

Diagnosing Mild Traumatic Brain Injury in Post-9/11 Veterans

Catherine Fortier, PhD

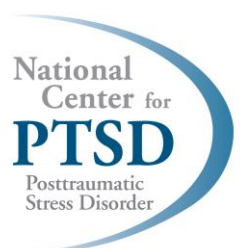
Associate Clinical Director & Principle Investigator

VA RR&D National Network Research Center

Translational Research Center for TBI and Stress Disorders (TRACTS)

VA Boston Healthcare System

April 30, 2018



Agenda

- Unique challenges in the assessment of mTBI in post-9/11 Veterans
- Development of the Boston Assessment of TBI-Lifetime (BAT-L): A semi-structured clinical interview.
- Correspondence of the BAT-L and the VA TBI Screen
- Correspondence of the BAT-L and the VA Comprehensive TBI Evaluation
- Conclusions and Q&A

Poll Question #1

- What is your primary role in VA?
 - student, trainee, or fellow
 - clinician
 - researcher
 - administrator, manager, or policy-maker
 - other

Poll Question #2

- Which best describes your experience in assessing mild traumatic brain injury?
 - have not been involved in mTBI assessment
 - have trained in mTBI assessment or participated in mTBI assessment as a team member
 - have conducted clinical or research mTBI assessment myself
 - have led a funded mTBI research grant
 - have led mTBI clinical assessment team/group

Translational Research Center for TBI and Stress Disorders (TRACTS): VA RR&D TBI National Network Research Center

Mission: To conduct multidisciplinary clinical research aimed at providing a psychological, biological, and neurobiological characterization of the effects of traumatic brain injury (TBI) and related stress disorders, and to use this understanding to create effective treatment opportunities for post-9/11 Veterans

- Funded since 2009
- Based at VA Boston Healthcare System
- Network site at the Michael E. DeBakey VA Medical Center in Houston
- Supports an extensive longitudinal cohort
- Adopts a multidisciplinary Veteran-centric approach



Why is there an epidemic of TBI in post-9/11 Veterans?

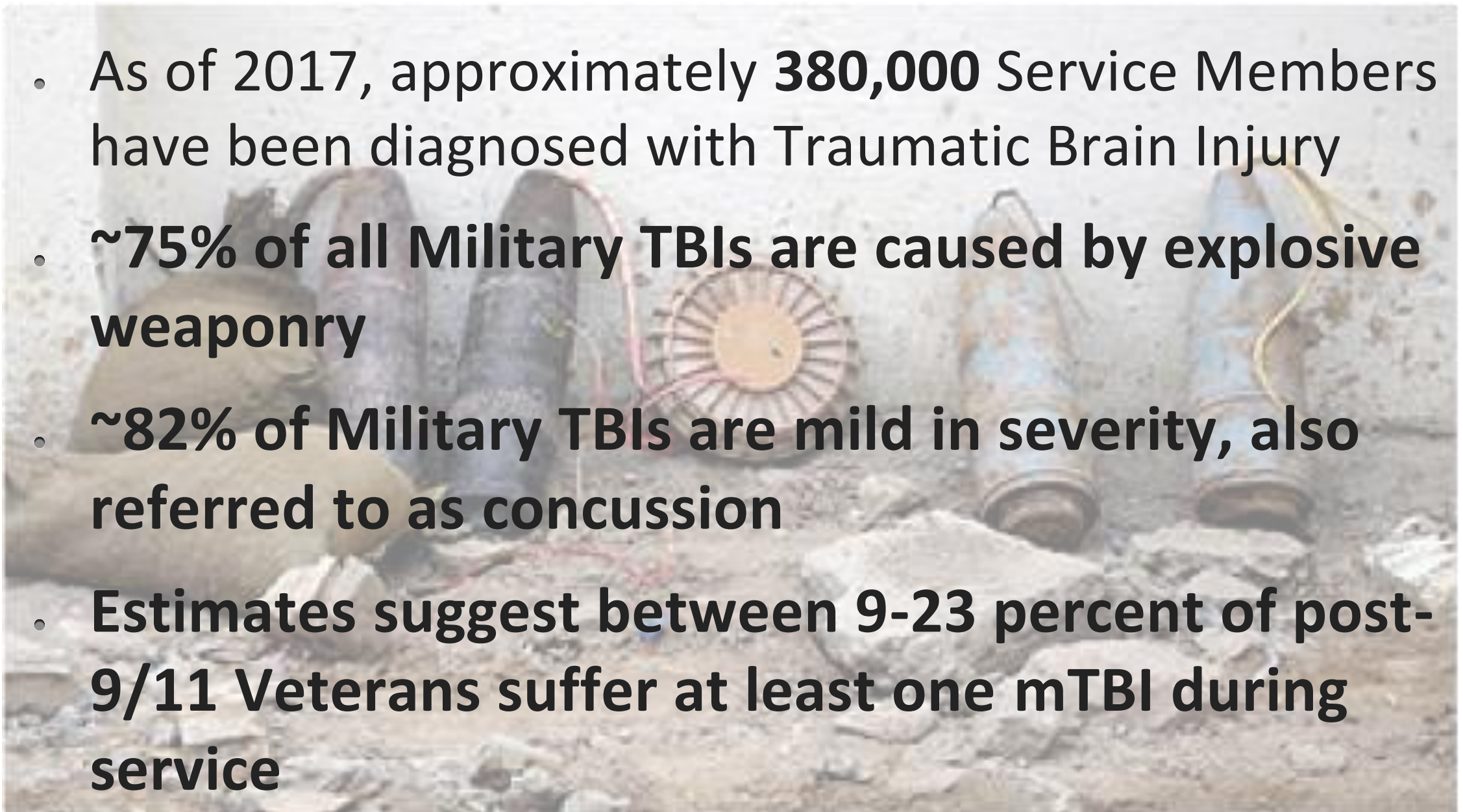
1. Use of explosive weaponry by the enemy
2. Improved body armor and helmets increased survival
3. Improved field treatment and rapid transport to state-of-the-art medical facilities
4. 90% survival of wounded who have been transported to these facilities

TBI Diagnosis and Severity Achieved by Consensus

Diagnosis According to DOD Criteria (2009)

Criteria	Mild	Moderate	Severe
Loss of Consciousness	0-30 minutes	>30 minutes & <24 hours	>24 hours
Alteration of Mental Status	0-24 hours	>24 hours; severity based on other criteria	
Posttraumatic Amnesia	0-1 day	>1 day & <7 days	>7 days
Glasgow Coma Scale	13-15	9-12	<9

The DoD continues to report that **TBI** is the most common type of physical Injury sustained by post-9/11 Service Members.

- 
- As of 2017, approximately **380,000** Service Members have been diagnosed with Traumatic Brain Injury
 - **~75% of all Military TBIs are caused by explosive weaponry**
 - **~82% of Military TBIs are mild in severity, also referred to as concussion**
 - **Estimates suggest between 9-23 percent of post-9/11 Veterans suffer at least one mTBI during service**

Source: Defense and Veterans Brain Injury Center, <http://www.dvbic.org/dod-worldwide-numbers-tbi>.

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):453–463.

Schell T, Marshall G, eds. Survey of individuals previously deployed for OEF/OIF. In: Tanielian T, Jayox L, eds. *Invisible Wounds of War: Psychological and Cognitive Injuries, Their Consequences, and Services to Assist Recovery*. Vol 4. Santa Monica, CA: RAND; 2008:87–116.



DoD Numbers for Traumatic Brain Injury Worldwide – Totals

2000 - 2017

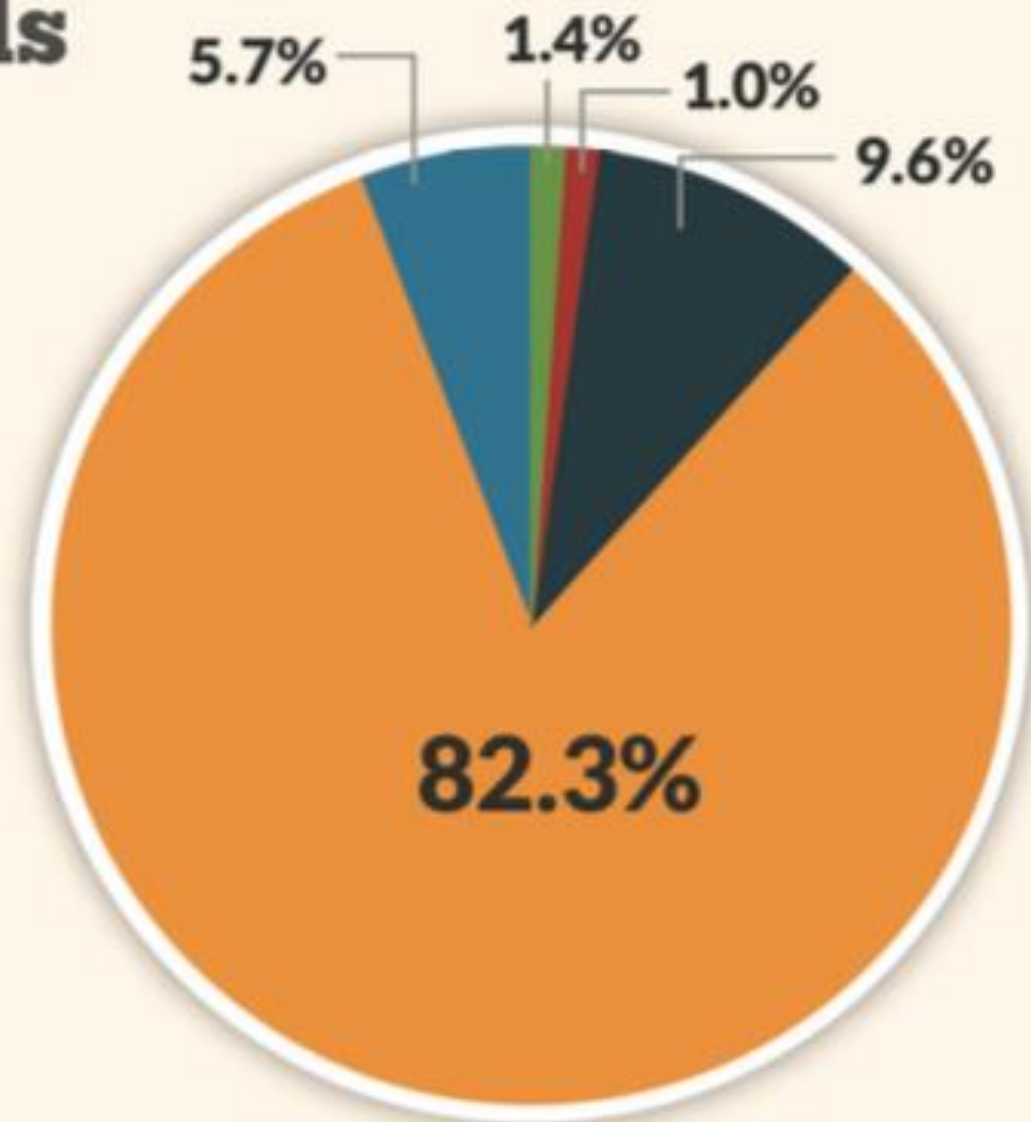
Penetrating	5,175
Severe	3,974
Moderate	36,269
Mild	312,495
Not Classifiable	21,606

Total - All Severities **379,519**

Source: Defense Medical Surveillance System (DMSS),
Theater Medical Data Store (TMDS) provided by the
Armed Forces Health Surveillance Center (AFHSB)

Prepared by the Defense and Veterans Brain Injury Center (DVBIC)

**Percentages may not add up to 100% due to rounding*



2000-2017, as of February 14, 2018

What makes the assessment and experience of TBI unique
in post 9/11 Service Members and Veterans?

Blasts produce **simultaneous** physical and psychological
trauma



Setting the stage for complex physical and psychological illness

Summary of the challenges of assessment of mTBI

Diagnosis of military mTBI is complex and unique from the diagnosis of civilian acquired brain injury

1. Novel mechanism of injury: blast vs. blunt vs. both?
2. Force of exposure?
3. Direction of exposure?
4. Time since exposure?
5. Time-course of injury?
6. Lifetime history of concussion?
7. Co-occurrence of psychological trauma?
8. Difficulty obtaining in-theater documentation of symptoms at the time of injury

(especially pre-2010; see *U.S. Medicine* 2011, Army Medical Communications for Combat Casualty Care [MC4] electronic medical record use began in 2010)

Assessment of mTBI

Limitations of existing measures faced in 2009 in establishing TRACTS longitudinal cohort study:

1. Most developed for civilian population
2. Existing military measures focused on combat injuries only
3. Designed to determine absence or presence of military TBI (not severity or duration of symptoms)
 - No consideration of possible head trauma before and after military service
4. Frequent co-occurrence of TBI and stress/trauma necessitate a more guided, refined and nuanced assessment of head injury

The Boston Assessment of Traumatic Brain Injury–Lifetime (BAT-L) Semistructured Interview: Evidence of Research Utility and Validity

*Catherine Brawn Fortier, PhD; Melissa M. Amick, PhD; Laura Grande, PhD;
Susan McGlynn, PhD; Alexandra Kenna, PhD; Lindsay Morra, BA; Alexandra Clark, BA;
William P. Milberg, PhD; Regina E. McGlinchey, PhD*

Objective: Report the prevalence of lifetime and military-related traumatic brain injuries (TBIs) in Operation Enduring Freedom and Operation Iraqi Freedom (OEF/OIF) veterans and validate the Boston Assessment of TBI–Lifetime (BAT-L). **Setting:** The BAT-L is the first validated, postcombat, semistructured clinical interview to characterize head injuries and diagnose TBIs throughout the life span. **Participants:** Community-dwelling convenience sample of 131 OEF/OIF veterans. **Design:** TBI criteria (alteration of mental status, posttraumatic amnesia, and loss of consciousness) were evaluated for all possible TBIs, including a novel evaluation of blast exposure. **Main Measures:** BAT-L, Ohio State University TBI Identification Method (OSU-TBI-ID). **Results:** About 67% of veterans incurred a TBI in their lifetime. Almost 35% of veterans experienced at least 1 military-related TBI; all were mild in severity, 40% of them were due to blast, 50% were due to some other (ie, blunt) mechanism, and 10% were due to both types of injuries. Predeployment TBIs were frequent (45% of veterans). There was strong correspondence between the BAT-L and the OSU-TBI-ID (Cohen $\kappa = 0.89$; Kendall $\tau\text{-b} = 0.95$). Interrater reliability of the BAT-L was strong ($\kappa\text{s} > 0.80$). **Conclusions:** The BAT-L is a valid instrument with which to assess TBI across a service member's lifetime and captures the varied and complex nature of brain injuries across OEF/OIF veterans' life span. **Key words:** *assessment, blast, OEF/OIF, traumatic brain injury (TBI), veterans*



BOSTON ASSESSMENT OF TBI –LIFETIME BAT-L

Have you ever experienced a blow to the head?

Listed below are situations in which you may have experienced a blow to the head. For each event listed, please circle yes or no to indicate if you have experienced it. If yes, did you lose consciousness and/or were you dazed or confused as a result?

#	Did you experience this event		If you experienced the event...					
			Did you lose consciousness?			Were you dazed and confused?		
1	In a car crash?	Yes No	Yes	No	Unsure	Yes	No	Unsure
2	In a motorcycle crash?	Yes No	Yes	No	Unsure	Yes	No	Unsure
3	In an all-terrain or other type of vehicle crash?	Yes No	Yes	No	Unsure	Yes	No	Unsure
4	As a pedestrian hit by a vehicle?	Yes No	Yes	No	Unsure	Yes	No	Unsure
5	Being hit by a falling object?	Yes No	Yes	No	Unsure	Yes	No	Unsure
6	Being hit by equipment?	Yes No	Yes	No	Unsure	Yes	No	Unsure
7	Falling down stairs?	Yes No	Yes	No	Unsure	Yes	No	Unsure
8	Falling from a high place?	Yes No	Yes	No	Unsure	Yes	No	Unsure
9	During a fainting spell?	Yes No	Yes	No	Unsure	Yes	No	Unsure
10	During a drug or alcohol blackout?	Yes No	Yes	No	Unsure	Yes	No	Unsure
11	While biking?	Yes No	Yes	No	Unsure	Yes	No	Unsure
12	While roller blading or skateboarding?	Yes No	Yes	No	Unsure	Yes	No	Unsure
13	While horseback riding?	Yes No	Yes	No	Unsure	Yes	No	Unsure
14	While skiing or snowboarding?	Yes No	Yes	No	Unsure	Yes	No	Unsure
15	While skydiving?	Yes No	Yes	No	Unsure	Yes	No	Unsure
16	While participating in other sports? ex: football, hockey, baseball, basketball, soccer, lacrosse, boxing, wrestling, martial arts, etc.	Yes No	Yes	No	Unsure	Yes	No	Unsure
17	While on the playground?	Yes No	Yes	No	Unsure	Yes	No	Unsure
18	While diving into water?	Yes No	Yes	No	Unsure	Yes	No	Unsure
19	Being physically abused?	Yes No	Yes	No	Unsure	Yes	No	Unsure
20	While being assaulted or mugged?	Yes No	Yes	No	Unsure	Yes	No	Unsure
21	During a military or other training exercise?	Yes No	Yes	No	Unsure	Yes	No	Unsure
22	During combat?	Yes No	Yes	No	Unsure	Yes	No	Unsure
23	Other?	Yes No	Yes	No	Unsure	Yes	No	Unsure

BAT-L Assessment Approach

- TBI is assessed during 3 time epochs:
 - (1) Pre-Military
 - (2) Military
 - (3) Post-Military
- Evaluate 3 most severe injuries in each epoch
- Open-ended questioning & “Forensic Approach”
- Factors related to estimation of AMS queried
- Occurrence and duration of neurobehavioral symptoms following each injury recorded

TBI Diagnosis and Severity Achieved by Consensus

Diagnosis According to DOD Criteria (2009)

Criteria	Mild	Moderate	Severe
Loss of Consciousness	0-30 minutes	>30 minutes & <24 hours	>24 hours
Alteration of Mental Status	0-24 hours	>24 hours; severity based on other criteria	
Posttraumatic Amnesia	0-1 day	>1 day & <7 days	>7 days
Glasgow Coma Scale	13-15	9-12	<9

mTBI Graded Stage 1, II, III

(Developed from Bailes and Cantu, 2001)

Criteria (must be >0 for one of the following)	Grade I	Grade II	Grade III
Loss of Consciousness	None	< 5 minutes	> 5 minutes
Posttraumatic Amnesia	0-15 minutes	<24 but >15minutes	>24 hours
Alteration of Mental Status	0-15 minutes	<24 but >15minutes	>24 hours

Demographics/Deployment Information

BAT-L Validation from TRACTS Cohort (n=131)

Gender	85% male 15% female
Age	33.9 years (9.22) Range: 20-62
Ethnicity	White/Caucasian 74.8% Hispanic/Latino 11.5% American Indian 1.5% Asian 2.3% Black/African American 8.4%
Years of Education	13.7 (1.80) Range: 12-20
Number of Deployments	1.26 (0.48) Range: 1-3
Duration of Deployments (months)	13.4 (7.18) Range: 3 - 38
Time since last Deployment (months)	33.8 (24.3) Range: 1-99

Blast Exposures

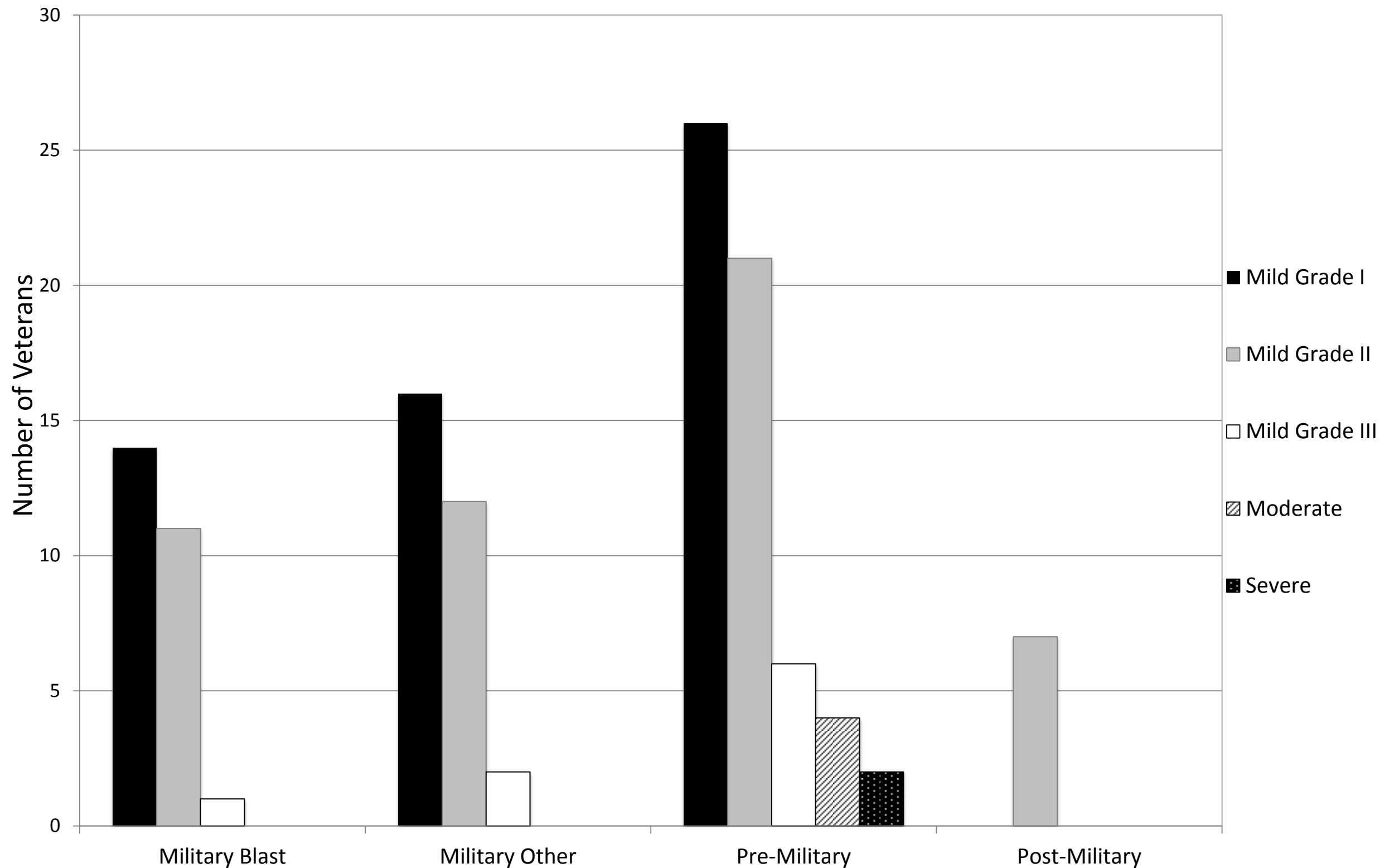
	<10 meters	11-25 meters	26-100 meters	Total Blast within 100 meters
Number of Service Members Exposed	42 (32%)	50 (38%)	91 (69%)	101 (77%)
Mean Blasts/Service Member (SD)	.70 (1.50)	1.8 (4.74)	11.5 (47.7)	14.0 (49.0)
Median Number of Blasts/Service Member	0	0	1	2
Range of Blasts/ Service Member	0-9	0-37	0-500	0-511

*Groups are not mutually exclusive



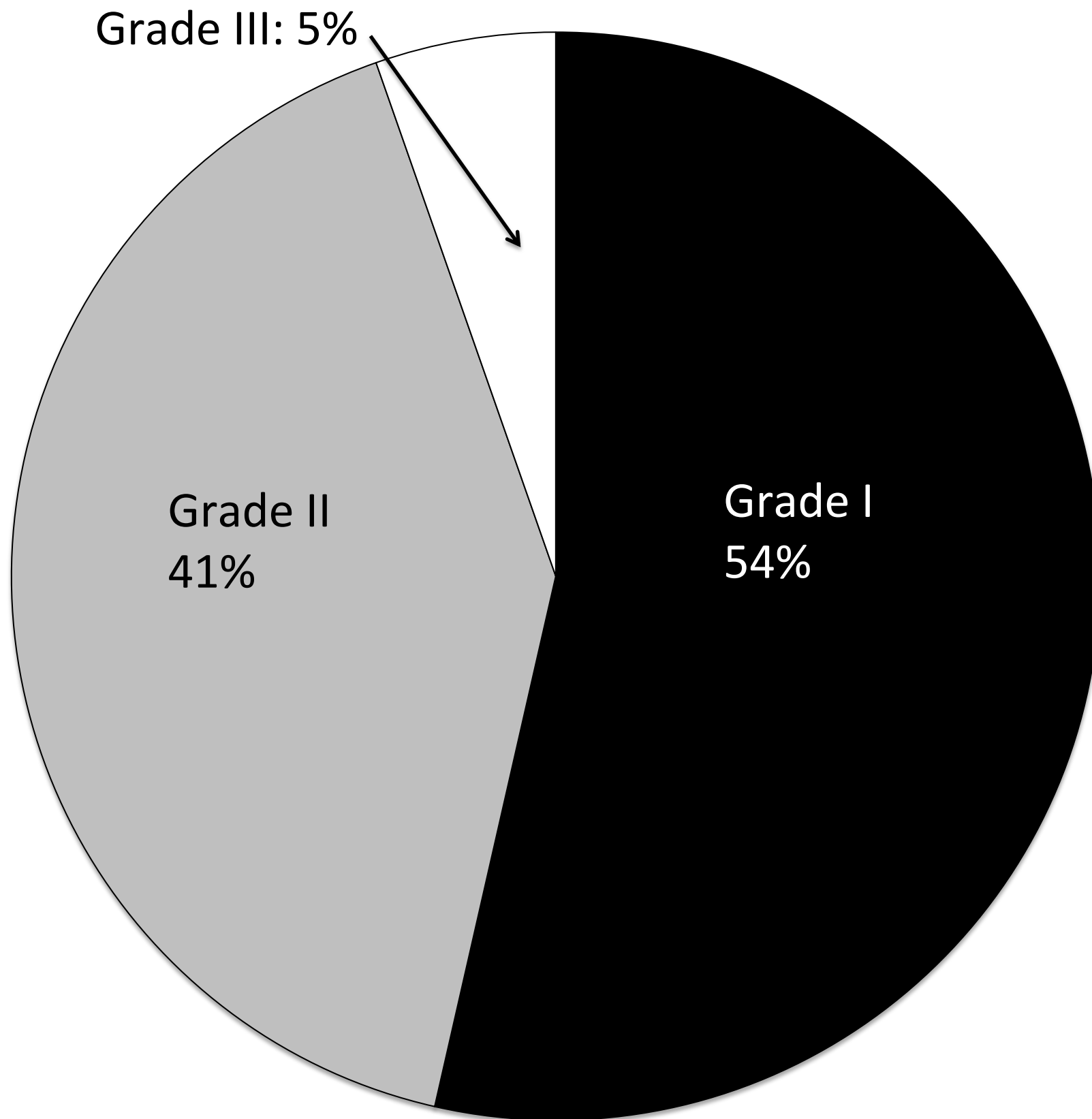
Traumatic Brain Injury in OEF/OIF

Boston Assessment of TBI-Lifetime (BAT-L)



*groups are not mutually exclusive

Military TBI Total



Blast exposure in first 456 deployed TRACTS participants (BATL-Assessment)

	< 10 meters	11 – 25 meters	26-100 meters	Total Blast Exposures < 100 meters
Number of Service Members Exposed (%)	211 (46.3%)	213 (46.7%)	342 (75.0%)	380 (83.3%)
Mean Blasts per Service Member (SD)	3.0 (21.6)	3.3 (12.4)	27.9 (104.6)	34.2 (115.4)
Median Blasts per Service Member (IQR)	0 (0, 2)	0 (0, 2)	2 (1, 10)	4 (1, 18)
Range of Blasts per Service Member	0 – 416	0 – 204	0 – 999	0 – 1102

TBI Severity (BAT-L) in Deployed TRACTS Participants (n=456)

TBI Severity	Deployment Blast	Military “Other”	Pre-Deployment	Post-Deployment
Mild	142 (31%) (27 with multiple)	123 (27%) (32 with multiple)	188 (41%) (70 with multiple)	35 (8%) (3 with multiple)
Moderate	2	3	11	1
Severe	1	0	2	1

BAT-L

Inter-rater Reliability

Inter-rater reliabilities were strong
(all Kappa's >0.80)

TBI Diagnosis:

OSU* as compared to BAT-L in 131 OEF/OIF Service Members

OSU	BAT-L (Converted to OSU Scoring)					
		1	2	3	4	5
		no TBI	mTBI Grade I	mTBI Grades II&III	Moderate TBI	Severe TBI
	1 (Improbable TBI)	42	1	0	0	0
	2 (Possible TBI)	1	32	5	0	0
	3 (mTBI)	0	0	44	1	0
	4 (Moderate TBI)	0	0	1	1	0
	5 (Severe TBI)	0	0	0	1	2

Kappa = .89, Kendall's tau-b = .95

*OSU = Ohio State University TBI Identification Method (Corrigan & Bogner, 2007)



Conclusions:

BAT-L Validation Study

The BAT-L is the first validated post-combat semi-structured clinical interview to characterize head injuries and diagnose TBIs throughout the lifespan.

Interview and manuscript are available for download at:

<https://heartbrain.hms.harvard.edu/bat-l-boston-assessment-traumatic-brain-injury-lifetime>

Key considerations in post-9/11 Veterans

1. TBIs acquired during deployment are far more likely to be mild in severity rather than moderate to severe
2. Blast-related TBIs occurred in approximately 20% of the sample, although blast exposures very prevalent (80%) and have neurobiological and cognitive consequences (Robinson, Trotter, Grande).
3. If a blast-related TBI did occur – overwhelming majority are mild
4. Childhood injuries in the TRACTS sample prevalent and are often more severe than military-related injuries.

VA TBI screen

- VHA Directive 2007 requiring TBI screening of all OEF/OIF/OND Veterans
- Lead to the rapid and widespread use of the VA TBI screen
- Computer-based
- Designed to be more sensitive than specific

TABLE 1 *VA TBI screen^a*

VA TBI screen Clinical Reminder

- 1 Did you have any injury(ies) during your deployment from any of the following? (Blast or explosion, vehicular accident, fragment wound above the shoulders, fall)
- 2 Did any injury you received while deployed result in any of the following? (Losing consciousness, being dazed or confused, not remembering the event, concussion, head injury)
- 3 Did any of these begin or get worse afterwards? (Memory problems, balance problems, sensitivity to bright light, irritability, headaches, sleep problems)
- 4 In the past week, have you had any of the above symptoms? (The same symptoms as question 3 are queried).

^aA veteran must respond affirmatively to all 4 questions to produce a positive screen and be referred on for further “second-level” traumatic brain injury evaluation.

Literature examining the VA TBI screen as compared to clinician diagnostic interview

- Sensitivity and specificity inconsistent across studies
- Some studies showed poor sensitivity (~60%) with adequate specificity (Terrio, 2011; Belanger, 2015)
- Terrio: sensitivity increased with only questions 1 and 2
- Other studies, including a large database study (N = 48,175) showed better sensitivity, but moderate to poor specificity (Donnelly, 2011; Belanger 2012)
- Poor test-retest stability ($\phi = 0.34$) has also been demonstrated (Belanger, 2015)

Sources:

Terrio HP, Nelson LA, Betthausen LM, Harwood JE, Brenner LA. Postdeployment traumatic brain injury screening questions: sensitivity, specificity, and predictive values in returning soldiers. *Rehabil Psychol*. 2011;56(1):26–31.

Donnelly KT, Donnelly JP, Dunnam M, et al. Reliability, sensitivity, and specificity of the VA traumatic brain injury screening tool. *J Head Trauma Rehabil*. 2011;26(6):439–453.

Belanger HG, Vanderploeg RD, Soble JR, Richardson M, Groer S. Validity of the Veterans Health Administration's traumatic brain injury screen. *Arch Phys Med Rehabil*. 2012;93(7):1234–1239.

Correspondence of the Boston Assessment of Traumatic Brain Injury-Lifetime (BAT-L) Clinical Interview and the VA TBI Screen

Catherine Brawn Fortier, PhD; Melissa M. Amick, PhD; Alexandra Kenna, PhD, William P. Milberg, PhD; Regina E. McGlinchey, PhD

TABLE 2 *Mean, standard deviation, and range are provided for the basic demographics of the sample^a*

	Mean (SD)
Age, y	33 (8.25), range = 20-62
Education, y	13.9 (1.97) ^a , range = 12-20
Gender	
Female	12%
Male	88%
Ethnicity	
White	66.5%
African American	11.7%
Asian	2.8%
American Indian	0.6%
Hispanic	16.8%
Unknown	1.7%
Number of OEF/OIF/OND deployments	1.37 (0.66), range = 1-5
OEF/OIF/OND deployment duration, mo	14.6 (8.82), range = 3-56
Time since last OEF/OIF/OND deployment, mo	34.0 (27.3), range = 1-99

TABLE 4 *Identification of possible TBI according to VA TBI screen compared with BAT-L in 179 OEF/OIF/OND service members^a*

VA TBI Screen	BAT-L for military TBI during OEF/OIF/OND deployment(s)		
	Positive	Negative	Total
Positive	55 (true positive)	20 (false positive)	75
Negative	10 (false negative)	94 (true negative)	104
Total	65	114	179

Abbreviations: BAT-L, Boston Assessment of TBI-Lifetime; OEF, Operation Enduring Freedom; OIF, Operation Iraqi Freedom; OND, Operation New Dawn; TBI, traumatic brain injury; VA TBI, Department of Veterans Affairs Traumatic Brain Injury.

^aKappa = 0.65, Kendall τ -b = 0.65; sensitivity (0.85) and specificity (0.82).

TABLE 5 *Identification of possible traumatic brain injury according to VA TBI screen items 1 and 2 compared with BAT-L in 179 Operation Enduring Freedom/Operation Iraqi Freedom service members^a*

VA TBI screen: Items 1 and 2 only	BAT-L for military TBI during deployment(s)		
	Negative	Positive	Total
Negative	86	9	95
Positive	28	56	84
Total	114	65	179

Research versus Clinical Context

- Poor correspondence between the BAT-L military TBI diagnosis and historical clinician administered VA TBI screen ($\kappa = 0.31$; Kendall τ -b = 0.32)
- Sensitivity of the clinician-administered VA TBI screen was greatly reduced (sensitivity, 0.48; similar to Belanger et al, 2015) while specificity was similar (specificity, 0.82)
- More than half of individuals who were diagnosed with a military-related TBI during deployment on the BAT-L were “missed” by the clinician-administered VA TBI screen
- Interrater reliability of research-administered versus clinician-administered VA TBI screen was low ($\kappa = 0.30$; Kendall τ -b = 0.32).

Conclusions:

BATL compared to VA TBI screen

- The VA TBI screen demonstrated adequate specificity and its sensitivity may be lacking
- Our data suggest that it does not oversample possible TBIs to catch all potential Veterans with TBI as intended
- Missing one subset of military injuries in particular: noncombat military injuries
- Consider administering only the first 2 TBI-specific items with no loss of sensitivity or specificity

Conclusions:

BATL compared to VA TBI screen

- Poor correspondence between the BAT-L military TBI diagnosis and historical clinician-administered VA TBI screen (VA medical records).
 - time disparity between administrations
 - significant contextual disparity
 - interviewer style and experience with TBI
- Implications for the utility of the VA TBI screen when administered across the healthcare system by a range of healthcare providers

Correspondence of the Boston Assessment of Traumatic Brain Injury-Lifetime and the VA Comprehensive TBI Evaluation

Lauren J. Radigan, BA; Regina E. McGlinchey, PhD; William P. Milberg, PhD;
Catherine Brawn Fortier, PhD

TABLE 1 *Demographic Information*

Characteristics	Value
Age, mean (SD), range, y	31 (8.0), 21-61
Education, mean (SD), y	13.6 (1.7), 12-19
Gender	
Female	8 (7.7%)
Male	96 (92.3%)
Ethnicity	
White	78.1%
Hispanic/Latino	14.3%
African American	3.8%
American Indian	1.0%
Unknown	2.9%

TABLE 2 *OEF/OIF/OND deployment injuries^a*

VA CTBIE	BAT-L for military TBI during OEF/OIF/OND deployment(s)		
	Positive for TBI	Negative for TBI	Total
Positive for TBI	58 (true positive)	13 (false positive)	71
Negative for TBI	18 (false negative)	15 (true negative)	33
Total	76	28	104

Abbreviations: BAT-L, Boston Assessment of Traumatic Brain Injury-Lifetime; OEF/OIF/OND, Operation Enduring Freedom/Operation Iraqi Freedom/Operation New Dawn; TBI, traumatic brain injury; VA CTBIE, Veterans Affairs Comprehensive Traumatic Brain Injury Evaluation.

TABLE 3 *Descriptions of diagnosis disagreement between the BAT-L and CTBIE*

Category	Number of cases	Description	Example(s)
Errors	8	Explicit factual mistake in one or the other assessment	Two cases received positive diagnoses on the basis of the CTBIE although the CTBIE report explicitly stated that those individuals did not experience the signs necessary for diagnosis according to the DoD criteria. Six cases were negative for TBI diagnosis although the CTBIE specifically noted that the patient experienced the signs associated with a concussion
Inconsistent reporting	11	The Veteran reported different signs across assessments	Veterans denied any TBI signs at one assessment, but reported them at the other (3 false positives and 8 false negatives)
Confounding factors	5	Circumstances surrounding the injury may have clouded the Veteran's interpretation of his/her symptoms	One Veteran reported feeling confused after a blast woke him up in the middle of the night. This was considered AMS on the basis of the CTBIE; however, when further queried on the BAT-L, he reported that he was able to respond appropriately/perform duties as expected within seconds of awakening. His confusion was thought to be related to being awoken during a chaotic situation rather than related to acute AMS caused by a TBI
PCS vs TBI diagnostic criteria	3	Veterans reported PCS, but did not report acute AMS, PTA, or LOC at the time of the injury	Veterans denied any signs of TBI at the time of their injury, but reported symptoms such as headaches, dizziness, and memory problems persisting after the incident. These symptoms are often secondary to other causes, such as the stress or chaos of the combat situation, dehydration, lack of sleep, etc

Abbreviations: AMS, altered mental status; BAT-L, Boston Assessment of Traumatic Brain Injury-Lifetime; CTBIE, Comprehensive Traumatic Brain Injury Evaluation; DoD, Department of Defense; LOC, loss of consciousness; PCS, postconcussive symptom; PTA, posttraumatic amnesia; TBI, traumatic brain injury.

Conclusions:

BATL compared to VA CTBIE

- Poor correspondence of TBI diagnosis between research administered BAT-L and clinically administered CTBIE
- Findings were not related to engagement or symptom exaggeration
- Addition of key aspects of the BAT-L to CTBIE could help increase sensitivity and specificity:
 - Additional probes to obtain a detailed timeline for each possible injury
 - Focus on evaluation of functioning immediately after injury (not PCS)
 - Use probes to discern AMS from common potential military confounds
 - Query about blast exposure (without resultant TBI) and noncombat-related mTBIs
- Two primary factors at play that contributed to disagreement between assessments:
 1. Human error
 2. Inconsistent reporting
- Limitations:
 1. Remote assessments of TBI
 2. Confusing and stressful combat setting makes TBI assessment more challenging

Conclusions on TBI Assessment

Part of our mission at TRACTS is to examine the relationships between TBI indices (as assessed by the BAT-L) as well as other co-occurring conditions and functional outcome post-deployment. Such longitudinal information will provide the necessary data needed to set clinical goals to improve service members' overall functionality. TBI does not occur in isolation; therefore, the many co-occurring conditions and their effects on function must also be considered when assessing the impact of TBI on outcome.

VA RR&D National Network Research Center
Translational Research Center for TBI and Stress Disorders
(TRACTS)

Conclusions:

- Complex issues require a holistic approach to research and treatment
- Military TBI is only a piece of a complicated puzzle
- Blast exposure? Lifetime burden of PTSD?
- Beginning to understand the complexity of these injuries and how they may group together in neurobiological syndromes that we haven't yet confronted as a society
- Potential to improve outcomes of cognitive and other therapies through earlier, more individualized, approaches
- Tremendous opportunity to improve lifetime outcomes given most recent Veterans are relatively young

Q & A

TRACTS Team

Directors: Gina McGlinchey & William Milberg

Houston site PI: Ricardo Jorge



Catherine Fortier, PhD

Associate Clinical Director

VA RR&D National Network Research Center

Translational Research Center for TBI and Stress Disorders (TRACTS)

VA Boston Healthcare System