



# Disclosures & Acknowledgements

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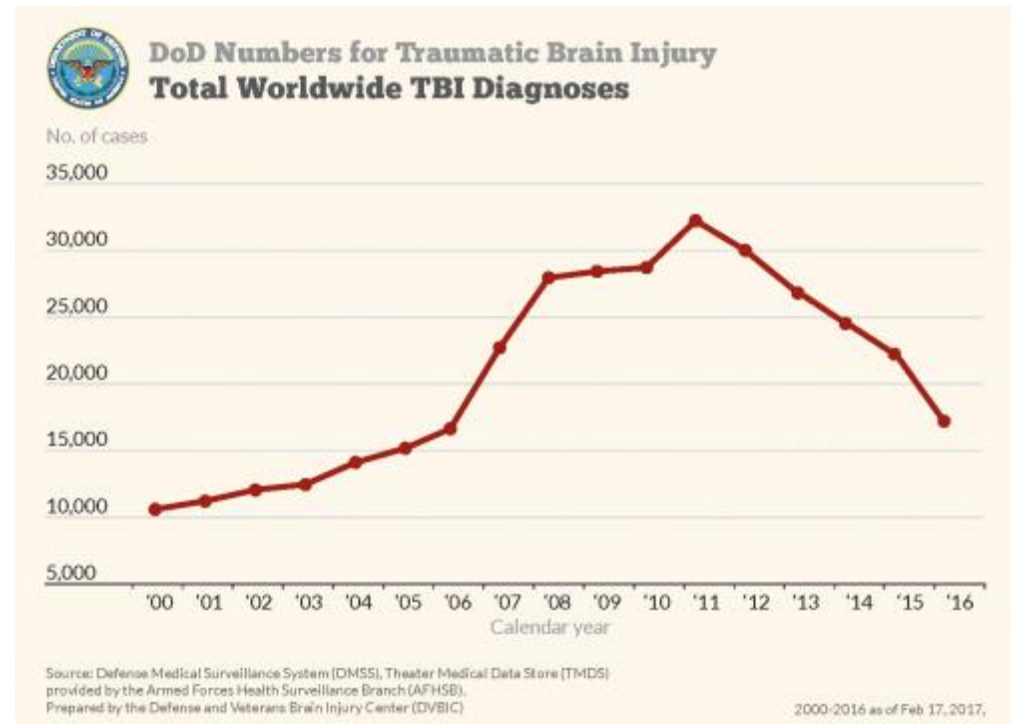
# Background

# Polling Question

- What is the incidence of TBI among Iraq/Afghanistan Veterans?
  - a) Less than 10%
  - b) 10-20%
  - c) 20-30%
  - d) 30-40%
  - e) More than 40%

# Military TBI

- A “signature injury” of Iraq & Afghanistan conflicts
- 361,000 TBI diagnoses from 2000 – 2016
- 11 – 23% of deployed military members sustain probable TBI



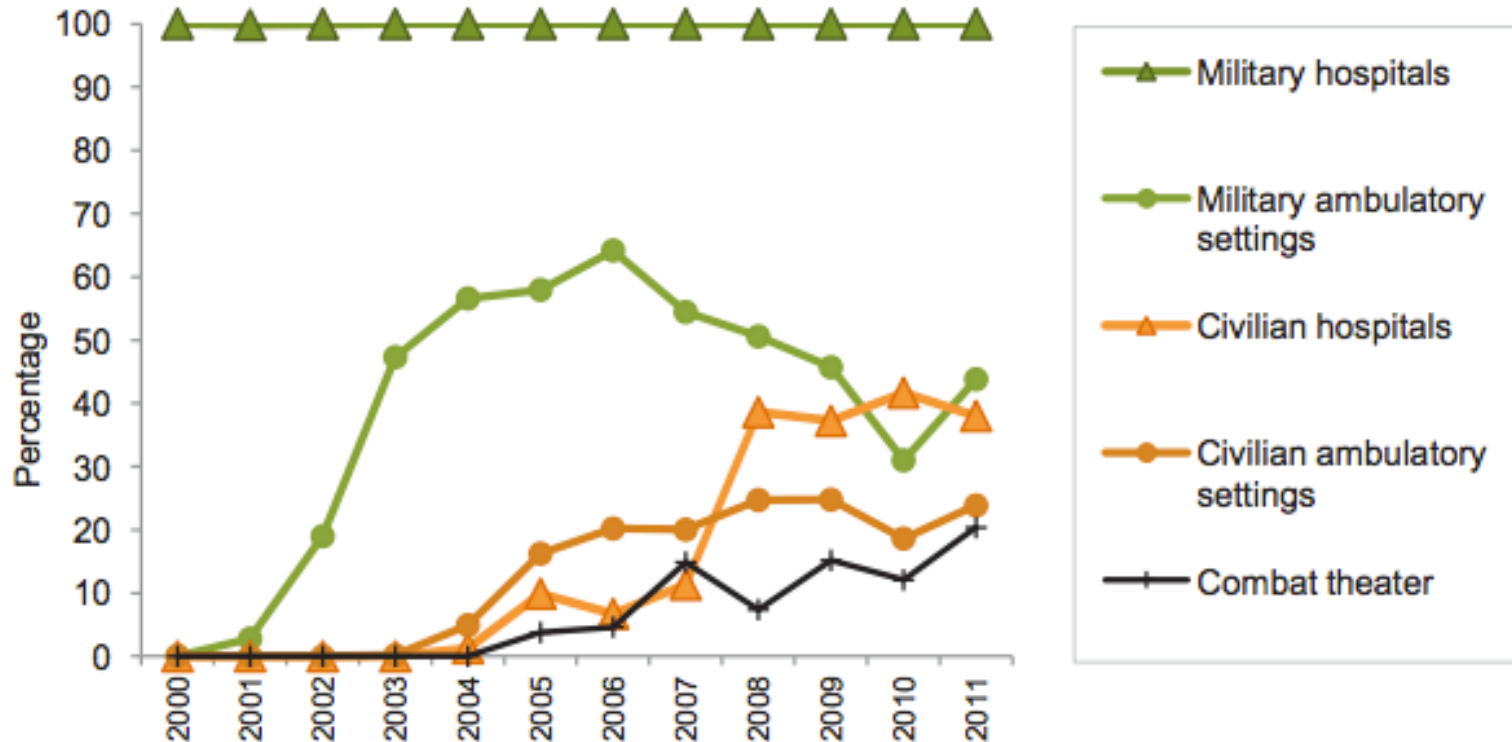


# Consequences of TBI

- Of veterans with positive TBI screens, 80% with comorbid psychiatric diagnoses (Carlson et al., 2010):
  - PTSD (50%)
  - Depression (33%)
  - Anxiety disorders
  - Alcohol use disorders
- Other sequelae include
  - Cognitive impairment
  - Pain disorders
  - Suicidal ideation, attempt, completion
    - Veterans with TBI are 1.55 times more likely to die from suicide than those without TBI

# Characterizing TBI

**FIGURE 2.** Percentage of TBI case-defining medical encounters with any cause of injury code, by clinical setting, active component, U.S. Armed Forces, 2000-2011

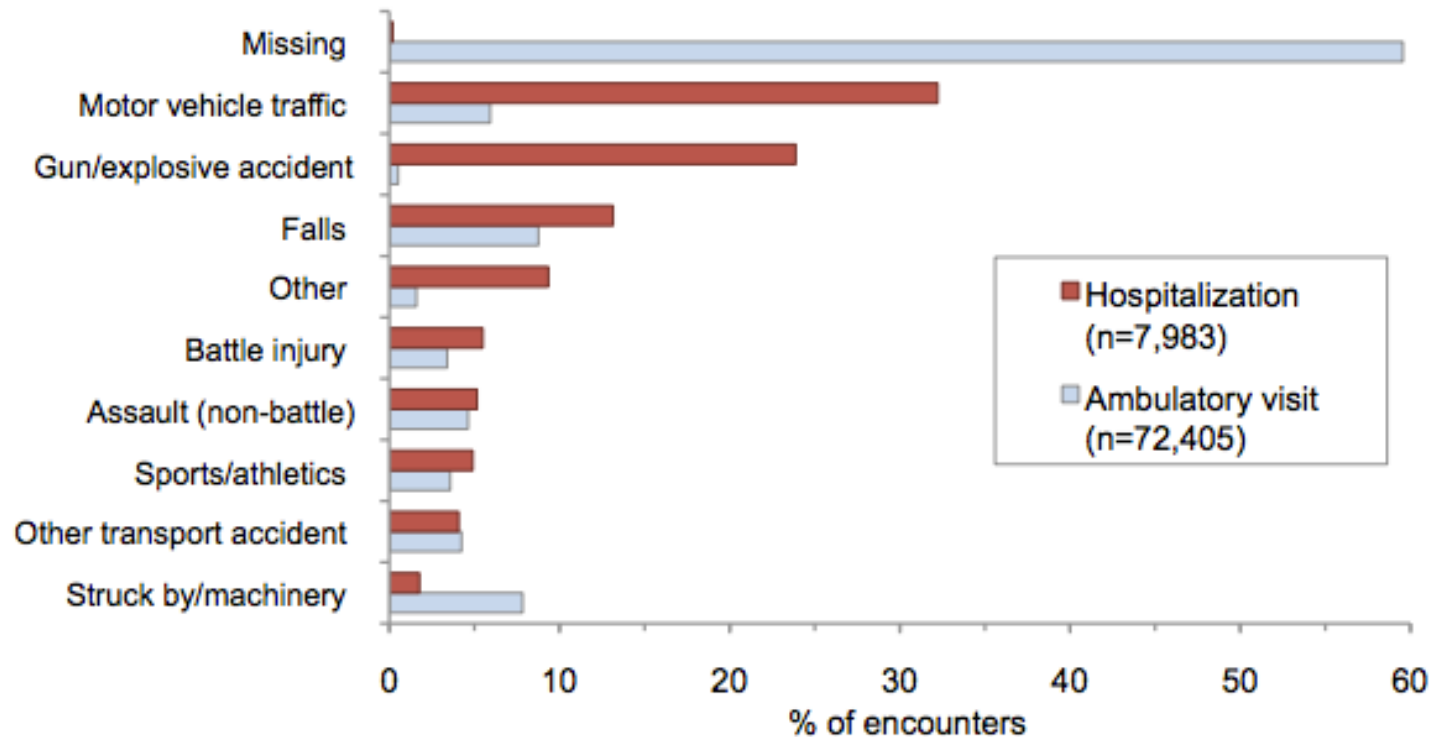






# Characterizing TBI

**FIGURE 3.** Percentage of TBI case-defining medical encounters with a specific cause<sup>a</sup> or with no cause recorded, by clinical setting of treatment, military treatment facilities, active component, U.S. Armed Forces, 2000-2011



<sup>a</sup>"Assault (non-combat)" and "combat" are intentional injuries. All others are unintentional (accidental) injuries.

# Questions about TBI

- What are typical characteristics of TBI occurring during military service?
- What percentage had head injuries prior to military service?
- Are veterans with multiple head injuries more likely to report current physical and mental health symptoms?
- Questions addressed with data from a national survey enrolling a random sample of military veterans who served since 9/11.

# Methods











# Measures: Assessing TBI

- Assessed probable TBI before, during and after military service
- For each period, assessed:
  - Head injury
  - Number of head injuries
- For worst head injury during each period, assessed:
  - Age at time of injury
  - Mechanism of injury
  - Loss of consciousness
  - Duration of unconsciousness
  - Memory impairment

# Results

# Veteran Sample Demographics

Sample Demographics	n=1102 % (n) or median
Age	34 years
Male gender	84.4% (930)
Caucasian race	70.5% (775)
Education beyond high school	81.1% (893)
<b>Branch of Service</b>	
Army	53.6% (584)
Air Force	19.3% (210)
Navy	15.7% (171)
Marine Corps	11.2% (122)
Coast Guard	0.3% (3)
Reserves/National Guard	47.4% (525)
Officer rank	16.7% (184)
Multiple deployments	26.4% (284)
<b>Type of service</b>	
Direct combat	33.7% (370)
Combat or service support	66.3% (731)

Table 1. Characteristics of Veteran Sample

# Veteran Sample: TBI Numbers

Sample Demographics	n=1102 % (n) or median
Reported head injury during military service	223 (20.3)
Met criteria for probable TBI during military service	191 (17.3)
Number of head injuries during military service	
1	112 (50.2)
2	56 (25.0)
3	29 (13.2)
4	11(4.9)
≥5	15 (6.6)
Met criteria for probable TBI before military service	85 (7.8)
Number of head injuries before military service	
1	54 (64.1)
2	16 (19.5)
3	9 (10.5)
4	2 (2.4)
≥5	3 (3.8)
<b>Of veterans with probable TBI during military service, sustained probable TBI before military service</b>	<b>22 (11.6)</b>

Table 1. Characteristics of Veteran Sample



# Characteristics of TBI during Service

<b>Characteristic</b>	<b>TBI during service, No. (%) (n = 191)</b>
<b>Lost consciousness</b>	87 (45.6)
<b>Skull fracture</b>	7 (3.8)
<b>Required brain surgery</b>	1 (0.5)
<b>Immediate symptoms following TBI</b>	
<b>Dazed, confused, or “seeing stars”</b>	172 (90.0)
<b>Dizziness</b>	125 (65.5)
<b>Blurred vision</b>	104 (54.5)
<b>Loss of coordination</b>	96 (50.5)
<b>Ruptured eardrums</b>	25 (13.0)

*Table 2. Characteristics of Traumatic Brain Injury During Military Service*

# Characteristics of TBI during Service

Characteristic	TBI during service, No. (%) (n = 191)
<b>Severity of TBI</b>	
Mild	167 (87.3)
Moderate/Severe	24 (12.7)
<b>Post-traumatic amnesia</b>	37 (19.2)
<b>Problems beginning or getting worse after TBI</b>	
Headaches	111 (57.9)
Memory problems/lapses	92 (48.0)
Sleep problems	83 (43.5)
Irritability	76 (39.7)
Balance problems or dizziness	56 (29.4)
Sensitivity to bright light	55 (29.1)

Table 2. Characteristics of Traumatic Brain Injury During Military Service

# Risk Factors for TBI during Service

Multivariate analysis	Risk of TBI during military service		
	OR	CI	p
Male gender	1.254	0.731 – 2.149	0.4111
Caucasian race	1.148	0.794 – 1.658	0.4632
Post-high school education	0.921	0.615 – 1.379	0.6893
Multiple deployments	1.464	0.953 – 2.248	0.8160
Deployment > 1 year	1.312	0.846 – 2.036	0.2250
Officer rank	0.502	0.296 – 0.852	0.0107
High combat exposure	2.877	1.971 – 4.200	<0.0001
TBI before military service	2.257	1.288 – 3.956	0.0045

Table 3. Multivariate Analysis: Individuals Who Sustained TBI During Military Service (N=1,102)



# Outcomes: Single vs. Multiple Head Injuries

Outcome	Single Head Injury		Multiple head injuries		Analysis	
	%	n	%	n	$\chi^2$	p
<b>PTSD</b>	28.0%	26	62.3%	62	22.57	<0.0001
<b>Depression</b>	44.5%	41	61.7%	61	5.41	0.0200
<b>Suicidal ideation</b>	17.3%	16	31.4%	31	5.14	0.0234
<b>Violence</b>	16.9%	16	19.8%	20	0.27	0.6051
<b>Back pain</b>	54.0%	50	74.8%	74	9.09	0.0026
<b>Headache</b>	59.8%	55	63.8%	63	0.33	0.5884
<b>Any pain</b>	56.5%	52	75.4%	74	7.55	0.0060

Table 4. Outcomes of Single Compared With Multiple Head Injuries During Military Service

# Discussion

# TBI Mechanisms

- Results consistent with AFHSC 2013 report
- Most common mechanism was blast/explosion (33%), though object hitting head/head hitting object was close second (31%)
  - Blast/Explosion accounts for 1/3<sup>rd</sup> of injuries
  - Supports allocating resources to preventing other types of TBIs as well
  - Future research should look at differences and commonalities between blast and non-blast TBI

# Screening for TBI

- 233 veterans reported head injury during military service
- 191 veterans met criteria for probable TBI during military service
  - 14.3% of those reporting head injury did not meet criteria for probable TBI
  - Clinicians may find false positives if only asking veteran patients about “head injuries”
  - Supports use of VA/DoD criteria for TBI screening

# Risk Factors for Sustaining Military TBI

- Enlisted rank
- High combat exposure
- *Sustaining TBI prior to military service*
  - Veterans had double the odds of sustaining TBI during service if they sustained TBI prior to service
  - Supports comprehensive screening for pre-military TBI in Standards of Medical Fitness

# Outcomes

- Nearly half of veterans reported more than one head injury during military service
- Veterans with more than one head injury had statistically significant higher rates of PTSD, depression, suicidal ideation, and pain.
- Implications for policy and practice
  - Clinicians should inquire about number of TBIs as well as type.

# Limitations

- Self-reported data may be affected by incomplete or inaccurate recall
- Only collected data on whether the veterans' worst head injury met criteria for TBI
  - Could not compare single vs. multiple TBI
- Likely other variables that may predict military TBI that need to be explored

# Questions?

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