Challenges Associated with TBI Research and Clinical Practice in the DoD and VA: Diagnostics, Pathology, & Ethics

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Disclaimer – All Presenters

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Learning Objectives:

1. Understand the potential iatrogenic effects of mass screening for mTBI in the DoD and VA systems of care.
2. Raise awareness as to the limitations and potential uses of NCATs in screening for mTBI.
3. Understand the research related to consistency of self-reported concussions within service members and veterans.
4. Review existing research on the neuropathology of blast injury and present initial data on outcomes following blast mTBI with post-deployed veterans.
6. Understand the emerging research on return to duty protocols and the associated ethical principles within the military environment.
Agenda

- Brief Introduction to TBI in the DoD and VA
- Section 1: Screening and Initial Assessment of TBI
- Section 2: Neuropathological mechanism in TBI
  - Overview of general TBI pathology
  - Blunt vs blast trauma
  - Initial results from CENC
- Section 3: Return to Duty and Ethical Considerations
  - RTD Protocols
  - Potential consequences of misdiagnosis
  - Ethical Principles
- Section 4: Conclusions and Discussion

Introduction to DoD
Diagnosing Concussion

2015 DoD Definition of Traumatic Brain Injury:
A traumatically induced structural injury or physiological disruption of brain function, as a result of an external force, that is indicated by new onset or worsening of at least one of the following clinical signs immediately following the event:

- Any alteration in mental status (e.g., confusion, disorientation, slowed thinking, etc.).
- Any loss of memory for events immediately before or after the injury.
- Any period of loss of or a decreased level of consciousness, observed or self-reported.
- Presence of neurological deficits

TBI in the U.S. Military

- Since 2000, >350,000 service members diagnosed with a TBI, with most (>80%) characterized as mild TBI (mTBI)/ concussion
mTBI Identification and Assessment

- mTBI can be a challenging diagnosis
  - Symptoms develop over time – hours to days
  - May not be present at initial assessment
- Drop zones and training environments
- Can make recognition and reporting difficult
  - Other trauma may be more obvious and need more immediate care
- The Military Acute Concussion Evaluation (MACE) is the standardized mental status examination – “sideline” assessment
- CT or MRI recommended only if there is a suspected intracranial bleed or skull fracture
- Early detection and treatment are the keys to preventing long-term effects of concussion

mTBI in the Military

- Approximately 80% of military mTBIs are diagnosed in garrison – most due to falls
- Blast injuries account for 78-80% of deployed mTBI.
Introduction to VA

First, Some Background

• Veteran = anyone who served in military
• Veteran ≠ VA
  • 21.6 million Veterans in FY 2014\(^1\) or 6.7% pop.
  • 2.5 million post 9/11\(^2\)
  • 9.1 million enrolled in VA in FY 2014\(^1\)
  • Less than half enroll, fewer actually use VA for healthcare: Why?
  • >3.5 million receiving disability in 2012\(^3\)

\(^1\)Congressional Research Service, 2014
\(^3\)https://www.va.gov/vetdata/docs/Quickfacts/SCD_trends_FINAL_2012.pdf
Why Does that Matter?

VA’s mission is different than the DoD’s

- DoD: “To provide the military forces needed to deter war and to protect the security of our country”¹
- VA: “To care for him who shall have borne the battle”²
- Fitness for duty versus health care/disability

¹www.defense.gov
²www.va.gov

So What is VA?

1. Veterans Health Administration (VHA)
   - > 1,700 hospitals, clinics, and facilities
2. Veterans Benefits Administration (VBA)
   - Education, voc rehab, disability, loans, etc.
3. National Cemetery Administration
   - 135 national cemeteries, burial services
Key Point

Veteran ≠ VHA ≠ VBA
• Precision in language in research
• Understanding of differences in clinical work

Section 1

Screening and Initial Assessment
Screening in the DoD

• Post Deployment Health Assessment (DD Form 2796)
  o Between 30 days before and 30 days after return from deployment

PDHA- TBI related questions

10.a. During this deployment, did any of the following events happen to you? (Mark all that apply)
   (1) Blast or explosion (e.g., IED, RPG, EFP, land mine, grenade, etc.)?
       o Yes o No
       If yes, please estimate your distance from the closest blast or explosion:
       o Less than 25 meters (82 feet)
       o 25-50 meters (82-164 feet)
       o 55-100 meters (180-328 feet)
       o More than 100 meters (328 feet)
   (2) Vehicle accident/crash (any vehicle including aircraft)?
   (3) Fragment wound or bullet wound?
       a. Head or neck?
       b. Rest of body
       o Yes o No
   (4) Other injury (e.g., sports injury, accidental fall, etc.)?
       o Yes o No
   If yes to any of the above, please explain: ____________________________

10.b. As a result of any of the events in 10.a., did you receive a jolt or blow to your head that IMMEDIATELY resulted in:
   (1) Losing consciousness (“knocked out”)?
       o Yes o No
       If yes, for about how long were you knocked out?
       o Less than 5 min. o 5-30 min. o more than 30 min
   (2) Losing memory of events before or after the injury?
   (3) Sewing scars, becoming disoriented, functioning differently, or nearly blacking out?
       o Yes o No

10.c. How many total times during this deployment did you receive a blow or jolt to your head?
   (only answer if you had a yes to any of the questions on 10a.)
   o 0 o 1 o 2 o 3 o more than 3 (be specific number of times) __________
Screening in the DoD

• Post Deployment Health Re-assessment (DD Form 2900)
  o Between 90 and 180 days after return from deployment
  o Question 3 asks “Were you wounded, injured, assaulted or otherwise hurt during your deployment?” If yes are you having any problems or concerns related to the events?
  o Patient Health Questionnaire includes possible post concussive symptoms for endorsement (i.e., Headaches, Dizziness, Nausea, Fatigue, Balance problems, Cognitive problems, photophobia, irritability, insomnia, etc.).

• Periodic Health Assessments (DD Form 3024)
  • As of 2016 collapsed across branches with the question any “head Injury/concussion/TBI” since last PHA.
TBI Screening in the VHA

The Polytrauma System of Care

• Tiered system
• Top-down: rehab for more severe directly from DoD to PRC
• Bottom-up: follow up for TBI screen in outpatient OEF/OIF clinics
Four Tiers

1. Polytrauma Rehabilitation Center (5)
   A. Also include Polytrauma Transitional Rehabilitation Programs
2. Polytrauma Network Sites (23)
3. Polytrauma Support Clinic Teams (87)
4. Polytrauma Points of Contact (39)
VA TBI Screen: Item 1

Section 1: During any of your OIF/OEF deployment(s) did you experience any of the following events?

☐ Blast or Explosion (IED, RPG, Land Mine, Grenade, etc)
☐ Vehicular accident/crash (any vehicle, including aircraft)
☐ Fragment wound or bullet wound above the shoulders
☐ Fall
☐ Blow to head (head hit by falling/flying object, head hit by another person, head hit against something, etc.)
☐ Other injury to head

ALSO choose one of the responses below:
☐ No, none of the above (Negative Screen)
☐ Yes, one or more of the above.

Item 2

Section 2: Did you have any of these symptoms IMMEDIATELY afterwards?

☐ Losing consciousness/“knocked out”
☐ Being dazed, confused or “seeing stars”
☐ Not remembering the event
☐ Concussion
☐ Head injury

ALSO choose one of the responses below:
☐ No, none of the above (Negative Screen)
☐ Yes, one or more of the above.
Item 3

Section 3: Did any of the following problems begin or get worse afterwards?
(Choose all that apply):
- Memory problems or lapses
- Balance problems or Dizziness
- Sensitivity to bright light
- Irritability
- Headaches
- Sleep problems

ALSO choose one of the responses below:
- No, none of the above (Negative Screen)
- Yes, one or more of the above.

Item 4

Section 4: In the past week, have you had any of the symptoms from section 3?
(Choose all that apply):
- Memory problems or lapses
- Balance problems or dizziness
- Sensitivity to bright light
- Irritability
- Headaches
- Sleep problems

ALSO choose one of the following:
- No, none of the above. This is a negative screen
- Yes, one or more of the above. This is a positive screen. All patients with a positive result should be referred for further evaluation. Results of TBI Screen discussed with patient.
- Order consult for further evaluation, patient agrees
- Patient refuses further evaluation.
What the screen is really...

To screen for a history of “possible TBI”

**AND**

Current symptom complaints; may or may not be related to TBI

• Second Level TBI eval: by medical practitioner, full exam follow up

Seal et al. (2016)

• 2007-2012 ~ 540,000 screened
• 111,503 positive
• 66,089 completed second level eval, positive TBI, complete data
• NSI: moderate/severe cognitive impairment
  • In 78% w/ mTBI and 64% without
  • Lowest risk was mTBI only; increasing risk with depression/PTSD
Hoge et al. (2008, p. 462)

“Screening for mild traumatic brain injury months after the injury is likely to result in the referral of a large number of persons for evaluation and treatment of non-specific health symptoms attributed to brain injuries, with potential iatrogenic consequences.”


- Nocebo Effect: “a negative reaction experienced by a patient who receives an inert substance.”
- Argue that select contexts cause a nocebo effect and explain why a minority of patients do not follow the typical course of recovery after injury.
  - Sensational media coverage about the adverse effects of sports-related concussion, the notable attention to blast related concussions in military, and DoD/VA population based screening programs set the stage for negative expectations to exert an adverse influence on patients’ belief systems and ultimately leads to increased symptoms with concurrent misattribution of symptoms.
Application: Nocebo Effect

• Early Clinical Predictors of 5-year outcome after concussive blast traumatic brain injury
  • Mac Donald et al., JAMA Neurology
• Prospective, longitudinal study of AD US Military after blast related mild TBI (n=50) and combat-deployed controls (n=44)
• Followed from acute/subacute stage to five years post injury, assessed yearly for neurobehavioral, cognitive, and psychological changes.
• Main findings: Global disability, life satisfaction, psychiatric symptom severity, and sleep impairment were significantly worse in the mTBI group. Though objective cognitive impairment evidenced no differences.

Application: Nocebo Effect

• Study limitations acknowledged by authors:
  • Modest sample size
  • Lack of comprehensive preinjury and acute postinjury clinical data
  • Heterogeneous treatment after injury
  • Possible unmeasured covariates that may influence results
• Study limitations not explicitly acknowledged by the authors:
  • Lack of trauma control and no combat exposure scale
  • Potential minimization of significant differences across multiple psychological measures (i.e., CAPS, PCL-M, MADRES, BDI)
  • Limited employment of PVT/SVTs
  • No control for service connection
• Nocebo effect?
  • What are the consequences of calling someone every year, bringing to their attention the fact that they had a TBI, and then asking how they are doing? Particularly in the context of elevated psychological distress?
Application: Nocebo Effect

The impact of a nocebo effect on research like the Mac Donald et al study has not been addressed in the existing literature and represents a possible confound to outcomes.

Vanderploeg & Belanger (2013)

“The core conditions essential for beneficial medical screening – progressive disease, symptoms related to the identified disease, suitable tests or examinations for accurate diagnosis, and accepted and effective treatments – are not present within the context of TBI Screening....population screening for mild TBI is unnecessary at best and potentially harmful at worst.”
Key Point

• VA TBI screen is only for combat TBI that has not been previously diagnosed
• Positive is possible history of TBI plus current (non-specific) symptoms
• Thus, positive TBI screen ≠ TBI
  • Clinically, many will be missed
  • For research: caution relying on this

NCAT
Computerized Neurocognitive Assessment Tools (NCATs)

- Also known as:
  - Computerized Neurocognitive Tests (CNTs)
  - Neurocognitive Assessment Devices (CNADs)
- Have been in use for decades, and many are components of standard testing batteries (e.g. CPT-II)
- Term largely refers to standalone batteries, meant to be used as screens or proxies for traditional tests
- Numerous available tasks: ANAM4, CNS-VS, CogState/CogSport, ImPACT, DANA, etc.

How Are NCATs Currently Used?

They are NOT used to “diagnose concussion.”

- With civilians:
  - ImPACT is the most widely used test.
  - Preseason baseline assessments
  - Post-TBI evaluations
    - The goal is to identify a return to baseline.
  - Clinical testing, ideally as a supplement
- With service members (SMs):
  - ANAM is typically used.
    - Special Forces use ImPACT.
  - Pre-deployment baseline evaluations
  - Post-TBI evaluations
    - Assist with return-to-duty (RTD) decisions
Advantages of NCATs

• Often shorter duration than a traditional test battery
  • 20-30 minutes vs. hours of testing
• Delivery can be standardized without extensive training.
  • Test proctor vs. neuropsychologist or psychometrist
• Ability to administer to larger groups
• Potential for almost unlimited alternate forms
  • Beneficial for post-injury repeated assessments
• Precise measurements, e.g., reaction time
• Rapid availability of results
• Centralized data storage, analysis and reporting
  • Norms can be constantly updated
Potential Limitations of NCATs

- Cost
- Access
  - Equipment
  - Proprietary nature of many features of tests
- Hardware and software issues
- Loss of qualitative data from behavioral observations
- Auto-generated reports may result in faulty conclusions.
- Precise measurements, e.g., reaction time
- Limited psychometric properties in the literature

DCoE NCAT Clinical Recommendation

Key recommendations:
- NCAT should be one component of post-TBI assessment.
- Not sufficient alone for RTD determinations
- Administer in a quiet, comfortable setting with minimal distractions.
- SMs with concussion and rapidly resolving symptoms do not typically benefit from NCAT administration.
- Attempt to administer within 24-72 hours of injury.
- Repeat every 3-4 days as symptoms persist.
- Consult with a psychologist/neuropsychologist for interpretation.
Current Literature

A review of the validity of computerized neurocognitive assessment tools in mild traumatic brain injury assessment

Computerized neurocognitive assessment tools (CNATs) offer potential advantages over traditional neuropsychological tests in concussion assessment. However, their psychometric properties and their validity are still questionable. The lack of standardization of test protocols, differences in the administration of tests, and the lack of uniformity in test scores make it difficult to compare results across studies. In addition, computerized tests have some advantages as well as disadvantages. They are more reliable than traditional tests due to the absence of examiner effects. Moreover, they are more efficient, allow for easier test administration, and are less expensive. However, they are also more prone to practice effects. It is important to note that the validity of these tools is only for research use, and they should not be used for clinical diagnosis.

• Other notable references:

Test-retest Reliability

• Reliability for clinical tests typically desired at .90
• Wide range of test-retest reliability has been published
  - Different populations (athletes vs. military)
  - Different intervals (e.g. days vs. months vs. years)
  - Different authors (e.g. test developers vs. independent researchers)
• General consensus is reliability is lower than desired
• Recent results from a large (>1 million) database of ANAM4 suggests a practice effect over shorter intervals (e.g. 30 days) but more stability over 1, 3 and 5 years (per Meyers, NCAB)
Validity

• Multiple types of validity
  • Content
  • Construct (convergent and discriminant)
  • Criterion (concurrent and predictive)
• Correlations with traditional NP tests are generally moderate at best
• Often no clear patterns of convergent and discriminant validity
• Though those with mTBI often perform worse, the diagnostic accuracy is questionable

DVBIC “Head to Head” Study

• ANAM4, CNS-VS, CogState, ImPACT
• Test-retest reliability
  • 419 healthy controls, with 215 returning approximately 30 days later
  • Randomly assigned to 1 of the 4 NCATs
• Validity
  • 272 healthy controls and 231 within 7 days of mTBI
  • Randomly assigned to take 2 of the 4 NCATs. Also administered a traditional NP test battery
Findings to Date

Test-retest Reliability Results

• Each NCAT had at least one score in the “adequate” range (.70 - .79), and ImPACT was the only test with one score in the “high” range (.80 - .89). Intraclass correlations (ICC) ranged from .22 to .83.
• Each NCAT had at least one score in the “adequate” range (.70 - .79), and ImPACT was the only test with one score in the “high” range (.80 - .89).
• Cogstate had the highest ratio of scores (4 out of 5) in the adequate range.
• Generally the test-retest reliability across all four NCATs were lower than desired for clinical decision making.
• Results were largely consistent with other studies.
Validity Results

• Order of NCAT administration did not appear to influence results

• Only .6% of correlations between NCAT scores and traditional NP scores were considered large (≥.50). The majority were small or nonexistent (≤.30)

• Those with mTBI consistently performed worse than controls

• However, the unique variance accounted for in NCAT scores by group status was minimal (semipartial $R^2 \leq .062$)

Lessons Learned

• Comparisons of NCATs vs. traditional tests and NCATs vs. NCATs can be “apples to oranges.”
  • Different stimulus delivery and response methods
  • The same cognitive domain can be measured in different ways, impacting direct comparisons.
  • Impairment can be defined differently.
  • Participant effort is assessed differently.
Consider the Technology


• Hardware and software interactions...
  • Type of CPU (e.g. multi-core processors)
  • Settings of BIOS
  • Background programs
  • Latency between mouse and CPU

“Platforms” Study

• Simple and Procedural RT (SRT and PRO) on ANAM4

• 3 different computer platforms:
  • ANAM recommended Dell (circa 2007)
  • New Dell with downgraded BIOS to run like 2007 computer
  • New Dell as is out-of-box

• Two Objective RT measures:
  • High speed camera
  • Blackbox Toolkit

• Controls take SRT and PRO on each platform, randomly assigned to the order
Platforms Study Results

• Objective RT measures, mean latency (sd) in ms

<table>
<thead>
<tr>
<th>Platform</th>
<th>High Speed Camera</th>
<th>BBTK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) ANAM D630</td>
<td>30.9 (5.1)</td>
<td>44.0 (1.0)</td>
</tr>
<tr>
<td>2) BIOS Downgraded</td>
<td>36.9 (1.1)</td>
<td>51.7 (4.9)</td>
</tr>
<tr>
<td>3) New “As Is”</td>
<td>70.8 (.6)</td>
<td>87.0 (7.6)</td>
</tr>
</tbody>
</table>

• Preliminary results from healthy controls:
  • Significant differences ($p<.001$) between Platforms 1 and 3 and 2 and 3, with medium to large effects ($d = .57$ to $1.1$)

Future Directions

• Explore alternative metrics
  • E.g. Intra-individual variability (Cole et al., 2017)

• Factor analyses
  • Ensure accurate comparisons
  • Meyers with NCAB releasing factor scores for ANAM

• Changes to ANAM4
  • New norms (> 2 million SMs), additional subtests to address shortcomings

• Other NCATs, e.g. DANA

• Moving to tablet-based platforms
  • May address some technical issues
Consistency of Self-Reported Symptoms

Russo (2012)

• Evaluated consistency of self-reported memory impairment between VA TBI evaluation and previous DoD PDHA (n=50).
• 98% reported moderate to severe memory impairment on VA evaluation, but only 14% reported any memory problems with PHA.

Consistency of Self-Reported Injuries

Russo & Fingerhut (2016)

• Examined the consistency of self-reported symptoms and concussive events between VA TBI evaluation and PDHA in 149 OIF/OEF/OND veterans.
• With VA evaluation significantly higher reports of cognitive difficulties, PTS symptoms, concussions and post-concussive sequelae (e.g., LOC) relative to PDHA.
• Of note, while 84% reported a severe level of impairment, most of the sample were working and/or completing college.
• Findings bring into question the accuracy of self-reported TBIs, as well as symptoms in the veteran population.
Section 2

Neuropathology

General Factors

• Pathology is related to mechanism of injury
• Primary versus secondary injury
• Consider severity: in DoD and VA, if it’s abnormal on clinical imaging, it’s not a concussion
• Single versus multiple injuries
Mechanisms

The brain is a 3-pound Jell-O mold
• Direct impact
• Coup countercoup
• Translational forces (e.g., rotation)
• Blast

Bleeds: Primary

1. Epidural hemorrhage-arterial
   • Middle meningeal artery; lucid interval
2. Subarachnoid hemorrhage-arterial
3. Subdural hemorrhage-venous
4. Microbleeds – intracerebral bleeds from capillaries
Bleeds: Secondary

- Mass effect & herniation
- Increased intracranial pressure
- Vasospasm & delayed ischemia

Contusions

The brain shifts within the skull, hitting bone & compressing tissue
### Contusions

White and grey matter are different densities.
When brain Jell-O mold bounces around, there is tugging and pulling.
Neurons stretch and shear.
Pathology at white-grey matter junction.
Cell death.

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### Axonal Sheering-DAI
Common Injury Areas

Old View of DAI

- Immediate injury
- Axon is torn
- Axon retracts
- Formation of end ball
New View of DAI

- Progressive injury
- Axon is stretched
- Increased permeability
- Calcium influx
- Damage to cytoskeleton
- Impaired axoplasmic transport
- Axonal swelling
- Detachment

Other Secondary Factors

- Edema
- Inflammation
- Free radical changes
- Neural damage $\rightarrow$↑ glutamate $\rightarrow$ excitotoxicity $\rightarrow$ cell death $\rightarrow$ encephalomalacia, atrophy
So, What Causes AOC in mTBI?

- Shaw (2002): *The neurophysiology of concussion*
  1. EEG: Increase excitability followed by depression
  2. EP: Loss of activity
Five Hypotheses of Concussion

1. Vascular Hypothesis
2. Reticular Hypothesis
3. Centripetal Hypothesis
4. Pontine Cholinergic System Hypothesis
5. Convulsive Hypothesis

Shaw (2002)

Then there’s blast...

1. Primary: pressure wave force
2. Secondary: blunt/penetrating trauma
3. Tertiary: translational forces
4. Quarternary: heat and burn injuries
5. Quinary: (other) hypoxia, poison, chemical, infection, radiation, tetanus (Cernak, 2017)
Research Examples on Blast

- Greer et al. (2017): Systematic Review
- Lange et al. (2012): NP outcomes of blast plus vs. blunt
- Newsome et al. (2016): FC of blast TBI
- Shively et al. (2016): post-mortem case series
Final note...

TBI (and blast) is as much about the brain that sustains the injury as it is the injury itself

• Age
• Prior lesions
• Cerebral reserve
• Pre-existing psych and substance issues
• Medical conditions
• Post-injury factors
"The Chronic Effects of Neurotrauma Consortium (CENC) is a coordinated, multicenter collaboration linking basic science, translational and clinical neuroscience researchers from the VA, military, and academia to effectively address the long-term effects of mild traumatic brain injury (mTBI) and its diagnosis and treatment."

https://cenc.rti.org/
Study 34: Hefner VAMC

- Preliminary evidence suggests that early evolution of blast-related mild TBI may differ from other injury mechanisms.
- The goal of this study is to more fully characterize the neurobiological sequelae of exposure to primary blast forces.

The Pilot DoD Study

Taber et al. (2015)
- Control \( (n = 16) \)
- Blast \( (n = 23) \)
- Blast mTBI \( (n = 6) \)

- Changes in WM integrity (FA) for both blast groups...
**Study 34 Method**

- **Day 1 (~6 hours):** questionnaires, TBI interview, blast interview, CAPS-5, SCID, and cognitive testing (TOPF, MSVT, b Test, WAIS-IV, NIH TB, TMT, COWAT, Animals)
- **Day 2 (~4 hours):** full set of MRI sequences, 90 minutes in the MEG, questionnaires, testing in MEG
- Recruiting blast and no-blast exposure
- Invalidity (MSVT, b Test, SIMS) excludes from day 2
## Descriptives

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<th>Variable</th>
<th>Full Day 1 Sample</th>
<th>Valid Day 1 Sample</th>
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<tr>
<td></td>
<td>M (SD) or N (%)</td>
<td>M (SD) or N (%)</td>
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<tr>
<td>Age</td>
<td>40.5 (9.4; 26-68)</td>
<td>41.0 (9.8)</td>
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<td>Years Education</td>
<td>14.8 (2.3)</td>
<td>14.8 (2.4)</td>
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<td>Income</td>
<td>50,077 (28,752)</td>
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<td>Sex (m)</td>
<td>113 (89.7%)</td>
<td>83 (89.2%)</td>
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<td>Ethnicity (W)</td>
<td>82 (65.1%)</td>
<td>61 (65.6%)</td>
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<td>TBI (y)</td>
<td>84 (66.7%)</td>
<td>58 (62.4%)</td>
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<tr>
<td>Blast (y)</td>
<td>73 (57.9%)</td>
<td>49 (52.7%)</td>
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### Key Point: Validity

**Stand alone PVTs**
- Fail MSVT $n = 18$ (14.3%)
- Fail b Test $n = 9$ (7.1%)
- Fail either $n = 25$ (19.8%)
- Fail both $n = 2$ (1.6%)

**SIMS**
- $> 24 n = 15$ (11.9%)
- $> 14 n = 59$ (46.8%)

Point: *EVEN* in research only settings, we need to account for invalid response
Interestingly...

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</tbody>
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Base Rates of PVT Failures

- Military
  - Clinical Evaluations: Failure rates range from 3% - 55%
  - Disability (MEB) Evaluations: Failure rates roughly 50%

- VA (non-research)
  - Clinical Evaluations: Failure rates range from 14-68%
  - Disability (C&P) Evaluations range from 43-59%

- VA (research)
  - PVT Failure rates range from 8-38%
How Do We Measure Blast??
Issue 1

Blast Characteristics

• How far away was it?
• What caused it? Mortar, IED, RPG...
• Was it one, multiple discrete events, or more constant over a long period?
• Individual experience
Secondary factors

• Were you wearing PPE?
• Was there anything between you and blast?
• Was this also TBI/Criterion A PTSD event?
• Did you return to duty? When?

Informative, but do not answer the question

BAT-L (Fortier et al., 2013)

Boston Assessment of TBI-Lifetime
• Rates 3 most severe across: blast injuries, other military, pre-military, and post-military
• Blast = within 100 meters
• Focuses on grading severity, threshold is TBI or not and within 100 meters (0-5)
• Secondary factors inquired on, but not measured
Our Blast Interview

“I want to go over any time you were exposed to a blast or explosion. This includes blasts and explosions that were close, as well as those that were not so close. If you could see it, hear it, feel it, or had some other indication that there was a blast or explosion we want to talk about it.”

Has the participant been exposed to blasts of any kind? YES/NO
1. When did this happen?
2. PTSD criterion A event? YES/NO

Traumatic event? YES/NO
TBI event? YES/NO
   during deployment? YES/NO
   during military service? YES/NO
3. Were you:
   - in a vehicle? YES/NO
   - behind cover? YES/NO
   - Was anything between you and the blast? YES/NO
   - wearing a helmet? YES/NO
   - wearing ear protection? YES/NO
   - wearing eye protection? YES/NO
   - wearing body armor? YES/NO
   - injured from the blast (burns, lacerations, etc)? YES/NO
   - thrown to the ground by the blast? YES/NO
   - thrown into anything by the blast? YES/NO
   - hit by anything from the blast? YES/NO

4. What caused the blast? Mortar / Rocket / IED / grenade / RPG / missile / bomb / landmine / other

5. (next slide)

6. How far were you from the blast?
   - quantity: _____ units:_______
Individual Experience of Blast

5. Use the following scale to rate how much you experienced the following due to the blast:
   a) Wind: 0 1 2 3 4 5
   b) Debris: 0 1 2 3 4 5
   c) Ground shaking: 0 1 2 3 4 5
   d) Pressure change/gradient: 0 1 2 3 4 5
   e) Temperature change/gradient: 0 1 2 3 4 5
   f) Sound: 0 1 2 3 4 5
   
   d) Pressure change/gradient:
   0 = none
   1 = slightly, noticeable but not uncomfortable
   2 = noticeable and uncomfortable
   3 = moderately, results in minor pain or alteration in function
   4 = resulted in minor injury
   5 = strongly, resulted in greater than minor injury

Multiple Exposures

7. Is this a multiple exposure rating? **YES/NO**
   a) Start date to End date:
   b) “How many events do you estimate occurred during this time period?”
   c) for any event were you:
      i. thrown to the ground by the blast?
      ii. thrown into anything by the blast (wall, vehicle, or other object)?
      iii. hit by anything from the blast?
      iv. If yes to any, did ppt strike their head as a result?
How Do We Operationalize Blast?

Issue 2

What is the threshold?

Blast exposure ≠ TBI

Many studies now look at possibly sub-concussive blast injuries (as our pilot, Taber et al., 2015)

So how do we define an exposure, as many will not have TBI symptoms (e.g., AOC, neurological signs)
Example 1

• Combat PTSD, 3 non-blast TBI (sibling rivalry, accident, fight)
• Deployment 1: 3 bomb exposures (multiple)
  • Ground 3, sound 2, pressure 1
  • 300 yards
• Deployment 2: ~ 100 rocket exposures (multiple)
  • Wind 1, debris 2, sound 2
  • 50 yards

Example 2

• Combat PTSD, 2 TBI (martial arts, blast)
• 4 discrete deployment blasts: IEDs and RPG
• Most severe was blast TBI (IED)
  • 60 min. AOC, 2 hr. HA, 10 min. difficulty speaking/hearing
  • Wind 3, debris 4, ground 5, pressure 5, temp 4, sound 5
  • 25 yards
Example 3

- No PTSD, no TBI; fleet Navy
- In 4 years, from training exercises...
  - ~50 exposures from ship guns as “bridge team”
  - Pressure 2, “close,” never more than 75 yards based on size of ship

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Rating n</th>
<th># TBI</th>
<th>% TBI</th>
</tr>
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<tbody>
<tr>
<td>&lt;br&gt;0</td>
<td>94</td>
<td>11</td>
<td>11.7%</td>
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<tr>
<td>&gt; 0</td>
<td>163</td>
<td>47</td>
<td>28.8%</td>
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<tr>
<td>&gt; 1</td>
<td>118</td>
<td>44</td>
<td>37.3%</td>
</tr>
<tr>
<td>&gt; 2</td>
<td>64</td>
<td>36</td>
<td>56.3%</td>
</tr>
<tr>
<td>&gt; 3</td>
<td>25</td>
<td>20</td>
<td>80.0%</td>
</tr>
</tbody>
</table>
Some Initial Analyses

• Using the pressure gradient criteria, in our valid sample ($n = 93$)
  Blast $n = 49$
  No Blast $n = 44$

• Demographics:
  • age, highest pay grade, years education, number of tours, and service connection percent not different
  • blast group had significantly lower yearly income ($44,733 vs. $59,034$)

Blast Outcomes: Cognitive

<table>
<thead>
<tr>
<th>Variable</th>
<th>Blast</th>
<th>No Blast</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSIQ</td>
<td>50.3 (8.9)</td>
<td>49.3 (9.3)</td>
<td>0.3</td>
<td>.595</td>
</tr>
<tr>
<td>GAI</td>
<td>51.3 (9.3)</td>
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<tr>
<td>WMI</td>
<td>47.2 (9.0)</td>
<td>47.5 (11.4)</td>
<td>0.0</td>
<td>.897</td>
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<tr>
<td>PSI</td>
<td>51.1 (11.0)</td>
<td>49.0 (9.6)</td>
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<tr>
<td>LNS</td>
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<tr>
<td>Cancellation</td>
<td>47.8 (8.9)</td>
<td>46.0 (8.5)</td>
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<tr>
<td>TMT A</td>
<td>50.6 (13.4)</td>
<td>49.9 (7.3)</td>
<td>0.1</td>
<td>.757</td>
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<tr>
<td>TMT B</td>
<td>47.4 (10.0)</td>
<td>50.6 (11.6)</td>
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<td>COWAT</td>
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<tr>
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Blast Outcomes: Symptoms

<table>
<thead>
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<th>No Blast M (SD)</th>
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<th>p</th>
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<tbody>
<tr>
<td>DRRI-2</td>
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<td>28.4 (12.2)</td>
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<td>PCL-5</td>
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<td>19.2 (15.5)</td>
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<tr>
<td>AUDIT</td>
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<td>4.0 (3.9)</td>
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<td>.187</td>
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<td>PHQ-9</td>
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<td>8.3 (5.3)</td>
<td>15.9</td>
<td>&lt; .001</td>
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<tr>
<td>NSI</td>
<td>28.3 (14.9)</td>
<td>16.3 (13.7)</td>
<td>16.3</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>

Outcomes Summary

- Blast exposed veterans are not performing any lower on intelligence, processing speed, attention, working memory, or executive measures
- Blast exposed veterans report more combat exposure, PTSD symptoms, depression symptoms, and neuropsychiatric symptoms
- This is after excluding failures on SIMS, MSVT, and b Test
- SO, blast = no persisting cognitive deficits, but more subjective symptoms
- Not controlling for diagnoses, TBI, or other relevant variables
# Blast, TBI, & PTSD

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Variable</th>
<th>n</th>
<th>$\chi^2$</th>
<th>p</th>
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<tbody>
<tr>
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<tr>
<td>Dep. TBI</td>
<td>37</td>
<td>PTSD</td>
<td>27</td>
<td>1.22</td>
<td>.269</td>
</tr>
</tbody>
</table>

## MEG

- Like EEG, but uses magnetic instead of electric fields
- Better resolution than EEG
- No interference from skull
- Connectivity: global or focal
MEG and blast

<table>
<thead>
<tr>
<th>Metric</th>
<th>F</th>
<th>p</th>
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<tr>
<td>Rich Club Diff</td>
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<td>.861</td>
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<td>Rich Club MaxN</td>
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<td>.803</td>
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<tr>
<td>Rich Club MaxK</td>
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<tr>
<td>Rich Club Max</td>
<td>0.7</td>
<td>.581</td>
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<tr>
<td>Num Modules</td>
<td>0.9</td>
<td>.472</td>
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<tr>
<td>Q norm</td>
<td>0.9</td>
<td>.460</td>
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<td>Small World</td>
<td>0.8</td>
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<tr>
<td>AvgDegree Norm</td>
<td>1.4</td>
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<tr>
<td>Diameter Norm</td>
<td>0.9</td>
<td>.472</td>
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<tr>
<td>AvgPath Norm</td>
<td>1.0</td>
<td>.398</td>
</tr>
<tr>
<td>Cluster C norm</td>
<td>1.4</td>
<td>.272</td>
</tr>
</tbody>
</table>

Key Points

• There may be unique brain alterations in blast versus blunt TBI, but very tentative MEG does not support this
• Functional meaning of this is not yet known, with early evidence suggesting excellent prognosis in blast concussion (like other types), though difference in objective versus subjective outcomes
• Blast exposed are more likely to report combat trauma and psychiatric symptoms, but we hypothesize that such may be situational (e.g., IED exposure in combat situation versus knocking your head on a doorway)
• Lots more to come on this...
Section 3

Return to Duty

Elements of RTD Decision Making

- In-theater/deployed policy guidance (DoDI 6490.11)
- Concussion Management Algorithm (CMA)
- Progressive Return to Activity (PRA) Algorithm
- Symptom resolution
- Neurocognitive testing (if available)
- Exertional testing
Key TBI Guidance

DoD 6490.11
- Event-based protocol: line and medical responsibilities
- Mandates medical screening and rest period
- Specialized evaluation for multiple concussions

Garrison HQDA EXORD 165-13
- Mirrors Theater policy
- Event-based protocol
- Mandates recovery
- Specialized evaluations for multiple concussions

VA/DoD Concussion/mTBI CPG
- Highest-rated mTBI CPG in a 2011 research study published in Brain Injury

Management of Concussion/Mild Traumatic Brain Injury

VA/DoD Clinical Practice Guideline

Frontline Algorithm

- Priority – Quickly assess for Red Flags
- Conduct a MACE
- If positive findings or symptoms, refer to initial concussion management with a primary provider (or refer if 2+ concussions in past year)
- If no positive findings or symptoms, implement mandatory 24-hour recovery and re-assess
- Consult with the medical provider for RTD determinations
- Also algorithm for neuroimaging
Concussion in the Deployed Setting
Department of Defense Instruction (DoDI) 6490.11

• Provides comprehensive, maximum protection for Service members exposed to potentially concussive events in the deployed setting
• Describes mandatory responsibilities and processes for medical and line:
  • Identifies, tracks, and ensures the appropriate evaluation and treatment of Service members exposed to potentially concussive events, to include blast events
• Requires mandatory medical evaluation and minimum 24-hour rest period, beginning at the time of the event, for all Service members exposed to potentially concussive events

Development of Sports Return to Play Guidelines

• Many professional leagues use independent neurotrauma consultants and “spotters”
• Immediate removal from play with signs of a concussion
• Sideline evaluation
  • Neurological, cognitive (thinking/memory), vestibular (balance) – similar to MACE
• Emerging research and clinical guidance support a progressive and gradual return to play following concussion, using a graduated exercise challenge
• Problem: Types of activities are not thoroughly defined in each stage, progression lacked detailed standards following initial rest
Progressive Return to Activity
PRA

- Provide guidance for primary care managers in the deployed and non-deployed settings for safe return to normal activity levels after the mandatory rest period following a concussion/mTBI – rest is clearly defined
- Offer a standardized, step-wise, specific approach for SMs who remain symptomatic after sustaining a concussion/mTBI
- Identify recommended criteria for progression or referral to the rehabilitation provider based on recent concussion history
- Consistent with DoDI 6490.11 and Garrison HQDA EXORD 165-13

Progressive Activity Process

- Six stage approach from ‘Rest’ to ‘Unrestricted Activity’
- Progression is described across physical, cognitive, and vestibular domains
- Uses the Neurobehavioral Symptom Inventory (NSI) for symptom tracking
- Resting heart rate (HR) and target heart rate are used as physiological measures to evaluate activity tolerance
- Provides guidance for progression, regression and referral
Progressive Return to Activity

The PRA protocol measures three domains as parameters for ongoing evaluation:

• Physical Progression
  - starts with activities from extremely light physical exertion progressing to resistance training with maximum exertion tolerated

• Cognitive Progression
  - starts with very low cognitive demand progressing to activities that require multitasking or complex problem solving

• Vestibular and Balance Progression
  - Starts with activities with slow and limited range of head and body movement progressing to activities that challenge dynamic balance and vestibular demand (e.g., swimming with flip turns)

New ERA of Concussion Care

E - Provide Education
• Education is the single most effective intervention following acute mTBI, showing the greatest decrease in the number and duration of sx’s
• Acute Concussion (mTBI) Educational Brochure
• Return to Activity Educational Brochure

R – Provide mandatory Rest
• 24 hours for any concussion (no matter how many they’ve had in the past 12 months)

A - Ask how many concussions they’ve had in the past 12 months
• Algorithms based on number of concussions in previous year
Education

- Acute Concussion Educational Brochure
  - Should be given to all SMs at time of diagnosis of concussion
  - Used to establish expectation of recovery
  - Acceptable activities
  - Avoidable activities

PRA Algorithm
Algorithm – 4 “Paths”

1. First concussion in past year – RTD after 24/48 hrs of rest – no need for progressing through stages

2. First concussion in past year – RTD after PRA stages

3. Second concussion in past year – RTD after PRA stages

4. Third+ concussion in past year - referral to specialty care

First Concussion (asymptomatic)

C. Symptoms
- Confusion (24 hrs)
- In irritability
- Unsteadiness on feet
- Vertigo
- Nausea
- Headache
- Photophobia
- Phonophobia
- Sleep issues

D. Exertional Testing
- Exert to 65-75% of target heart rate (THR=220-age) using push-ups, sit-ups, running in place, step aerobics, stationary bike, treadmill and/or hand crank
- Maintain this level of exertion for approximately two minutes
- Assess for symptoms (headache, vertigo, photophobia, balance, dizziness, nausea, visual changes, etc)
- If symptomatic, stop testing, and consult with provider

** If possible, patient should wear gear they would normally use in their job/MOS while doing exertional testing
PRA Stages

<table>
<thead>
<tr>
<th>Rehabilitation Stages</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>Rest</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Light Routine Activity</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Light Occupation-oriented Activity</td>
</tr>
<tr>
<td>Stage 4</td>
<td>Moderate Activity</td>
</tr>
<tr>
<td>Stage 5</td>
<td>Intensive Activity</td>
</tr>
<tr>
<td>Stage 6</td>
<td>Unrestricted Activity</td>
</tr>
</tbody>
</table>

Review of Return to Activity Educational Brochure
Review of Return to Activity Educational Brochure

Other Resources Available
dcoe.dvbic.mil

- Management of Headache Following Concussion
- Management of Sleep Disturbances Following Concussion
- Neuroimaging Following Mild TBI in the Non-Deployed Setting
- Assessment and Management of Visual Dysfunction Associated with Mild TBI
- Assessment and Management of Dizziness Associated with Mild TBI
- Neuroendocrine Dysfunction Screening Post Mild TBI Recommendation
- Concussion Management Algorithm Pocket Cards
Challenges with RTD

• Definition of RTD
  • Medically cleared vs. back to work vs. deployable
  • Different military jobs have different demands
• Training of medical providers and medics on CRs
• Compliance of SMs and Command
• Indicators of readiness to return
  • Self-report vs. (potentially unproven) objective indicators
  • Using military-specific tasks as assessment may be tapping into overlearned processes

Challenges with Provider Training

• Analyses of practice behaviors in providers enrolled in the “PRA study”
  • Interviews pre- and post-PRA CR training
• Change of practice patterns does not occur easily
  • 64% of respondents reported no change, regardless of their level of familiarity with PRA CR
• Less experienced providers appear to change behaviors after training
  (McCulloch et al., 2017, MHSRS)
Preliminary Data from PRA Study

• 91.2% of the sample no longer had significant post-concussive symptoms 6 months from injury
  • Gradual symptom decline from within 72 hours of injury to follow-ups at 1 week, 1, 3, and 6 months
  • Consistent with expected recovery rates
• Relationship with persistent vestibular symptoms and engaging in “avoidable activities”
  • Atypical recovery at 3-months were 2 to 7 times more likely to engage in activities restricted by PRA CR
• Highlights the importance of progressive return to activity
  (Bailie, 2017, MHSRS)

ETHICAL CONSIDERATIONS IN THE MANAGEMENT OF CONCUSSION IN MILITARY SETTING
Ethics and RTD after Concussion

• Sports medicine literature has a number of well written papers on this topic
• While many of the principles outlined in these works are applicable to those who treat service members, there are several unique ethical issues with regards to the military population

APA Ethics

Divided into Principles and Standards:
• Principles - aspirational in nature and are intended to “guide and inspire psychologists toward the very highest ethical ideals of the profession.”
• Standards – “enforceable rules for conduct”
Applicable Principles and Standards

Principles:
1. Beneficence and Nonmaleficence
2. Respect for People’s Rights and Dignity

Standards:
1. Competence
2. Avoiding Harm
3. Conflict of Interest

Return to Duty

- Base rates of full recovery following an isolated concussion are very high and several DoD policies and practice guidelines appropriately work from this presumption and allow for recovery and a graded return to activity.
- For SMs who have experienced few concussions, an eventual return to duty (regardless of the environment) is likely and would be considered appropriate, reasonable, and ethical care.
- However.....
Return to Duty

.....what about
1. Premature RTD?
2. Those with multiple concussions?

Premature Return to Duty

• Policies and guidelines for return to duty following concussion and repeat concussion have been established for both theatre and garrison environments.
• Much of the information used for such a decision comes from patient self-report, which depending on the situation, can be skewed toward under-reporting.
Premature RTD: Case Study

• 45 year old, AD Army Officer referred for neuropsychological evaluation for cognitive complaints.
• History of at least a dozen concussions in adulthood from MVA, blast exposures, and sports

• Playing ultimate Frisbee when undercut and landed on head
• Brief AOC, eventually continued play, but when stopped had onset of vomiting and felt “hazy”
• Negative CT at ER, treated and released
• F/U in PC the following day
Premature RTD: Case Study

With PC follow up: “SM with mTBI while playing ultimate Frisbee. No LOC, minimal continued nausea, minimal HA. Normal head CT. SM to follow up with me tomorrow and daily until complete resolution of his symptoms. Strongly advised brain rest for rapid and expedient resolution of his symptoms, however the PT is a...commander and his unit is going to [training] starting today, so it is unlikely that he will be able to comply fully with this. Will counsel him thoroughly on the importance of brain rest for full and prompt recovery.”

Premature RTD: Case Study

• One year later while deployed SM in latrine when light fixture spontaneously fell from ceiling, striking him in the head and forcing him to fall and again hit his head on the toilet. Estimated LOC of a few minutes with subsequent vomiting.
• Presented to theatre clinic the next day reporting headache, blurred vision, photophobia, cognitive fog.
• MACE 25/30 and decreased balance on evaluation.
• Assigned to quarters for rest and RTC 24 hours for re-evaluation
• BUT.....
Premature RTD: Case Study

....SM did not return to clinic for re-evaluation (no note in AHLTA). With my interview he indicated that given his senior position and responsibilities he was unable to refrain from working.

So...patient with two instances of acute concussion with a strong desire to return to work, despite medical advice.

https://www.youtube.com/watch?v=kQZWRsUwMC0
Premature RTD: Case Study

Ethical Considerations: Respect for People’s Rights and Dignity

• Here lies the notion that psychologists respect individual’s right to self-determination and autonomous decision making.
• Military training and service necessarily stresses values like selfless service and a focus on mission and unit over personal needs. While these values have clear utility in the military environment, they can at times stand at odds with a service member’s medical treatment.
• In such situations, the SM’s autonomy can be placed into conflict with the psychologist’s (or other health care provider’s) role in promoting recovery and long term health.

Ethical Considerations: Avoiding Harm

• Is harm better avoided by keeping SM out of duty until total symptom remission
  • Possible harm to unit/mission
  • Possible psychological effects on SM
• Or is harm better avoided by allowing SM to return to duty somewhat prematurely
  • Physical suffering of SM
  • Risk of subsequent concussion
  • Possible compromised capability

Ethical Considerations: Conflict of Interest

• Competing interest of command versus best medical interests of the patient.
Repeat Concussion: Case Study

• 40 year old senior enlisted male combat engineer with history of several concussive events and sub-concussive blast exposures (e.g., 4 concussions in 5 days without LOC via IEDs while deployed in 2008; 3 concussions with LOC via 2 fights and 1 MVA)

• At time of evaluation assigned as grenade range trainer 2-4 days a week with multiple blast exposures and subsequent headache, n/v, blurred vision, and balance issues lasting up to several days

Repeat Concussion: Case Study

On evaluation:

• H/A x2 per week with associated vomiting and photophobia
  • With blast exposures on the range the SM stated that he could predict when he will have headaches and other symptoms based on how close the grenade was to his position

• Cognitive data shows deficits with attention, processing speed, and verbal/visual memory in the context of passed PVTs
Repeat Concussion: Case Study

• SM hesitant to be removed from duties, indicating that at the time he was one of only a few people in his unit qualified to engage his job

Repeat Concussion: Case Study

Ethical Considerations: Patient autonomy
• Similar to first case study
Repeat Concussion: Case Study

Ethical Considerations: Avoidance of Harm

• Possible concerns with multiple concussions
  • Lower threshold for future concussions
  • Increased recovery time with injury
  • Neurologic sequelae increases as a function of number of concussive injuries
  • Neurodegenerative conditions with repeat concussion (e.g., CTE)
    • Literature on such outcomes is far from clear; however for individual patients these factors should at the very least be considered

Where is the avoidance of harm?

• Is harm avoided by keeping SM out of job? If so how long?
• Career consequences if on extended profile?
• Neurologic consequences of repeated concussive injury even if asymptomatic?
• Mission consequences (possibly less pronounced in Garrison)?

Ethical Solutions

• As with most ethical issues, there is no uniform answer.
• Best solutions likely include involvement of multiple providers (or at least consultation) and collaborative care approach with SM and command as stake holders.
• Competence of provider - keeping abreast of current literature and standards of practice.
The Disability Incentive: VBA and mTBI

Iatrogenesis to Incentive

• We discussed iatrogenesis of screening, but what about external incentive?
• Roth & Spencer (2013)
• Mossman (1994) – “At the VA, it pays to be sick”
• Ethical issue: “hey doc, can you fill this out saying I have PTSD?”
Service Connection

- Veteran submits claim package to VBA regional office
- Condition incurred or exasperated during military service
- Initial C&P exam(s) completed
- Percentage awarded based on disability rating
- Unlimited ability to appeal decision

Base Pay Rates

<table>
<thead>
<tr>
<th>Rating</th>
<th>Monthly Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>$131</td>
</tr>
<tr>
<td>20%</td>
<td>$259</td>
</tr>
<tr>
<td>30%</td>
<td>$401</td>
</tr>
<tr>
<td>40%</td>
<td>$578</td>
</tr>
<tr>
<td>50%</td>
<td>$822</td>
</tr>
<tr>
<td>60%</td>
<td>$1,041</td>
</tr>
<tr>
<td>70%</td>
<td>$1,312</td>
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<tr>
<td>80%</td>
<td>$1,526</td>
</tr>
<tr>
<td>90%</td>
<td>$1,714</td>
</tr>
<tr>
<td>100%</td>
<td>$2,858</td>
</tr>
</tbody>
</table>

TBI and VA Disability

- TBI C&P: medical exam
- May request neuropsych, but not required
- Note that secondary conditions can be connected
- 2015: ~100,000 receiving disability for TBI (VBA, 2016)
- Young et al. (2016): estimated PVT failure rates 25% to 42%
Denning & Shura (2017)

1. To review PVT failure rates in veterans & SM
   - 50 non-overlapping study samples
   - Past 10 years; freestanding PVTs
   - \( n = 9,878 \)
   - TOMM, WMT, MSVT, NV-MSVT, and Victoria
   - Weighted average = 30% failure rate (3-68)

Denning & Shura (2017)

2. To estimate nationwide costs of all veterans receiving disability payments for mTBI who may have been malingering during their disability evaluation
   - mTBI neuropsych C&P evals at 1 VA
   - \( n = 74 \), m TBI, no neurological issues
   - TOMM and/or MSVT
   - Retrospective review: receiving disability or not after eval
Results

• Failure rates
  • 52% failed at least 1 PVT
  • 33% failed both
  • 41 receiving mTBI disability
Key Points

• Incentive in VA is high
• Lines are blurred between VBA and VHA
• OIG identifies fraud, but...
• Importance of PVT use is highlighted here
• Burden not only on taxpayer $, but also resources that could be allocated elsewhere
• That’s just mTBI...

Figure 1. The effects of invalid response styles.
Conclusions:
Take Away Points

1. Question as to the utility of mass screening for mTBI in the DoD/VA systems.
2. NCATs are not a diagnostic tool, and more work is needed to fully delineate their utility in tracking recovery after mTBI.
3. Current research suggests limited consistency between self-reported injury and symptoms around the time of injury and later VA care.
4. Validity testing in clinical, forensic, and research activity is essential.
5. Progressive/staged return to activity likely results in adequate recovery after mTBI, and formal clinical recommendations exist. Dissemination and adoption of that CR can be challenging, especially with more experienced clinicians.
6. Blast injury may reflect unique injury mechanisms and physiological disruption, but differences in functional outcomes are still unclear.
7. Several ethical standards are applicable to return to duty decisions to include patient autonomy, avoidance of harm, and potential conflicts of interest.

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Our Veterans and Service Members