Dr. Pugh MPI).
 - VA Health Services Research and Development Service RCS 17-297 (Dr. Pugh PI)
- Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the U.S. Government, the U.S. Department of Defense, or the U.S. Department of Veterans Affairs, and no official endorsement should be inferred.

Presentation Goals

- Describe mild TBI (mTBI) in the Veteran population
- Describe the prevalence of sensory disorders in the cohort of Post-9/11 deployed Veterans in VA care
- Describe associations between TBI and blast exposures on sensory conditions

Poll Question #1

- **What is your primary role at the VA?**
 - Student, trainee, or fellow
 - Clinician
 - Researcher
 - Administrator, manager or policy-maker
 - Other
 - Not involved at the VA

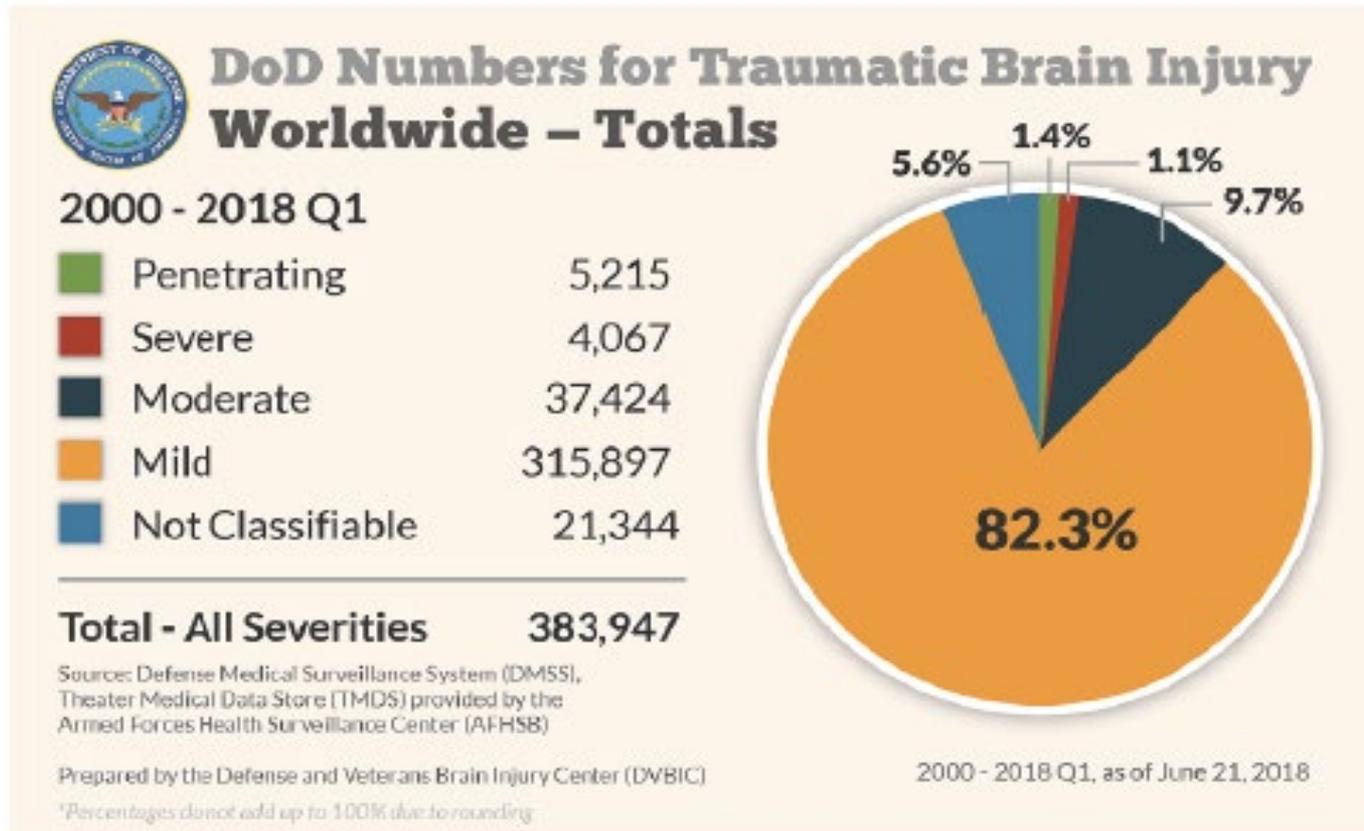
SIGNATURE INJURIES OF POST-9/11 CONFLICTS

Traumatic Brain Injury

Mental Health Conditions

Pain

TBI is Common among Military Personnel



The Impact of Mild TBI

- Short-term symptoms deemed inconsequential and often overlooked
- About 85% will recover completely
- Remaining 15% will have more chronic symptoms

Common symptoms after TBI

- Fatigue/Sleep issues
- Cognitive complaints
- Emotional/Mental Health
- Headaches
- Sensory dysfunction
- Dizziness and/or Balance problems

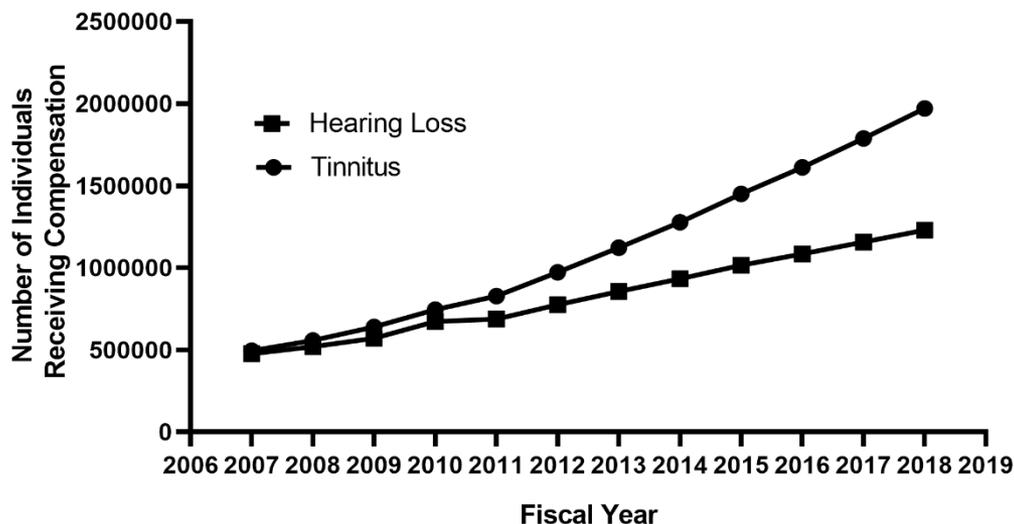
Poll Question #2

What do you think is the most common service-connected disability among Post-9/11 Veterans?

- Post-traumatic stress disorder (PTSD)
- Hearing Loss
- Tinnitus
- Limitation of flexion (knee)
- Migraine

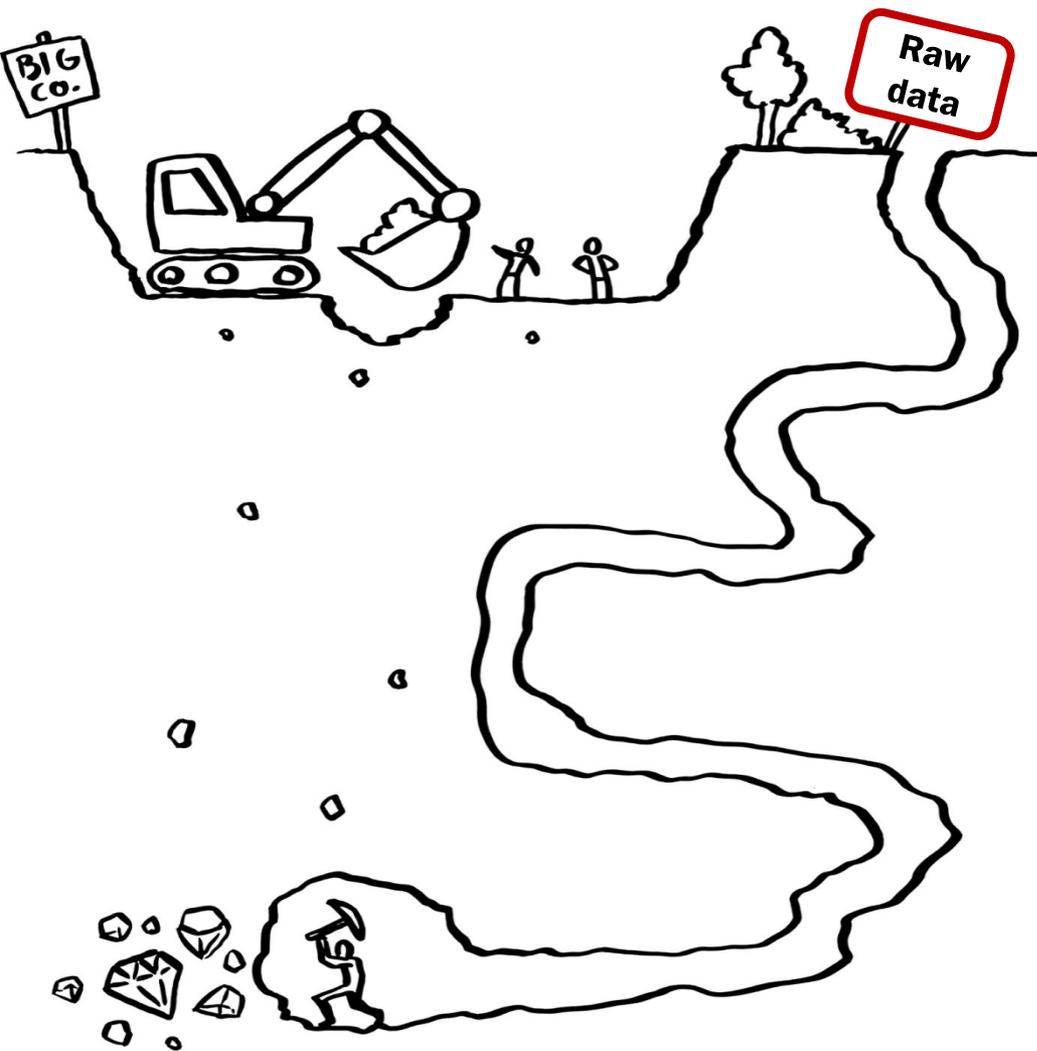
Service-Connected Disability (SCD)

- Post-9/11 Veterans are more likely than previous eras to have SCD
 - 1.23 million have at least one SCD
 - An average of 7.78 SCDs per individual
 - Payments to Veterans of this era: \$22 billion annually
- Tinnitus and Hearing Loss are among the most common SCDs of all eras



Other Sensory Dysfunctions

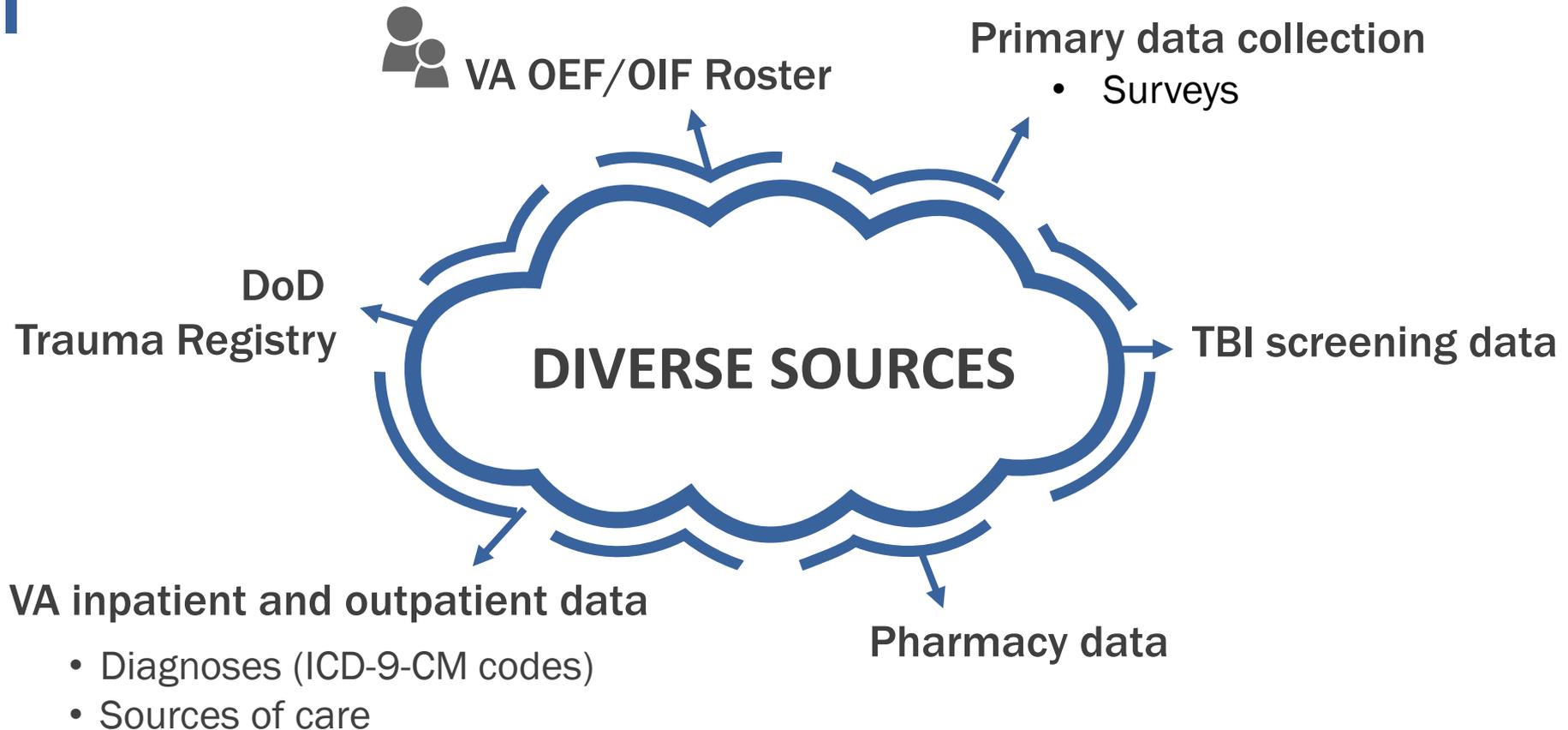
- Less common but have a profound impact on functional status and quality of life
 - Visual problems
 - Blurred Vision
 - Double Vision
 - Blindness
 - Vestibular Dysfunction, Dizziness, and Balance Problems
 - Chemosensory (taste/smell)
 - Other Auditory Conditions
 - Hyperacusis



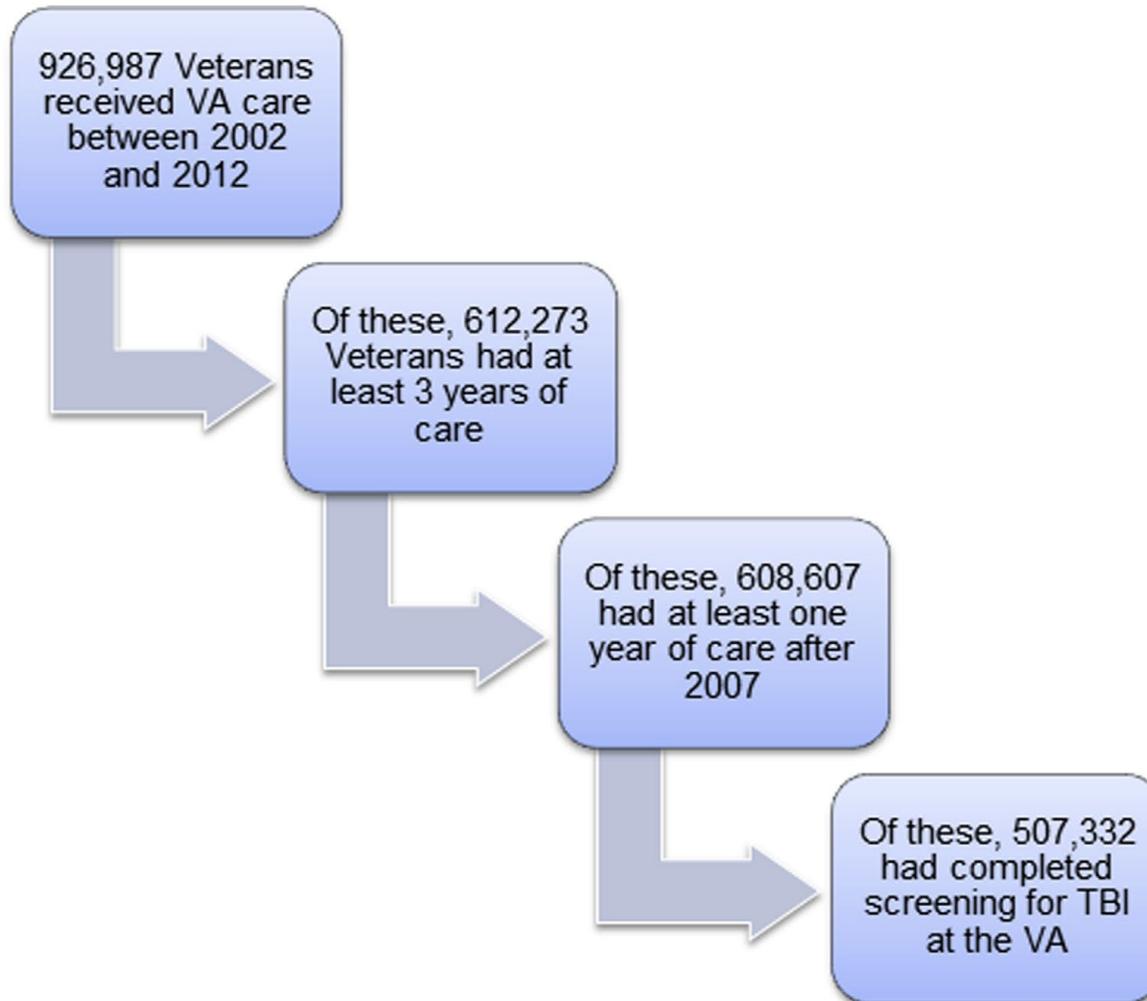
Goal.

Identify associations of TBI/TBI severity and sensory dysfunction in Post-9/11 deployed Veterans

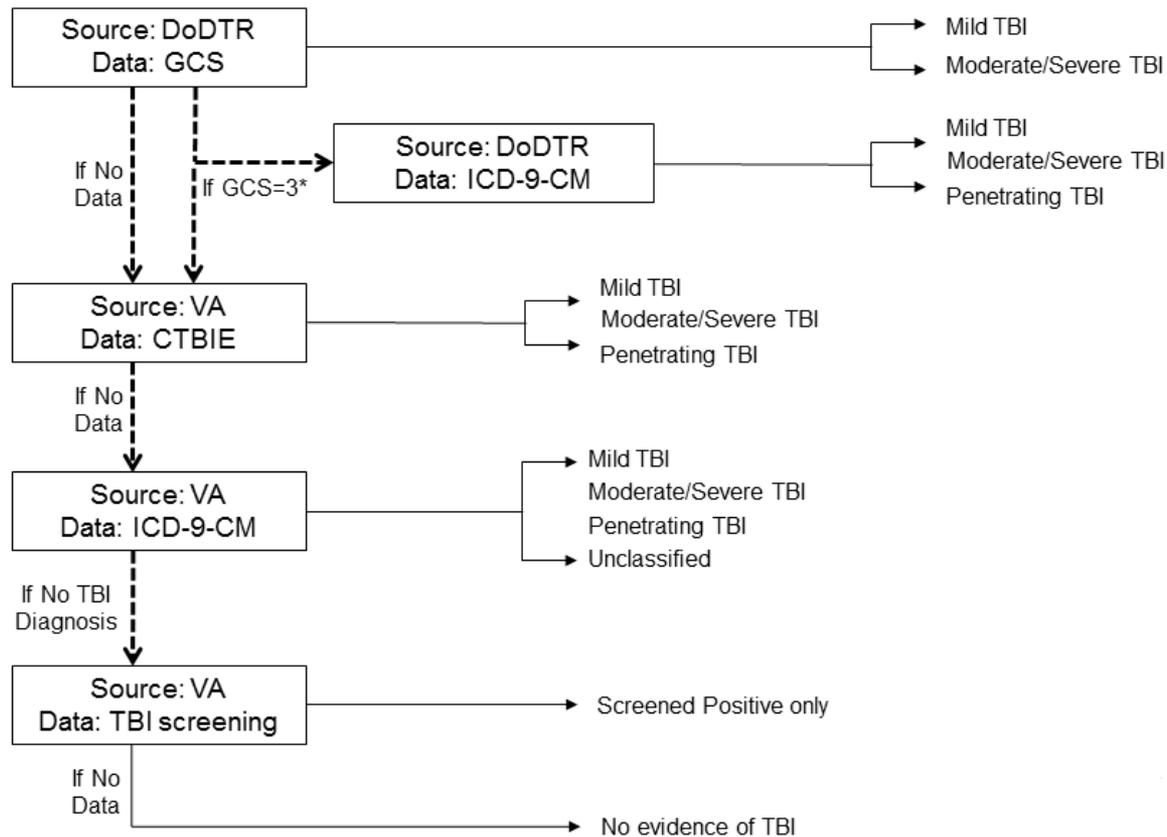
Data Sources



Cohort Flow Diagram



CENC Epidemiology Study: TBI severity algorithm



Diagnoses Identified Using ICD-9 Codes

Sensory Disorders

- Hearing Loss
- Tinnitus
- Vision disorders
- Vestibular disorders
- Chemosensory disorders

Post-concussive Conditions (such as):

- Mental Health (e.g., PTSD, depression)
- Pain (e.g., Headache)
- Sleep problems
- Cognitive problems

Blast Exposure Measures

- Blast exposure is hard to approximate
 - Subjective
 - Retrospective
- Blast exposure at in VA administrative data
 - Screening: Exposure
 - CTBIE: Cause, type, number, proximity
- Sensitivity and Specificity

Tertiary blast injury (injuries due to impact with another object)



Secondary blast injury (injuries due to missiles being propelled by blast force)

Primary blast injury (injuries due to the blast wave itself)

Illustration by Charles Stewart, MD.

Hearing Loss & Tinnitus

Research Paper

Prevalence of hearing loss and tinnitus in Iraq and Afghanistan Veterans: A Chronic Effects of Neurotrauma Consortium study

A.A. Swan ^{a, b, *}, J.T. Nelson ^{b, c}, B. Swiger ^d, C.A. Jaramillo ^a, B.C. Eapen ^a, M. Packer ^c, M.J. Pugh ^{a, b}

^a South Texas Veterans Health Care System, San Antonio, TX, United States

^b University of Texas Health Science Center San Antonio, San Antonio, TX, United States

^c Department of Defense Hearing Center of Excellence, United States

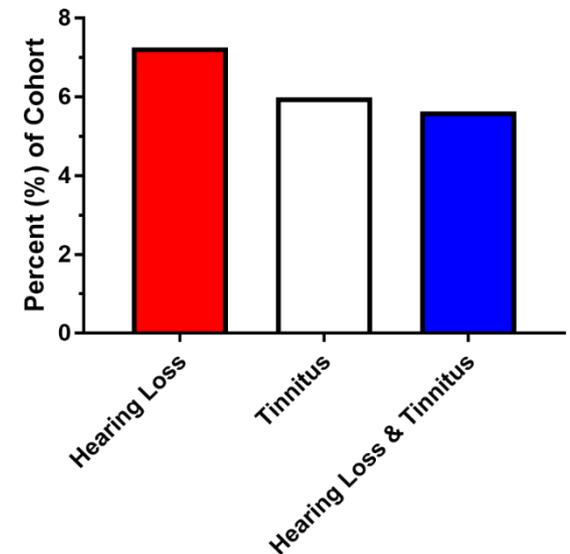
^d Center for Nursing Science and Clinical Inquiry, Brooke Army Medical Center, United States

Evaluate socio-demographics and common post-deployment conditions associated with hearing loss and/or tinnitus using the Post-9/11 CENC cohort

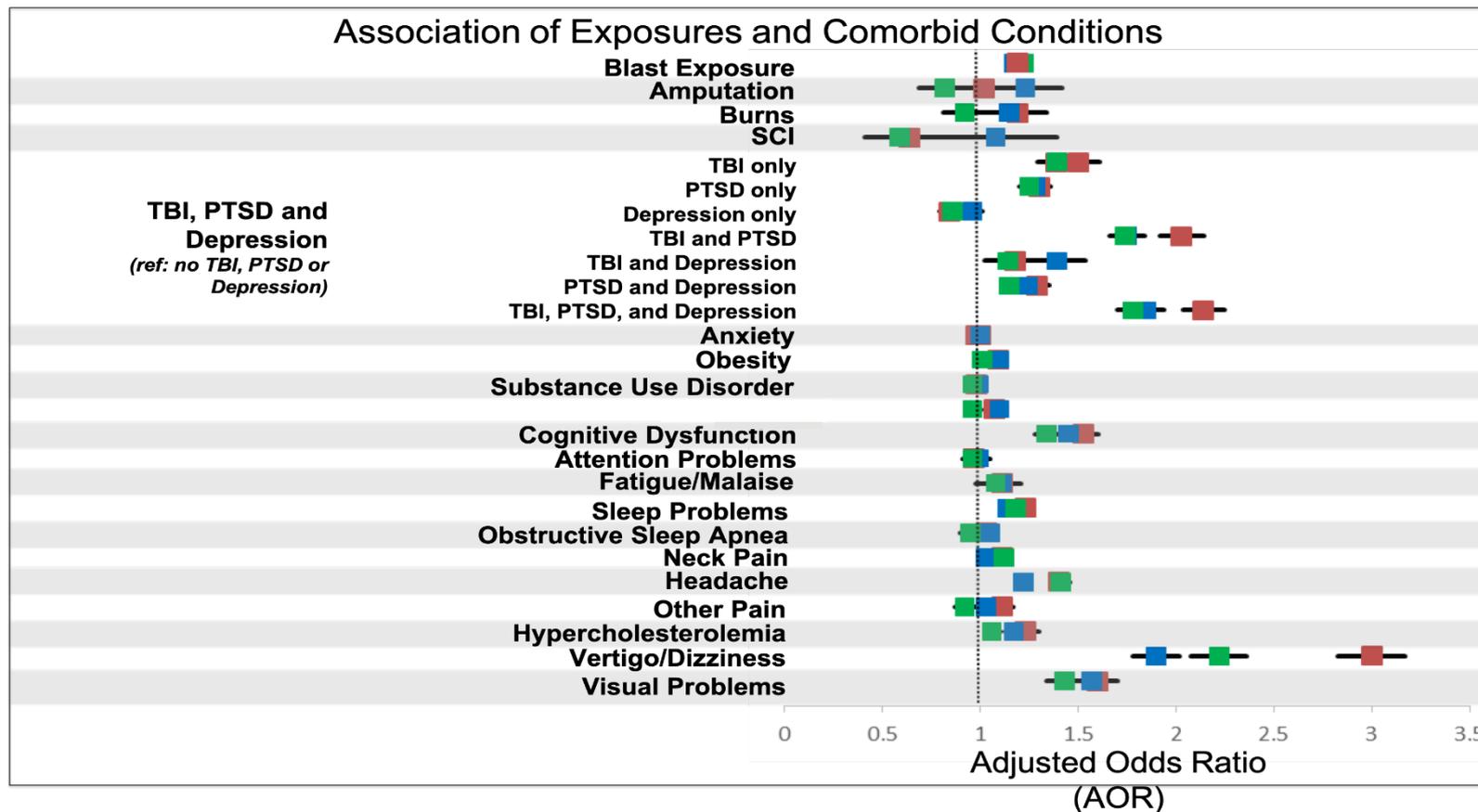
Hearing Loss & Tinnitus

- Veteran cohort N=570,248
- Multinomial logistic regression
- Those with any auditory dysfunction are more likely to:
 - Be male
 - Be Caucasian non-Hispanic
 - Be most recently in the National Guard/Reserve
 - Report exposure to blast (at TBI screening)
- However, Hearing Loss and Tinnitus do differ:
 - Increased age is associated with Hearing Loss, but not Tinnitus
 - Enlisted service members are more likely to have Hearing Loss diagnoses, but Officers are more likely to have Tinnitus diagnoses

Prevalence among Post-9/11 Veterans



Hearing Loss & Tinnitus

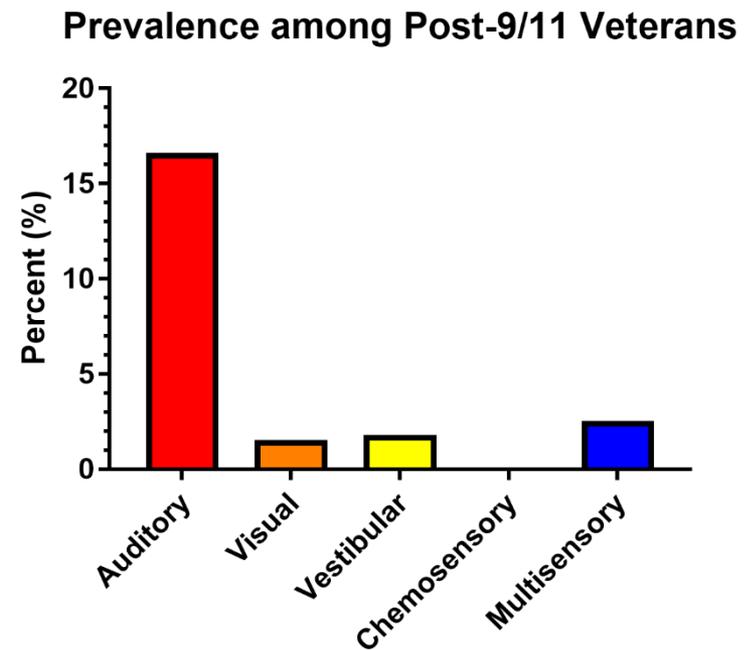


Sensory Dysfunction

Published in the *Brain Injury* special issue featuring the work of the Chronic Effects of Neurotrauma Consortium (CENC)

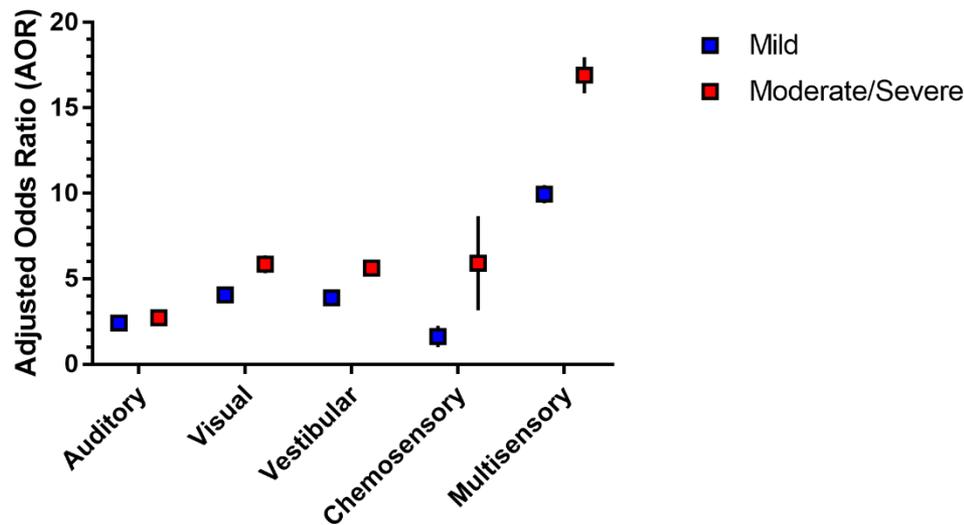
Examines all types of sensory dysfunction in Post-9/11 Veterans in the CENC cohort

Used multinomial regression to examine influence of TBI while controlling for sociodemographic factors



Sensory Dysfunction

Association with TBI by Severity



Associated with an increased rate of any type of sensory dysfunction:

- Enlisted rank
- Increased age
- TBI of any severity

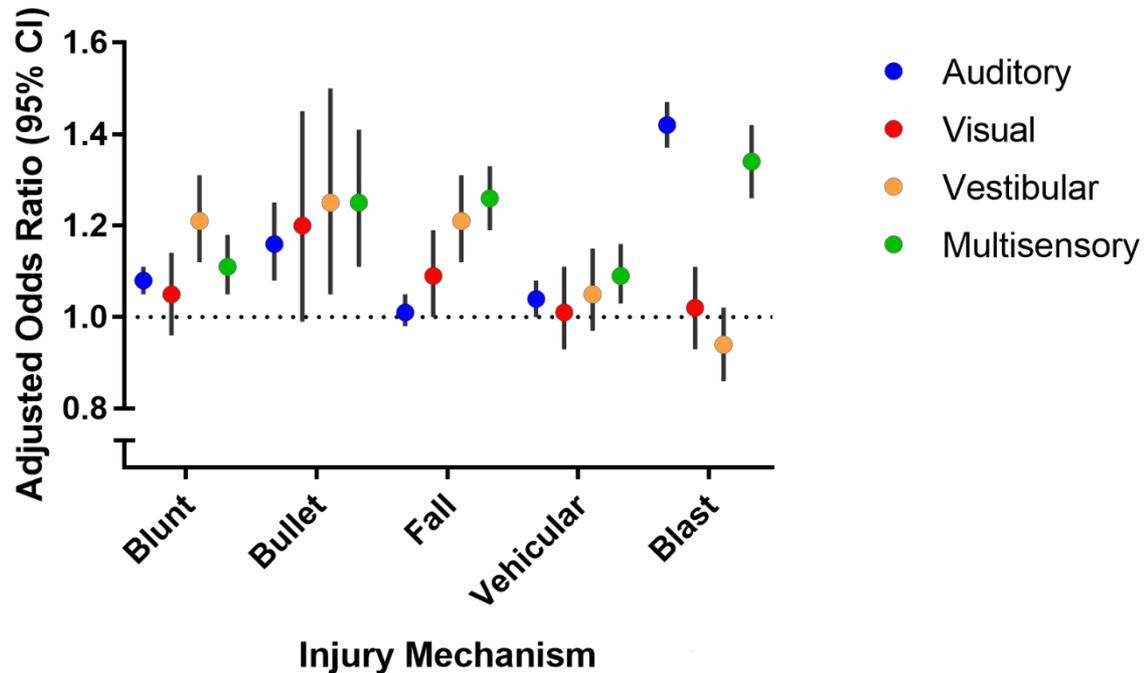
More nuanced differences:

- *Men* more likely to have Auditory problems, *Women* more likely to have Vestibular Problems
- *Caucasian non-Hispanic* more likely to have Auditory problems, Less likely to have Visual problems
- *Blast exposure* only related to increased rates of Auditory problems

Sensory Dysfunction

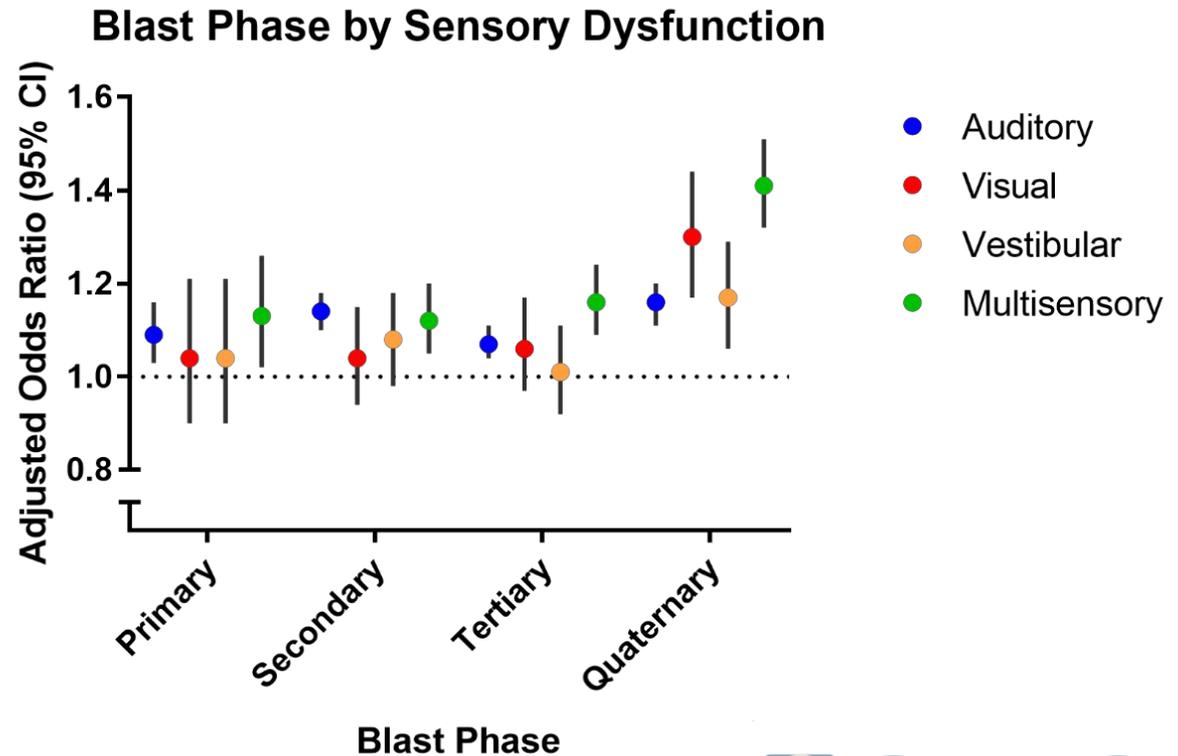
Among those that completed the Comprehensive TBI Evaluation (CTBIE), we examined the association between deployment injury mechanism and sensory dysfunction

Sensory Dysfunction by Injury Mechanism



Sensory Dysfunction

Among those that completed the *CTBIE* and reported blast exposure, we examined the association between **blast phase** and **sensory dysfunction**



Acknowledgments

- Megan Amuan, MPH
- Jeremy Nelson, PhD
- Faith Akin, PhD
- Terri Pogoda, PhD
- Robert Beck, PhD
- Peggie Wells
- Barb Elizondo
- Kathy Franklin

