

It's all about the Blast: PTSD and TBI after Combat Blast Explosions



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Disclosures

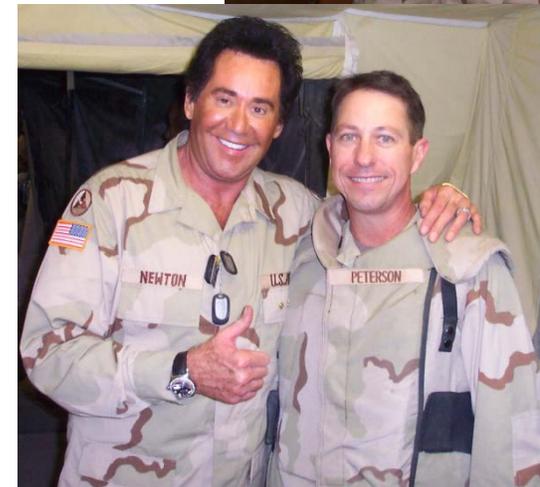
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Outline

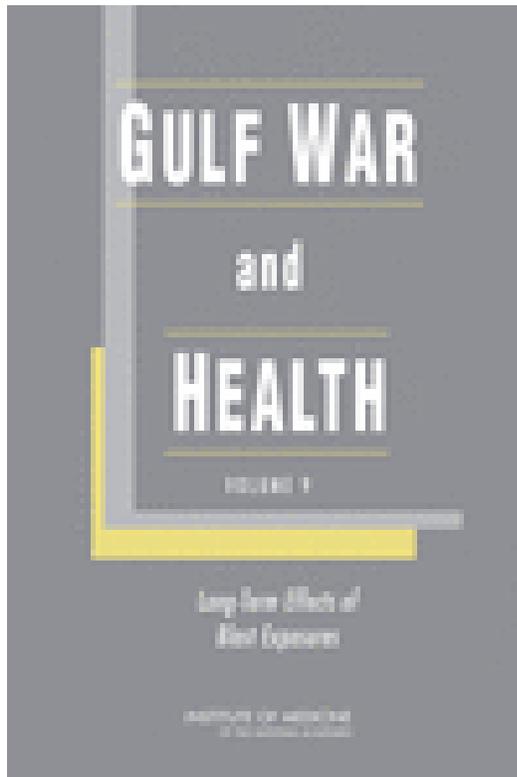
- Overview of blast exposure during military deployments
- Brief review of PTSD and TBI
- Brief overview of STRONG STAR and CAP
- Review of manuscript: Baker, Moring, Hale, Mintz, Young-McCaughan, Bryant, Broshek, Barth, Villarreal, Lancaster, Malach, Lara-Ruiz, Isler, & Peterson, for the STRONG STAR Consortium. (2018). Acute assessment of traumatic brain injury and posttraumatic stress after exposure to a deployment-related explosive blast. *Military Medicine*, 183(11-12), e555-e563. doi:10.1093/milmed/usy100

Brief Bio, Alan Peterson, PhD

- Retired USAF Clinical Health Psychologist (1976-2005)
 - Dept Chair and Fellowship Director, Wilford Hall Medical Center
 - Deployed in support of OEF/OIF/OND
- UT Health San Antonio (2005-present)
 - Krus Endowed Chair, Department of Psychiatry, School of Medicine
 - Professor and Chief, Division of Behavioral Medicine
 - Director, STRONG STAR Consortium
 - Director, Consortium to Alleviate PTSD
 - Associate Director of Research, Military Health Institute
- UTSA Dept of Psychology (2012-present)
 - Professor, Military Health Psychology PhD Program
- South Texas Veterans Health Care System (2014-present)
 - Research Health Scientist



Much of the blast data reported in this presentation are from the IOM Report on Long-Term Effects of Blast Exposures (2014)



GULF WAR and HEALTH

*Long-Term Effects of
Blast Exposures*

Committee on Gulf War and Health:
Long-Term Effects of Blast Exposures

Board on the Health of Select Populations

INSTITUTE OF MEDICINE
OF THE NATIONAL ACADEMIES

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Washington, D.C.
www.nap.edu

Overview

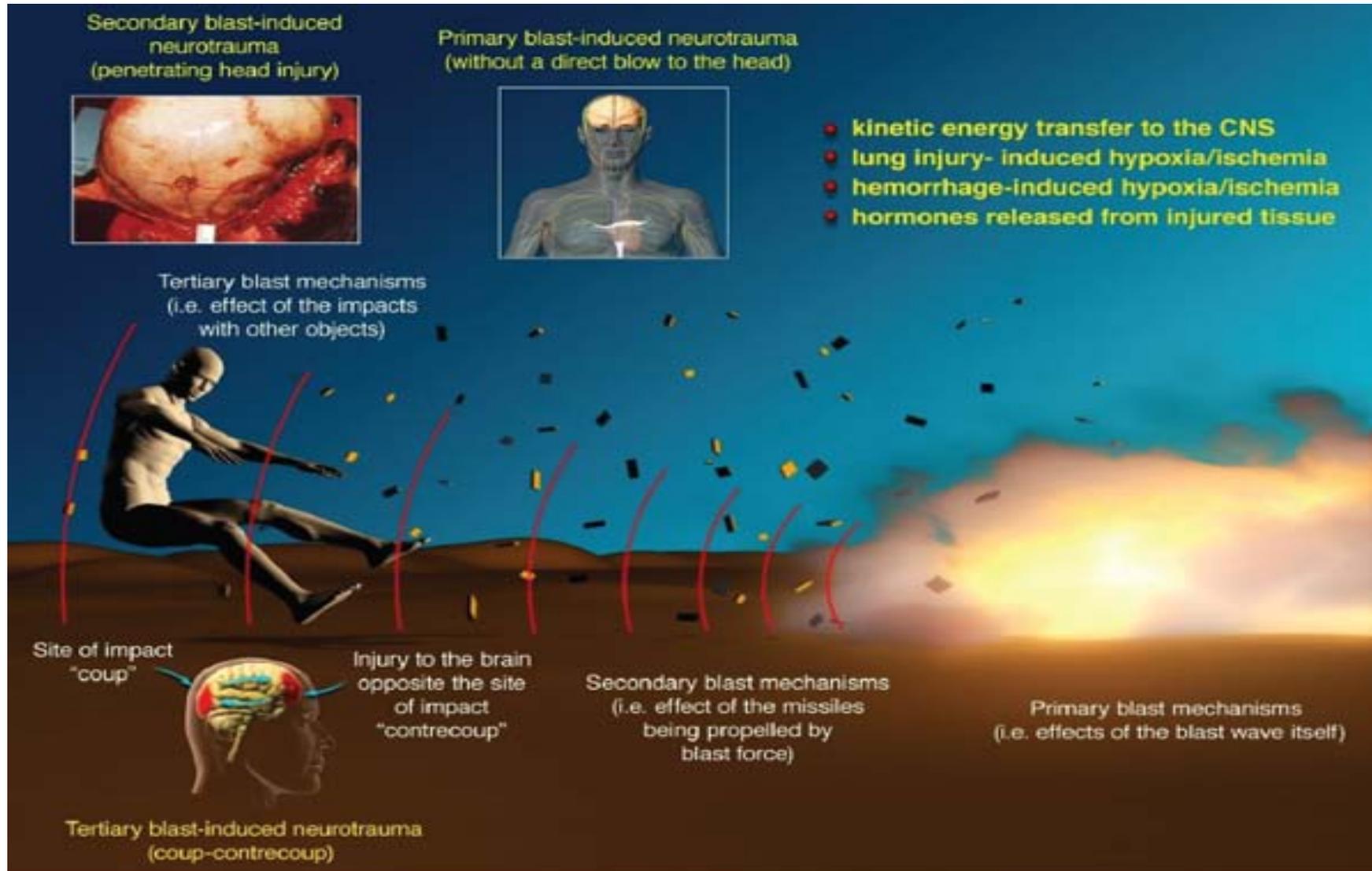
- Blast explosions have been the primary cause of morbidity and mortality in military personnel deployed in and around Iraq and Afghanistan (Eastridge et al., 2012; Greer et al., 2016)
 - Amputations
 - Burns
 - Posttraumatic stress disorder (PTSD)
 - Traumatic Brain Injury (TBI)
 - Other related injuries

Overview

- Explosive blasts can cause multiple forms of damage that are more complex than any other wounding agent (Champion et al., 2009; Jorolemon, & Krywko, 2019)
- Recent reports indicate that almost 80% of all combat-related injuries in US military personnel deployed to Iraq and Afghanistan have been from blasts (Institute of Medicine, 2014)
- This is the highest proportion seen in any large-scale conflict (Murray et al., 2005; Owens et al., 2008)

Complex Injurious Environment Due to Blast

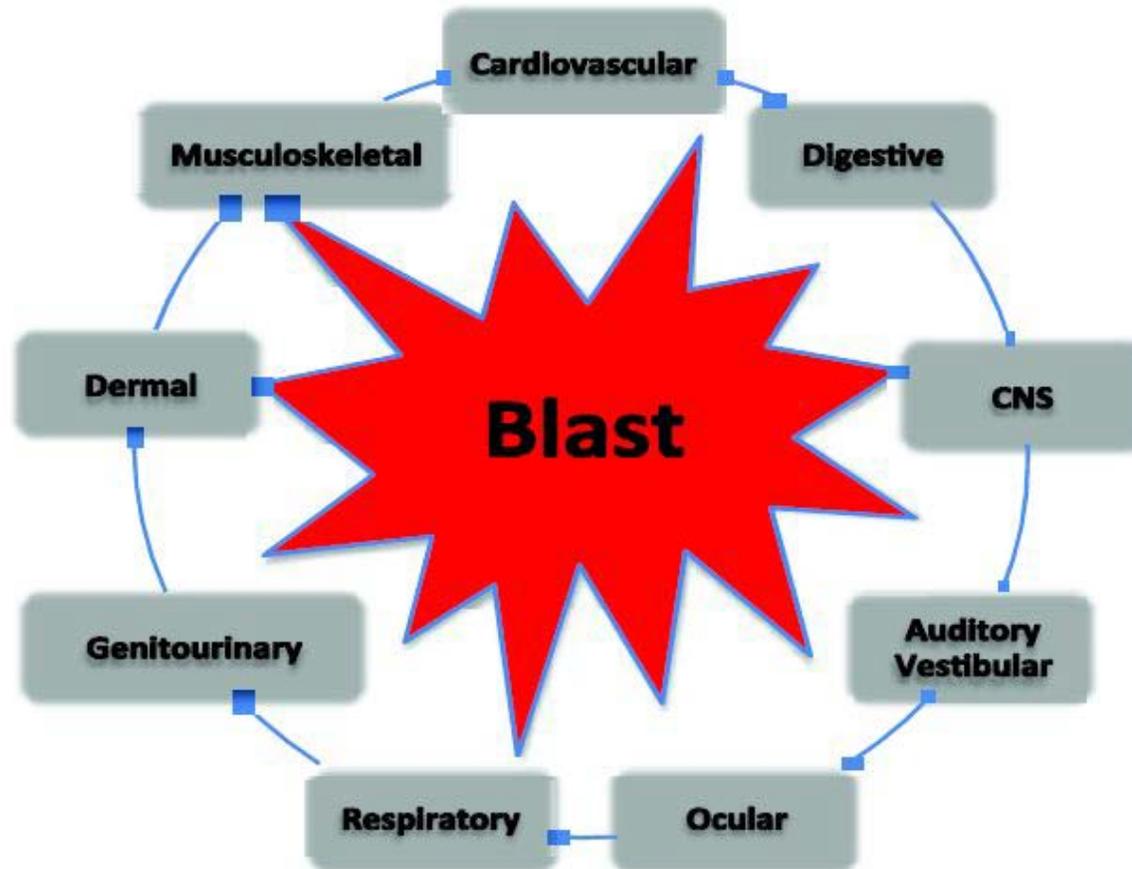
Institute of Medicine Committee on Long-Term Consequences of Blast Exposures (2014)



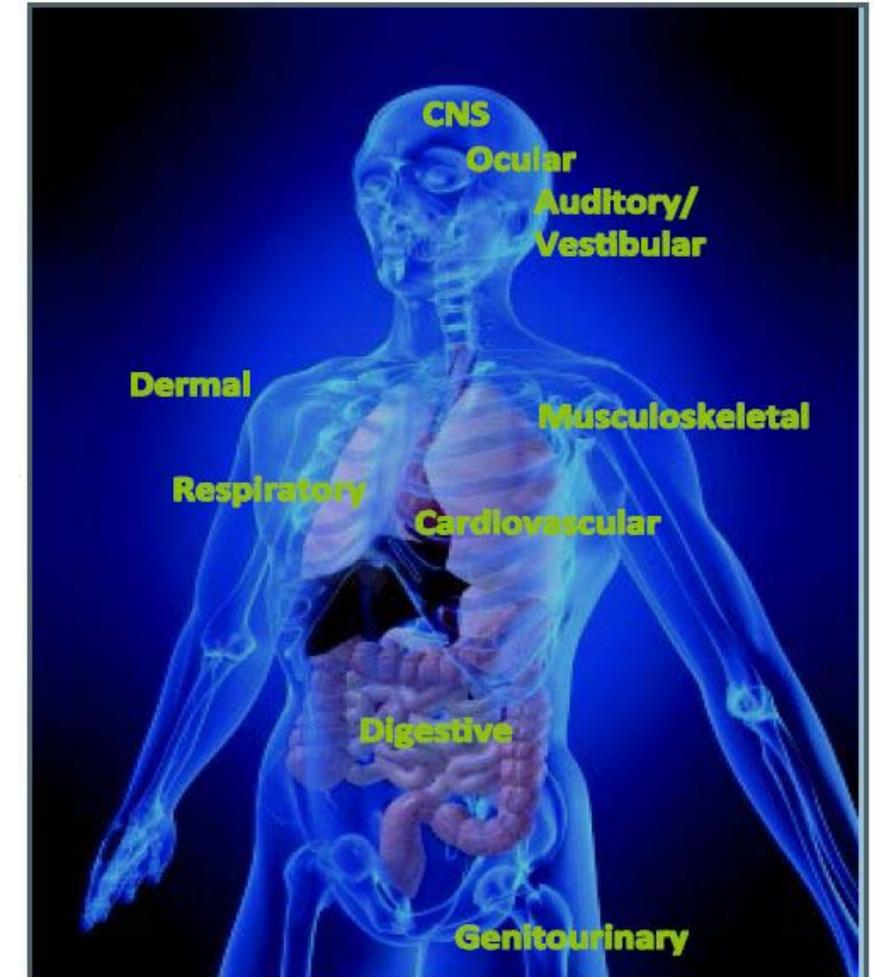
The Multi-System Response to Blast

Institute of Medicine Committee on Long-Term Consequences of Blast Exposures (2014)

Acute Blast: Vulnerable Organs/Systems



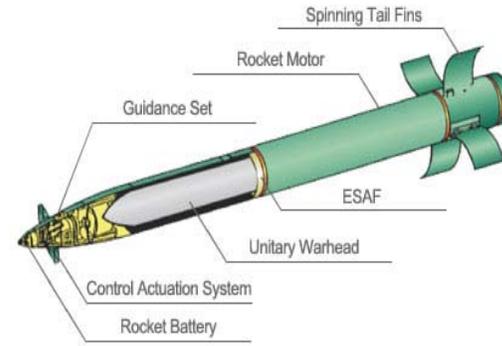
Long-term Secondary Effects



Modified from www.readengage.com

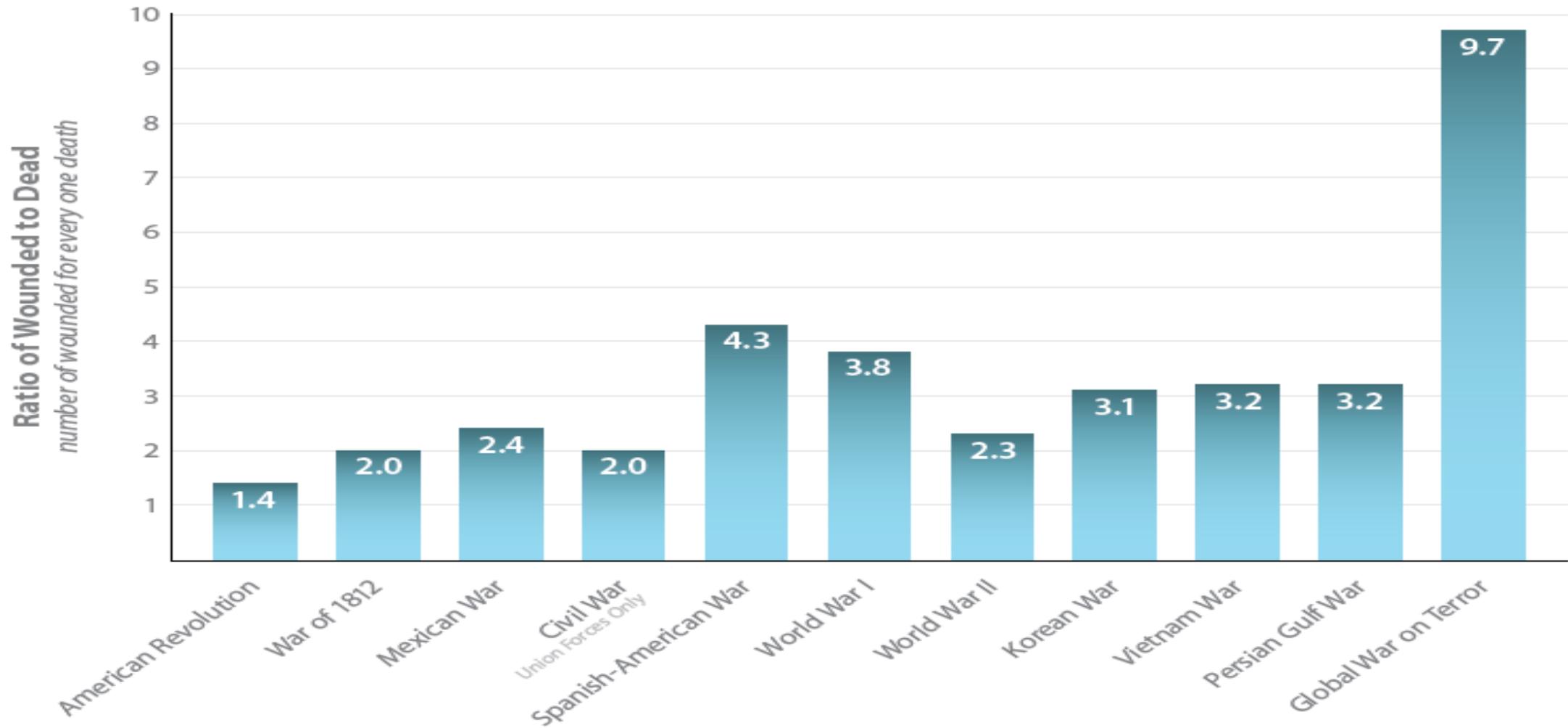
Primary Causes of Battlefield Explosions

Mortars
Rockets
RPGs
Mines
IEDs
VBEDs



Increased Ratio of Wounded to Deceased

Institute of Medicine Committee on Long-Term Consequences of Blast Exposures (2014)





STRONG STAR

- South Texas Research Organizational Network Guiding Studies on Trauma And Resilience
 - Acronym that should always be written as two words, all caps: STRONG STAR
- Headquartered at the UT Health Science Center at San Antonio
- Largest PTSD Research Consortium in world
- Funded by research grants through the DoD, VA, NIH, and private foundations
 - Over 14 of the world's leading investigators
 - Over 40 collaborating institutions
 - 60 research projects
- Conducting many of the most important military-relevant clinical trials and translational research in DoD
- Results have had direct impact on best clinical practices in military and VA treatment facilities

www.STRONGSTAR.org

The image shows the top portion of the STRONG STAR website. The header is dark blue with a gold star emblem on the left containing a red and white star and the text "STRONG STAR Building Strong. Resilient Warriors". To the right of the emblem, the text "STRONG STAR" is written in large white letters, followed by "South Texas Research Organizational Network Guiding Studies on Trauma And Resilience" and "A SECURE SITE" with a lock icon. In the top right corner, there is a red "Get Treatment" button with a white cross icon and three circular navigation buttons labeled "Home", "Login", and "Contact". Below the header is a dark grey navigation bar with white text for "About STRONG STAR", "Consortium Research", "Affiliated Studies", "Media and Publications", "PTSD Facts and Resources", and "Employment". The main banner features a photograph of two soldiers in camouflage uniforms shaking hands. The word "STRENGTH" is overlaid in large white letters on the left, and the phrase "Through Partnership" is written in a white script font across the bottom of the image. A name tag "PETERSON" is visible on the soldier's uniform. A video player control bar is at the bottom right of the banner.

STRONG STAR
South Texas Research Organizational Network Guiding Studies on Trauma And Resilience
A SECURE SITE

Get Treatment

Home Login Contact

About STRONG STAR Consortium Research Affiliated Studies Media and Publications PTSD Facts and Resources Employment

STRENGTH
Through Partnership

PETERSON

Overview of STRONG STAR Projects

- Approximately 150 peer-reviewed DoD, VA, NIH, and private grant submissions over past 12 years
- 63 Projects Funded
 - 14 Original STRONG STAR Projects
 - 38 STRONG STAR-Affiliated Projects
 - 10 Previous STRONG STAR-Affiliated Projects
 - 28 Ongoing STRONG STAR-Affiliated Projects
 - 11 CAP Projects



UT Health San Antonio and
the STRONG STAR Consortium present

THE STRONG STAR TRAINING INITIATIVE



- Launched in 2017
- Translate STRONG STAR Research and expertise into the practice of community mental health providers
- Competency-based training program in EBT for PTSD: Cognitive Processing Therapy and Prolonged Exposure

Funded by: Bob Woodruff Foundation and Texas Veteran + Family Alliance Grant Program

Learn More at: www.strongstartraining.org

San Antonio Combat PTSD Conference

Dates:

23-24 October 2019*

21-22 October 2020

Location:

Henry B. Gonzalez
Convention Center

Cost:

Free Registration.

Charge for CEUs



*2019 Conference is SOLD OUT!

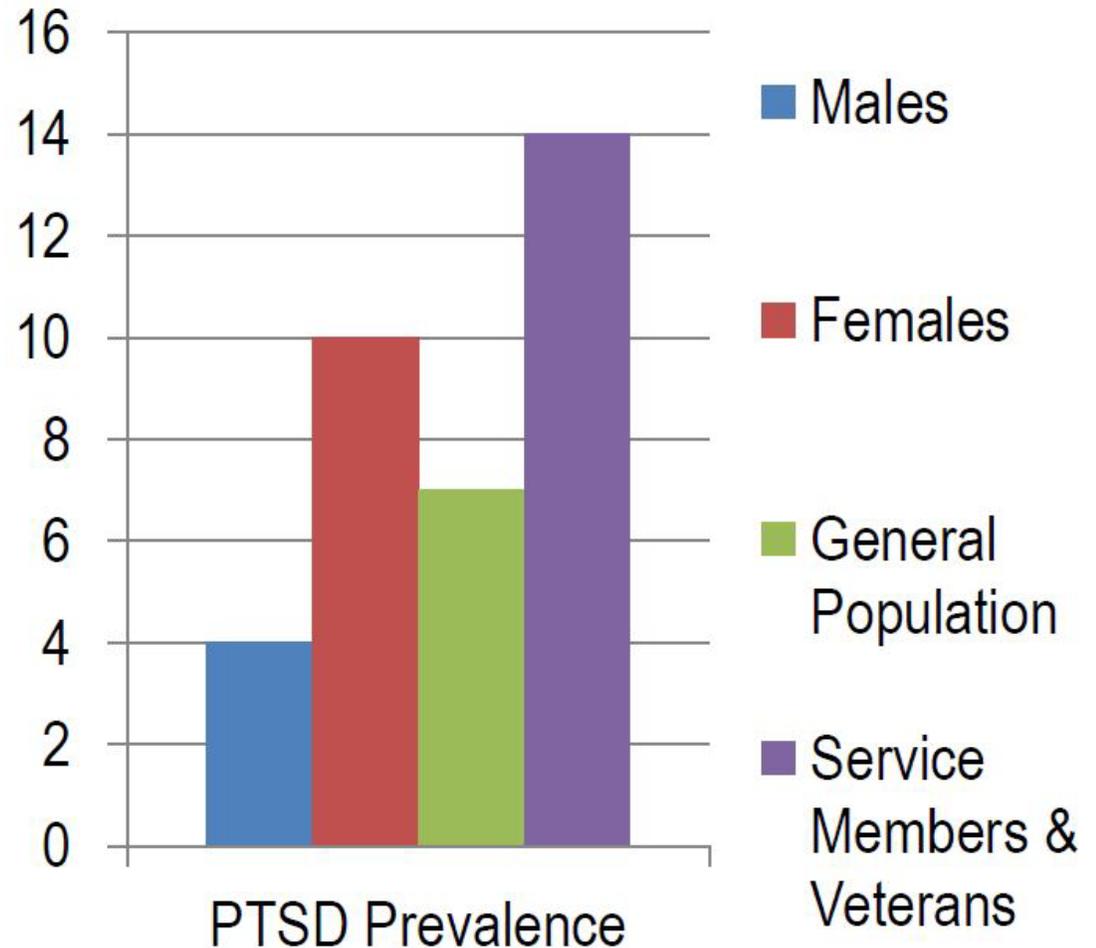
www.combatPTSDconference.com

What is Posttraumatic Stress Disorder (PTSD)?

- Results from exposure to one or more extreme traumatic events
 - Military Combat
 - Motor Vehicle Accidents
 - Physical or Sexual Assault
 - Terrorist Attacks
 - Natural Disasters
 - Other traumatic events
- Symptoms include
 - Distressing memories, dreams, flashbacks
 - Avoidance of trauma reminders
 - Negative changes in thought processes, mood
 - Heightened arousal (e.g., irritable, startle easily, difficulty concentrating, sleep disturbance)

How Common is PTSD?

- Affects 7% of Americans
 - 4% adult males
 - 10% adult females
- Percentage is twice as high in military service members and veterans (14%)



Who is at Greatest Risk for PTSD?

- Those with most significant or frequent traumas
- Tip-of-the spear military warriors
- Those in blast explosions resulting in horrific and mutilating injuries and death
- Those who experience significant risk of personal injury or death
- Those who experience things no humans should have to experience



Comorbidities of PTSD

- PTSD has many related or comorbid conditions
 - Depression
 - TBI
 - Sleep Disorders
 - Chronic Pain
 - Substance Use Disorders
 - Suicide



VA/DOD Definition of TBI

- A traumatically induced structural injury and/or a physiologic disruption of brain function
 - as a result of an external force
 - that is indicated by new onset or worsening of
 - at least 1 of 5 clinical signs immediately following the event

VA/DOD Definition of TBI

(Management of Concussion/mTBI Working Group, 2009)

- At least one of the following clinical signs immediately following the event:
 - Loss of consciousness
 - Loss of memory for events immediately before or after injury
 - Alteration in mental state at the time of injury
 - Neurologic deficits
 - Intracranial lesion

How is TBI Diagnosed?

- 2nd Level TBI Evaluation:
 - Interview
 - Physical Examination
 - Neurobehavioral Symptom Inventory
- TBI is a historical event
- It is most often retrospectively diagnosed

Severity of TBI

- Three main indices:
 - Duration of Loss of Consciousness (LOC) or Alteration of Consciousness (AOC)
 - Post-Traumatic Amnesia (PTA)
 - Glasgow Coma Scale (GCS)

Severity of Injury (VA/DOD)

Criteria	TBI Severity Index		
	Mild	Moderate	Severe
GCS	13-15	> 30 minutes and < 24 hours	> 24 hours
LOC	0-30 min	> 30 min and < 24 hours	> 24 hours
AOC	up to 24 hours	> 24 hours	
PTA	0-1 day	> 1 and < 7 days	> 7 days
Structural imaging	Normal	Normal or abnormal	Normal or abnormal

TBI Diagnostic Challenges

- Diagnostic criteria are based largely on patient self-report, particularly for mild TBI
- Possible threats to diagnostic accuracy:
 - Recall bias
 - Cognitive difficulties
 - Overlap of symptoms in co-morbid conditions (e.g., PTSD)
 - Other factors

TBI and PTSD Symptom Overlap

TBI

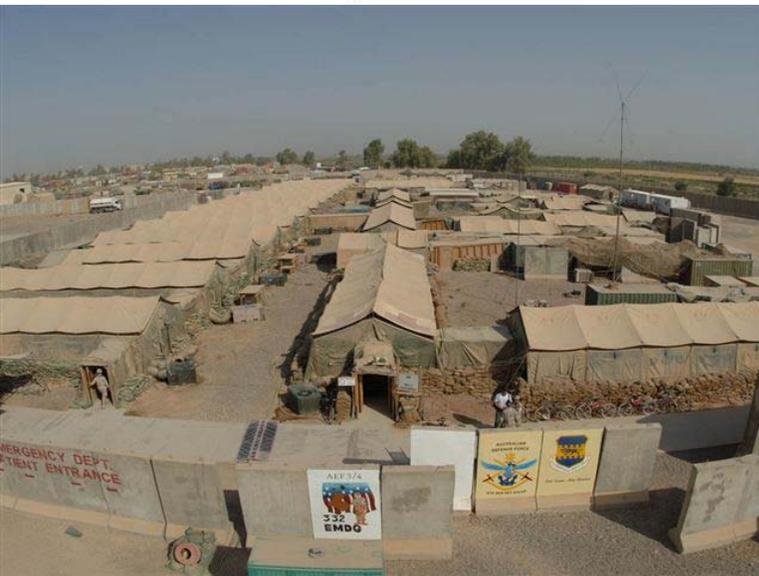
- Insomnia
- Memory Problems
- Poor concentration
- Depression
- Anxiety
- Irritability
- Headache
- Dizziness
- Fatigue
- Noise/light intolerance

PTSD

- Insomnia
- Memory problems
- Poor concentration
- Depression
- Anxiety
- Irritability
- Re-experiencing
- Avoidance
- Emotional numbing

Acute Assessment of Traumatic Brain Injury and Post-Traumatic Stress After Exposure to a Deployment-Related Explosive Blast

Lt Col Monty T. Baker, BSC USAF†; John C. Moring, PhD*; Willie J. Hale, PhD*‡; Jim Mintz, PhD*; COL Stacey Young-McCaughan, AN USA (Ret.)*; Richard A. Bryant, PhD§; Donna K. Broshek, PhD||; Jeffrey T. Barth, PhD||; Robert Villarreal, MS*; Cynthia L. Lancaster, PhD¶; Steffany L. Malach, PhD***; Jose M. Lara-Ruiz, MA*‡; Col William Isler†; Lt Col Alan L. Peterson, BSC USAF (Ret.)*‡††; for the STRONG STAR Consortium*



Study Overview

- Most studies on TBI severity and symptom presentation are conducted post deployment
- **Aim:** To provide a description of the methodology used and data collected in one of the largest studies to date of the assessment of acute stress disorder (ASD), PTSD, and TBI following exposure to a deployment-related explosive blast

Study Overview

- The neuropsychological and psychological assessment of patients occurred between September 2006 and September 2007 at the Air Force Theater Hospital, 332nd Air Expeditionary Wing, Joint Base Balad, Iraq
- At the time of the study, the Air Force Theater Hospital was one of the largest and busiest combat support hospitals in Iraq
- It was co-located with the Contingency Aeromedical Staging Facility (CASF) where the majority of U.S. military patients in Iraq who required aeromedical evacuation were staged prior to transport out of the combat theater

Study Overview

- At the time of the initiation of the assessments, no in-theater policy existed for the routine assessment of patients after a head injury
- Investigators established an acute assessment battery for neuropsychological and psychological symptoms in patients referred for evaluation after sustaining a head injury with a suspected mild TBI
- Soon after the establishment of this acute TBI assessment battery, the Balad became the primary referral site for TBI patients throughout Iraq
- Patients evaluated as part of routine clinical assessment of symptoms of TBI and psychological health symptoms to determine suitability for return to duty in theater
- Military IRB approval was obtained at Wilford Hall Medical Center in 2008 to establish a repository of de-identified patient data used for the data analysis

Sample

- 894 deployed U.S. military personnel completed an acute assessment of neuropsychological and/or psychological functioning as part of routine clinical care after exposure to a deployment-related traumatic event
- Data from 93 patients were removed from the data set for analysis because:
 - 84 experienced a head injury due to an event that was not a blast
 - 9 were only assessed for psychiatric symptoms
- Final N = 801 blast-exposed patients for data analysis

Sample Demographics

- Males (86%)
- Ages: 18–29 (76%)
- White/Caucasian (21%)
- Married/Partnered/Engaged (35%)
- Army Soldiers (72%)
- Active Duty (68%)
- Enlisted (82%)
- History of head injury: 51%



Number of Completed Pairs of Measures ($N = 801$)

	MACE	RBANS	CSI	ANAM4	PCL-M	ASDS	CES
MACE							
RBANS	186						
CSI	125	53					
ANAM4	146	92	69				
PCL-M	429	212	114	151			
ASDS	274	183	95	149	328		
CES	101	52	50	97	127	107	

Descriptive Statistics: Neuropsychological Measures

- **MACE:** Military Acute Concussion Evaluation
 - ($n = 565$), $M = 26.42$, ($SD = 3.01$)
- **RBANS:** Repeatable Battery for the Assessment of Neuropsychological Status
 - ($n = 313$), $M = 84.72$ ($SD = 16.43$)
- **CSI:** Cognitive Stability Index
 - ($n = 202$) factors ranged from $M = 87.64$ ($SD = 27.93$) to $M = 94.44$ ($SD = 15.63$)
- **ANAM4:** Automated Neuropsychological Assessment Metrics, Version 4.0
 - ($n = 158$), subtests ranged from $M = 16.83$ ($SD = 6.73$) to $M = 165.00$ ($SD = 65.70$)

Descriptive Statistics: Neuropsychological Measures

Neuropsychological Measures	Number of Patients	Possible Range of Scores	Mean Score	Standard Deviation
MACE total score	565	0–30	26.42	3.01
Immediate memory	487	0–15	14.46	1.31
Orientation	485	0–5	4.34	0.083
Concentration	483	0–5	3.86	1.09
Delayed recall	483	0–5	3.77	1.18
RBANS total score	333	40–160	84.72	16.43
Immediate memory	333	40–160	86.19	16.24
Visuospatial construction	333	40–160	100.08	15.30
Language	333	40–160	85.60	14.13
Attention	333	40–160	84.89	19.66
Delayed memory	333	40–160	82.66	20.44
CSI total score	N/A^b	N/A^b	–	–
Response speed	221	50–150	92.05	25.62
Memory	235	50–150	87.64	27.93
Attention	225	50–150	90.28	14.89
Processing speed	235	50–150	94.44	15.63
ANAM4 total score	N/A^b	N/A^b	–	–
Code substitution delayed ^c	155	0.4–154.6	30.12	15.06
Code substitution learning ^c	157	0.4–97.6	39.13	12.40
Matching to sample ^c	155	0.6–96.6	24.16	11.65
Mathematical processing ^c	155	0.6–144.8	16.83	6.73
Processing speed ^c	157	2.4–150.6	73.28	27.58
Simple reaction time (<i>R</i>) ^c	155	9.8–356.4	163.43	69.70
Simple reaction time ^c	158	4.2–366.2	165.00	65.70

Bivariate Correlations of Neuropsychological Measures

- Neuropsychological measures correlated with each other
 - Strongest correlations:
 - CSI factors and ANAM4 subtests ($r_s = .51$ to $.58$; $p < .05$)
 - RBANS attention domain score with the CSI attention factor, ($r = .72$; $p < .05$)

Descriptive Statistics: Psychological Measures

- **PCL-M: PTSD Checklist-Military Version**
 - ($n = 489$), $M = 37.42$ ($SD = 15.84$)
- **ASDS: Acute Stress Disorder Scale**
 - ($n = 328$), $M = 47.34$ ($SD = 18.88$)
- **CES: Combat Experiences Scale**
 - ($n = 154$), $M = 17.44$ ($SD = 11.80$)

Descriptive Statistics: Psychological Measures

Psychological Measures and Subscales	Number of Patients	Number of Items	Possible Range of Scores	Mean Score	Standard Deviation	Alpha
PCL-M	489	17	17–85	37.42	15.84	0.95
Re-experiencing	490	5	5–25	11.04	5.21	0.91
Avoidance	470	7	7–35	13.38	6.30	0.88
Hyperarousal	486	5	5–25	13.02	5.58	0.87
ASDS	328	19	19–95	47.34	18.88	0.95
Dissociation	332	5	5–25	12.95	5.24	0.83
Re-experiencing	332	4	4–20	9.83	4.73	0.85
Avoidance	330	4	4–20	8.82	4.60	0.86
Hyperarousal	331	6	6–30	15.77	6.89	0.90
CES	154	22	0–66	17.44	11.80	0.92

- Psychological measures were correlated with each other ($p = .01$)
- Strongest correlation was PCL-M and ASDS ($r = .88$; $p < .001$)

Proposed Analyses and Manuscripts*

- 1.The Impact of Prior History of Head Trauma and Trauma History on Symptom Presentation in Deployed Settings after Acute Blast Injury
- 2.The Predictive Validity of the Military Acute Concussion Evaluation
- 3.Validation of the Effort Index for the RBANS (replication study)
- 4.Comparison of cognitive performance between blast- and non-blast-induced mild traumatic brain injuries in the acute deployed setting
- 5.Comparison of the PCL-M and ASDS for Assessment of Combat Stress Symptoms in Deployed Settings after Acute Blast Injury

*We are open to suggestions regarding possible additional analyses

Discussion

- A significant association was found between combat experiences and psychological measures
- A relationship between psychological acute stress following exposure to a blast injury and cognitive performance in neuropsychological tests was found
- Patients performed below average to average on neuropsychological tests measuring different cognitive domains (e.g., attention, memory, executive functioning).

Discussion

- **Limitations: Missing Data**
 - Data-collection occurred in a busy in-theater hospital, patient fatigue or distress
- **Future Analyses**
 - Clarify the relationship among symptoms of posttraumatic stress, acute stress, TBI, and PCS
 - The interaction of prior history of head trauma and blast injuries that may promote deleterious effects
- **Conclusions**
 - Better differentiate between neuropsychological impairment and psychological symptoms, resulting in more parsimonious diagnoses
 - Evidence-based treatment strategies may be provided

