Traumatic Brain Injury and Post Traumatic Stress Disorder: Current State of the Science, Diagnostic Challenges, and Best Clinical Practices

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Director
VISN 19 Mental Illness Research Education and Clinical Center
PTSD – A Review
The person has been exposed to a traumatic event in which both of the following have been present:

– (1) the person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others (2) the person's response involved intense fear, helplessness, or horror.
**DSM-IV Criteria - PTSD**

B. Re-experiencing symptoms (nightmares, intrusive thoughts)
C. Avoidance of trauma cues and Numbing/detachment from others
D. Hyperarousal (increased startle, hypervigilance)

Duration of the disturbance (symptoms in Criteria B, C, and D) is more than one month.

The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.
PTSD and OEF/OIF
Seminal Study

- Exposure to combat greater among those deployed to Iraq
- The percentage of study subjects who met screening criteria for major depression, generalized anxiety disorder, or PTSD
  - Iraq 15.6%-17.1%
  - Afghanistan 11.2%
Rates of PTSD Vary

• Military
  – From 4%-5% to 30%-31%

  Why?
  ➢ More severe trauma results in more severe PTSD
  ➢ Contextual factors (e.g., combat environment)
  ➢ Time
  ➢ Nature of symptom presentation or acknowledgement

• Civilian
  – National Co-Morbidity Sample – 21% of women and 8% of men
  – Interpersonal vs. Impersonal
    • 55% of rape victims develop PTSD and only 7.5% of accident victims develop PTSD

How is PTSD Diagnosed?

Screening vs. Assessment

Objective Marker vs. Self-Report
• If we apply the range of prevalence estimates for PTSD (5 to 15 percent) and depression (2 to 10 percent) to the 1.64 million service members who have already been deployed, we can estimate that the number of service members returning home with PTSD will range from 75,000 to 225,000 and with depression, from 30,000 to 50,000.
Potential Consequences of PTSD

Social and Interpersonal Problems:

- Relationship issues
- Low self-esteem
- Alcohol and substance abuse
- Employment problems
- Homelessness
- Trouble with the law
- Isolation
Mild TBI – A Review
TBI – Definition

• Traumatic Brain Injury - A bolt or jolt to the head or a penetrating head injury that disrupts the function of the brain
  – Not all blows or jolts to the head result in a TBI. The severity of such an injury may range from “mild” (a brief change in mental status or consciousness) to “severe” (an extended period of unconsciousness or amnesia) after the injury.
Mild TBI Definition – American Congress of Rehabilitation Medicine

“Traumatically induced disruption of brain function that results in loss of consciousness of less than 30 minutes’ duration or in an alteration of consciousness manifested by an incomplete memory of the event or being dazed and confused.”

McCallister 2005
TBI – Mechanism of Injury
Mechanism of Injury – Acceleration/Deceleration

Coup

Contrecoup

Primary Impact

Secondary Impact

Thanks John Kirk, Ph.D.
Blast Injury

• Blast injuries are injuries that result from the complex pressure wave generated by an explosion.
  – The explosion causes an instantaneous rise in pressure over atmospheric pressure that creates a blast overpressurization wave

• Air-filled organs such as the ear, lung, and gastrointestinal tract and organs surrounded by fluid-filled cavities such as the brain and spinal are especially susceptible to primary blast injury
Blast Injury

- Primary – Barotrauma
- Secondary – Objects being put into motion
- Tertiary – Individuals being put into motion
TBI – Severity of Injury
## Injury Severity

<table>
<thead>
<tr>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altered or LOC&lt;30 minutes with normal CT and/or MRI</td>
<td>LOC&lt;6 hours with abnormal CT and/or MRI</td>
<td>LOC&gt;6 hours with abnormal CT and/or MRI</td>
</tr>
<tr>
<td>GCS 13-15</td>
<td>GCS 9-12</td>
<td>GCS&lt;9</td>
</tr>
<tr>
<td>PTA&lt;24 hours</td>
<td>PTA&lt;7 days</td>
<td>PTA&gt;7 days</td>
</tr>
</tbody>
</table>
Common Mild TBI Symptoms

**NOT** to be confused with the injury itself

TBI is a historical event
Common Mild TBI/Postconcussive Symptoms

- Headache
- Poor concentration
- Memory difficulty
- Irritability
- Fatigue
- Depression
- Anxiety
- Dizziness
- Light sensitivity
- Sound sensitivity

Immediately post-injury 80% to 100% describe one or more symptoms

Most individuals return to baseline functioning within a year

Ferguson et al. 1999, Carroll et al. 2004; Levin et al. 1987
7% to 33% have persistent symptoms
### Screening Results: n=3,973

<table>
<thead>
<tr>
<th>Injury Status</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injured with TBI</td>
<td>907 (22.8)</td>
</tr>
<tr>
<td>Injured without TBI</td>
<td>385 (9.7)</td>
</tr>
<tr>
<td>Not injured</td>
<td>2,681 (67.5)</td>
</tr>
<tr>
<td><strong>Total Screened</strong></td>
<td><strong>3,973 (100)</strong></td>
</tr>
</tbody>
</table>

### Injury Characteristics for Soldiers with TBI‡

<table>
<thead>
<tr>
<th></th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dazed or confused only</td>
<td>572 (63.1)</td>
</tr>
<tr>
<td>Had LOC* or could not remember the injury</td>
<td>335 (36.9)</td>
</tr>
<tr>
<td><strong>Total with TBI</strong></td>
<td><strong>907 (100)</strong></td>
</tr>
</tbody>
</table>

‡ TBI is defined by an alteration in consciousness, such as being dazed or confused, not remembering the injury event, and/or losing consciousness in the context of an injury

* LOC=loss of consciousness

Terrio et al., 2009
Ft. Carson:
Post-Deployment Data (n = 907)

Symptoms Beginning at TBI Event: Course of Symptoms (n = 844)

Currently Symptomatic: Onset of Symptoms (n = 844)

Potential Consequences of mTBI

Social and Interpersonal Problems:

- Relationship issues
- Low self-esteem
- Alcohol and substance abuse
- Employment problems
- Homelessness
- Trouble with the law
- Isolation
TBI

What Can We Expect?

• 320,000 veterans may have experienced a probable TBI during deployment
How it mTBI Diagnosed?

Screening vs. Assessment
Objective Marker vs. Self-Report
This form must be completed electronically. Handwritten forms will not be accepted.

POST-DEPLOYMENT HEALTH ASSESSMENT (PDHA)

PRIVACY ACT STATEMENT

AUTHORITY: 10 U.S.C. 168b, 1634, 321a, 321b, 3213, 3214, and 50 USC 4906.

PRINCIPAL PURPOSE(S): To assure your state of health after deployment to support of military operations and to assist military healthcare providers in identifying and providing present and future medical care you may need. The information you provide may result in a referral for additional healthcare that may include medical, dental or behavioral healthcare or diverse community support services.

ROUTINE USE(S): In addition to those disclosures generally permitted under 5 U.S.C. 3012a(b) of the Privacy Act, to other Federal and State agencies and civilian healthcare providers, as necessary, in order to provide necessary medical care and treatment. Responses may be used to guide possible referrals.

DISCLOSURE: Voluntary. If not provided, healthcare WILL BE furnished, but comprehensive care may not be possible.

INSTRUCTIONS: Please read each question completely and carefully before entering your response or marking your selection. YOU ARE ENCOURAGED TO ANSWER EACH QUESTION. ANSWERING THESE QUESTIONS WILL NOT DELAY YOUR RETURN HOME. Withholding or providing inaccurate information may impair a healthcare provider’s ability to identify health problems and refer you to appropriate sources for additional evaluation and treatment. If you do not understand a question, please ask for help.

DEMOGRAPHICS

Last Name: ____________________________  First Name: ____________________________  Middle Initial: __________

Social Security Number: ____________________________

Date of Birth (mm/dd/yyyy): ____________________________

Gender:  Male  Female

Service Branch:  [ ] Army  [ ] Marine Corps  [ ] Air Force  [ ] National Guard  [ ] Other

Component:  [ ] Active Duty  [ ] Reserve  [ ] Civilian Government Employee  [ ] Other

Date of arrival in theater (mm/dd/yyyy): ____________________________

Date of departure from theater (mm/dd/yyyy): ____________________________

Name of Operation: ____________________________

Location of Operation: To what areas were you mainly deployed (homebase operations) for more than 30 days? (please check all that apply, including the number of months spent at each location.)  

[ ] Country 1  Time at location (months): ____________  Time at location (months): ____________

[ ] Country 2  Time at location (months): ____________  Time at location (months): ____________

[ ] Country 3  Time at location (months): ____________  Time at location (months): ____________

[ ] Country 4  Time at location (months): ____________  Time at location (months): ____________

[ ] Country 5  Time at location (months): ____________  Time at location (months): ____________

Occupational specialty during this deployment (MOS/IOC, NCO/ICs, or APS/C): ____________________________

Combat specialty: ____________________________

Current Contact Information: ____________________________

Point of Contact who can always reach you:

Name: ____________________________  Phone: ____________________________  Email: ____________________________

Address: ____________________________  Mailing Address: ____________________________

DD FORM 2796, JAN 2008
PTSD – Challenges Associated With Screening
13. Have you ever had any experience that was so frightening, horrible, or upsetting that, IN THE PAST MONTH, you ....

a. Have had nightmares about it or thought about it when you did not want to?

b. Tried hard not to think about it or went out of your way to avoid situations that remind you of it?

c. Were constantly on guard, watchful, or easily startled?

d. Felt numb or detached from others, activities, or your surroundings?
Posttraumatic Stress Disorder Checklist (PCL)

The PCL is a 17-item self-report measure of the 17 DSM-IV symptoms of PTSD. Respondents rate how much they were “bothered by that problem in the past month”. Items are rated on a 5-point scale ranging from 1 (“not at all”) to 5 (“extremely”).

<table>
<thead>
<tr>
<th>No.</th>
<th>Response</th>
<th>Not at all (1)</th>
<th>A little bit (2)</th>
<th>Moderately (3)</th>
<th>Quite a bit (4)</th>
<th>Extremely (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Repeated, disturbing memories, thoughts, or images of a stressful experience from the past?</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2.</td>
<td>Suddenly acting or feeling as if a stressful experience were happening again (as if you were reliving it)?</td>
<td></td>
<td></td>
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<tr>
<td>3.</td>
<td>Feeling very upset when something reminded you of a stressful experience from the past?</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4.</td>
<td>Having physical reactions (e.g., heart pounding, trouble breathing, or sweating) when something reminded you of a stressful experience from the past?</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5.</td>
<td>Avoid thinking about or talking about a stressful experience from the past or avoid having feelings related to it?</td>
<td></td>
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<tr>
<td>6.</td>
<td>Avoid activities or situations because they remind you of a stressful experience from the past?</td>
<td></td>
<td></td>
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<td>7.</td>
<td>Trouble remembering important parts of a stressful experience from the past?</td>
<td></td>
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<tr>
<td>8.</td>
<td>Loss of interest in things that you used to enjoy?</td>
<td></td>
<td></td>
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<tr>
<td>9.</td>
<td>Feeling distant or cut off from other people?</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10.</td>
<td>Feeling emotionally numb or being unable to have loving feelings for those close to you?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Feeling as if your future will somehow be cut short?</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>12.</td>
<td>Trouble falling or staying asleep?</td>
<td></td>
<td></td>
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<tr>
<td>13.</td>
<td>Feeling irritable or having angry outbursts?</td>
<td></td>
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<tr>
<td>14.</td>
<td>Having difficulty concentrating?</td>
<td></td>
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</tbody>
</table>
The diagnostic accuracy of the PTSD Checklist: A critical review

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a Defense and Veterans Brain Injury Center, Richmond VA Medical Center, 1201 Broad Boulevard, Richmond, VA 23298, USA
b The Henry M. Jackson Foundation for the Advancement of Military Medicine, USA
c Department of Physical Medicine and Rehabilitation, Virginia Commonwealth University, USA
d Department of Physical Medicine and Rehabilitation, Virginia Commonwealth University, USA

ABSTRACT

The PTSD Checklist (PCL) is the most frequently used self-report measure of PTSD symptoms. Although the PCL has been in use for nearly 20 years and over a dozen validation studies have been conducted, this paper provides the first comprehensive review of its diagnostic utility. Eighteen diagnostic accuracy studies of the PCL are presented, followed by an examination of the potential role of specific factors, bias, and prevalence in understanding the variation in sensitivity, specificity, and other operating characteristics across these studies. Two major issues arise from the interdisciplinarity of the PCL’s three versions (civilian, military, and specific) and various scoring methods. Findings indicate that the PCL has significant strengths as a PTSD screening tool and suggest that it can be a useful tool when followed by a second-tier diagnostic test such as a structured interview. However, the PCL’s operating characteristics demonstrate significant variation across populations, settings, and research methods and low studies have examined such factors that may moderate the PCL’s utility. Recommendations and cautions regarding the use of the PCL as a clinical screening tool, a diagnostic tool in research, and as an estimator of PTSD population prevalence are provided.

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<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Gender (% Female)</th>
<th>Population</th>
<th>Diagnostic reference standard</th>
<th>Observed PTSD prevalence</th>
<th>Recruiting</th>
<th>Administration date of reference standard</th>
<th>Setting for PCL administration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PCL-Civilian</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Bollinger, Quevis, Vielhauer, Morgan, and Keane (2008)</td>
<td>57</td>
<td>30%</td>
<td>HIV-seropositive patients</td>
<td>CAPS</td>
<td>12%</td>
<td>Participants in a research study on HIV/AIDS treatment who also met criteria for past year substance abuse, dependence and another Axis I disorder, Antisocial Personality Disorder, or Borderline Personality Disorder</td>
<td>Not reported</td>
<td>Not reported</td>
</tr>
<tr>
<td>Dobie et al. (2002)</td>
<td>282</td>
<td>100%</td>
<td>VA primary care patients</td>
<td>CAPS</td>
<td>36%</td>
<td>Mailings to eligible veterans Patients screened for a CBT treatment trial for co-morbid PTSD and serious mental illness</td>
<td>Same day</td>
<td>Research session (oral administration)</td>
</tr>
<tr>
<td>Gulaugh Elhai, Cusack, Wetts, and Frueh (2007)</td>
<td>44</td>
<td>66%</td>
<td>Patients with psychotic disorders</td>
<td>CAPS</td>
<td>39%</td>
<td></td>
<td>Not reported</td>
<td></td>
</tr>
<tr>
<td>Harrington and Newman (2007)</td>
<td>44</td>
<td>100%</td>
<td>Residents of a women’s substance use disorder treatment facility</td>
<td>CAPS</td>
<td>30%</td>
<td>Approached by on-site clinicians</td>
<td>Same day</td>
<td>Research session</td>
</tr>
<tr>
<td>Hudson, Beckford, Jackson, and Philpot (2008)</td>
<td>100</td>
<td>58%</td>
<td>Inpatient or day-patients aged 65 years or older receiving inpatient or day treatment for medical and/or psychiatric conditions</td>
<td>CAPS</td>
<td>10%</td>
<td>Approached in a clinical setting (e.g., while hospitalized)</td>
<td>Same day is inferred</td>
<td>Research session</td>
</tr>
<tr>
<td>Keen et al. (2008)</td>
<td>114</td>
<td>0%</td>
<td>Community-dwelling veterans</td>
<td>CAPS</td>
<td>22%</td>
<td>Participants in a research study on trauma and community advertisements</td>
<td>Within 1 week after PCL</td>
<td>Research session</td>
</tr>
<tr>
<td>Lang and Stein (2005)</td>
<td>154</td>
<td>52%</td>
<td>VA and academic medical center primary care</td>
<td>CIDI</td>
<td>16%</td>
<td>Approached patients in primary care clinics</td>
<td>Not reported</td>
<td>Mail</td>
</tr>
<tr>
<td>Lang, Laffaye, Satz, Dresselhaus, and Stein (2003)</td>
<td>49</td>
<td>100%</td>
<td>VA primary care patients</td>
<td>CIDI</td>
<td>31%</td>
<td>Mailings to all female VA primary care patients</td>
<td>Within 1 month after PCL</td>
<td>Telephone</td>
</tr>
<tr>
<td>Manne et al. (1998)</td>
<td>65</td>
<td>100%</td>
<td>Mothers of pediatric cancer survivors</td>
<td>SCID</td>
<td>6%</td>
<td>Mailing to participants of another study</td>
<td>Not reported</td>
<td>Mail</td>
</tr>
<tr>
<td>Prins et al. (2003, 2004)</td>
<td>167</td>
<td>66%</td>
<td>VA primary care patients</td>
<td>CAPS</td>
<td>26%</td>
<td>Approached veterans in a VA primary care clinic</td>
<td>Same day</td>
<td>Research session</td>
</tr>
<tr>
<td>Walker et al. (2002)</td>
<td>261</td>
<td>100%</td>
<td>HMO patients</td>
<td>CAPS</td>
<td>11%</td>
<td>Mailings to patients of an HMO</td>
<td>Invited for CAPS within 2 months of receiving PCL</td>
<td>Mail</td>
</tr>
<tr>
<td>Widows, Jacobsen, and Fields (2003)</td>
<td>102</td>
<td>77%</td>
<td>Bone marrow transplant recipients</td>
<td>SCID</td>
<td>5%</td>
<td>Bone marrow patient registry</td>
<td>One week</td>
<td>Mail</td>
</tr>
<tr>
<td><strong>PCL-Military</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Weathers et al. (1993)</td>
<td>123</td>
<td>0%</td>
<td>Vietnam veterans</td>
<td>SCID (DSM-III-R)</td>
<td>54%</td>
<td>Clinical contact and advertisements</td>
<td>Not reported</td>
<td>Research session</td>
</tr>
<tr>
<td>Yeager, Maguder, Knapp, Nicholas, and Frueh (2007)</td>
<td>840</td>
<td>21%</td>
<td>VA primary care patients</td>
<td>CAPS</td>
<td>11%</td>
<td>Mailings and clinic follow-up</td>
<td>Within 2 months after PCL</td>
<td>During primary care visit. Setting not reported</td>
</tr>
<tr>
<td><strong>PCL-Specific</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Andykowski et al. (1998)</td>
<td>82</td>
<td>100%</td>
<td>Women with breast cancer</td>
<td>SCID</td>
<td>6%</td>
<td>Mailings to participants of another study</td>
<td>Same day</td>
<td>Telephone</td>
</tr>
<tr>
<td>Blanchard et al. (1996)</td>
<td>40</td>
<td>92%</td>
<td>Various research volunteers</td>
<td>CAPS</td>
<td>45%</td>
<td>Community advertisements and clinician referral</td>
<td>Not reported</td>
<td>Mail</td>
</tr>
<tr>
<td>Blesle et al. (2008)</td>
<td>724</td>
<td>3%</td>
<td>U.S. Army soldiers postdeployment</td>
<td>MINI (modified)</td>
<td>6%</td>
<td>Asked permission to use military mental health screening data for research purposes</td>
<td>Same day</td>
<td>Administered to Army units in an aircraft hanger</td>
</tr>
<tr>
<td>McDevitt-Murphy et al. (2005)</td>
<td>50</td>
<td>100%</td>
<td>Community-dwelling women</td>
<td>CAPS</td>
<td>25%</td>
<td>Community advertisements</td>
<td>Generally within 2 weeks after PCL</td>
<td>Research session</td>
</tr>
</tbody>
</table>

Notes. CAPS = Clinician-Administered PTSD Scale. CIDI = Composite International Diagnostic Interview. SCID = Structured Clinical Interview for DSM Disorders. MINI = Mini-International Neuropsychiatric Interview.
**Sensitivity** – Proportion of those with the disorder who are correctly identified by the test

**Specificity** – Proportion of those without the disorder who are correctly identified by the test

---

**Table 4**

Comparison across studies of the PTSD Checklist at a cut point of 50 and PTSD prevalence set at .50.

<table>
<thead>
<tr>
<th>Study</th>
<th>Population</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPP</th>
<th>NPP</th>
<th>Efficiency</th>
<th>Kappa</th>
<th>Estimated prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bollinger et al. (2008)</td>
<td>HIV-seropositive patients</td>
<td>.86 (0.74–0.93)</td>
<td>.79 (0.67–0.88)</td>
<td>.80 (0.68–0.89)</td>
<td>.85 (0.73–0.92)</td>
<td>.83 (0.70–0.90)</td>
<td>.58 (0.45–0.70)</td>
<td>.54 (0.41–0.66)</td>
</tr>
<tr>
<td>Dobie et al. (2002)</td>
<td>VA primary care patients</td>
<td>.58 (0.52–0.64)</td>
<td>.92 (0.88–0.95)</td>
<td>.88 (0.84–0.91)</td>
<td>.69 (0.63–0.74)</td>
<td>.75 (0.70–0.80)</td>
<td>.53 (0.47–0.59)</td>
<td>.33 (0.28–0.39)</td>
</tr>
<tr>
<td>Grubaugh et al. (2007)</td>
<td>Patients with psychotic disorders</td>
<td>.69 (0.54–0.81)</td>
<td>.67 (0.52–0.79)</td>
<td>.68 (0.53–0.80)</td>
<td>.68 (0.54–0.80)</td>
<td>.68 (0.53–0.80)</td>
<td>.36 (0.23–0.51)</td>
<td>.51 (0.37–0.65)</td>
</tr>
<tr>
<td>Hudson et al. (2008)</td>
<td>Inpatient or day-patients aged 65 years or older receiving inpatient or day treatment for medical and/or psychiatric conditions</td>
<td>.40 (0.31–0.50)</td>
<td>.97 (0.91–0.99)</td>
<td>.93 (0.86–0.97)</td>
<td>.62 (0.52–0.71)</td>
<td>.69 (0.59–0.77)</td>
<td>.40 (0.31–0.50)</td>
<td>.22 (0.15–0.31)</td>
</tr>
<tr>
<td>Keen et al. (2008)</td>
<td>Community-dwelling veterans</td>
<td>.56 (0.47–0.65)</td>
<td>.72 (0.63–0.79)</td>
<td>.67 (0.58–0.75)</td>
<td>.62 (0.53–0.70)</td>
<td>.64 (0.55–0.72)</td>
<td>.27 (0.20–0.36)</td>
<td>.42 (0.33–0.51)</td>
</tr>
<tr>
<td>Prins and Quimette</td>
<td>VA and academic medical center patients</td>
<td>.54 (0.46–0.62)</td>
<td>.94 (0.89–0.97)</td>
<td>.90 (0.84–0.94)</td>
<td>.67 (0.59–0.74)</td>
<td>.74 (0.67–0.80)</td>
<td>.50 (0.42–0.58)</td>
<td>.30 (0.23–0.38)</td>
</tr>
<tr>
<td>Lang et al. (2003)</td>
<td>VA primary care patients</td>
<td>.39 (0.27–0.53)</td>
<td>.94 (0.83–0.99)</td>
<td>.87 (0.74–0.94)</td>
<td>.61 (0.47–0.73)</td>
<td>.67 (0.52–0.78)</td>
<td>.38 (0.25–0.52)</td>
<td>.23 (0.13–0.36)</td>
</tr>
<tr>
<td>Manne et al. (1998)</td>
<td>Mothers of pediatric cancer survivors</td>
<td>.75 (0.63–0.84)</td>
<td>.89 (0.79–0.95)</td>
<td>.87 (0.77–0.94)</td>
<td>.78 (0.66–0.87)</td>
<td>.82 (0.71–0.90)</td>
<td>.55 (0.43–0.67)</td>
<td>.43 (0.32–0.55)</td>
</tr>
<tr>
<td>Walker et al. (2002)</td>
<td>HMO patients</td>
<td>.21 (0.16–0.26)</td>
<td>.98 (0.95–0.99)</td>
<td>.91 (0.87–0.94)</td>
<td>.55 (0.49–0.61)</td>
<td>.60 (0.53–0.65)</td>
<td>.22 (0.18–0.28)</td>
<td>.12 (0.08–0.16)</td>
</tr>
<tr>
<td>Widows et al. (2000)</td>
<td>Bone marrow transplant recipients</td>
<td>.20 (0.13–0.29)</td>
<td>.95 (0.89–0.98)</td>
<td>.80 (0.71–0.87)</td>
<td>.54 (0.45–0.64)</td>
<td>.58 (0.48–0.67)</td>
<td>.15 (0.09–0.23)</td>
<td>.13 (0.07–0.20)</td>
</tr>
<tr>
<td>Weathers et al. (1993)</td>
<td>Vietnam veterans</td>
<td>.82 (0.74–0.88)</td>
<td>.83 (0.75–0.89)</td>
<td>.83 (0.75–0.89)</td>
<td>.82 (0.74–0.88)</td>
<td>.83 (0.75–0.88)</td>
<td>.65 (0.56–0.73)</td>
<td>.50 (0.41–0.58)</td>
</tr>
<tr>
<td>Yeager et al. (2007)</td>
<td>VA primary care patients</td>
<td>.53 (0.50–0.56)</td>
<td>.95 (0.93–0.96)</td>
<td>.91 (0.89–0.93)</td>
<td>.67 (0.64–0.70)</td>
<td>.74 (0.71–0.77)</td>
<td>.49 (0.45–0.52)</td>
<td>.29 (0.26–0.32)</td>
</tr>
<tr>
<td>Andrykowski et al. (1998)</td>
<td>Women with breast cancer</td>
<td>.60 (0.49–0.70)</td>
<td>.99 (0.93–1.01)</td>
<td>.98 (0.92–1.00)</td>
<td>.71 (0.61–0.80)</td>
<td>.80 (0.69–0.87)</td>
<td>.65 (0.54–0.74)</td>
<td>.31 (0.22–0.41)</td>
</tr>
<tr>
<td>Blanchard et al. (1996)</td>
<td>Various research volunteers</td>
<td>.78 (0.63–0.88)</td>
<td>.86 (0.72–0.94)</td>
<td>.85 (0.70–0.93)</td>
<td>.80 (0.65–0.89)</td>
<td>.82 (0.67–0.91)</td>
<td>.64 (0.49–0.77)</td>
<td>.46 (0.32–0.61)</td>
</tr>
</tbody>
</table>

Notes. PPP = positive predictive power. NPP = negative predictive power. Kappa is a measure of efficiency adjusted for chance. Values in parentheses are 95% adjusted Wald confidence intervals. Rounding during calculation of PPP, NPP, efficiency and kappa may have resulted in slightly different values from those reported by the authors.
Conclusions

• “When a screening tool is used as a clinical screen or to populate groups in research, the population prevalence must be known in order to determine the appropriate cut score”

• As a clinical screening tool
  – Consider existing research

• As a diagnostic tool for group assignment – use to “narrow the field”

McDonald and Calhoun, 2010
mTBI – Challenges Associated With Screening
TBI Screen – Injury Event

9.a. During this deployment, did you experience any of the following events? *(Mark all that apply)*

(1) Blast or explosion *(IED, RPG, land mine, grenade, etc.)*
(2) Vehicular accident/crash *(any vehicle, including aircraft)*
(3) Fragment wound or bullet wound above your shoulders
(4) Fall
(5) Other event *(for example, a sports injury to your head)*. Describe:
9.b. Did any of the following happen to you, or were you told happened to you, IMMEDIATELY after any of the event(s) you just noted in question 9.a.?

(Mark all that apply)
(1) Lost consciousness or got "knocked out"
(2) Felt dazed, confused, or "saw stars"
(3) Didn't remember the event
(4) Had a concussion
(5) Had a head injury
Symptoms - Acute

9.c. Did any of the following problems begin or get worse after the event(s) you noted in question 9.a.?

(Mark all that apply)

(1) Memory problems or lapses
(2) Balance problems or dizziness
(3) Ringing in the ears
(4) Sensitivity to bright light
(5) Irritability
(6) Headaches
(7) Sleep problems
Symptoms - Persistent

9.d. In the past week, have you had any of the symptoms you indicated in 9.c.? *(Mark all that apply)*

1. Memory problems or lapses
2. Balance problems or dizziness
3. Ringing in the ears
4. Sensitivity to bright light
5. Irritability
6. Headaches
7. Sleep problems
6 primary concerns about TBI screening measures
6 Concerns

• Not all OEF/OIF service members have been screened (DoD – 2008/VA 2007)
• Post-deployment screening focuses exclusively on most recent deployment
• Most screening measures focus on a single injury

Iverson, Langlois, McCrea, and Kel1ly, 2009
6 Concerns

• Implemented in group setting – desire to get home
• Blast exposure confused as blast injury
• “The screening tools used by the DoD and the VA are likely to lead to misidentification of residual symptoms of mild TBI in some service members...logic and flow of the questions...establish an expectation of causation”

Iverson, Langlois, McCrea, and Kelly, 2009
Diagnostic Performance of the DoD TBI Screen

<table>
<thead>
<tr>
<th>Items</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items 1 &amp; 2</td>
<td>80%</td>
<td>93%</td>
</tr>
<tr>
<td>Items 1, 2, &amp; 3</td>
<td>72%</td>
<td>95%</td>
</tr>
<tr>
<td>All Items</td>
<td>60%</td>
<td>96%</td>
</tr>
</tbody>
</table>

Sensitivity – Proportion of those with the disorder who are correctly identified by the test

Specificity – Proportion of those without the disorder who are correctly identified by the test

Terrio et al, Under Review
How many psychometric studies on self-report measures (PTSD and/or mTB) have been conducted with OEF/OIF Veterans?
What continues to be the “gold standard” for TBI and/or PTSD diagnostic assessment?
OSU TBI-ID

- Structured interview designed to elicit lifetime history of TBI
- Uses multiple probes to stimulate memory
- Avoids misunderstanding about what a TBI is by first eliciting injuries, then determining if altered consciousness occurred as a result
- Provides richer information about history than simple “yes/no” (e.g., number, severity, effects, timing, etc.)
Can a person develop PTSD following a TBI with loss of consciousness?
PTSD with Amnesia?

Why the controversy?

Trauma → 

Retrograde Amnesia → LOC → Posttraumatic Amnesia → Encoding events

TIME

Thanks John Kirk, Ph.D.
TBI and Stress Disorders
Factors that Seem to Matter

• Comorbid Psychological Conditions
• Coping Styles
• Memories for the Traumatic Event
  – Length of Post Traumatic Amnesia
    • Severity of Injury
Predictors of Acute Stress Disorder following Mild TBI

- 48 patients sustained mild TBIs secondary to motor vehicle accidents (MVA)
  - Assessed within 18 days of trauma for Acute Stress Disorder (ASD)
- 14.6% diagnosed with ASD
- 4.2% diagnosed with sub-syndromal ASD
- Higher scores on the Beck Depression Inventory and “avoidant coping” were significant predictors of ASD and acute stress severity.
Acute Stress Disorder as a Predictor of PTSD

- Survivors of MVA with mild TBI assessed at the following intervals
  - 1 month (n=79) for ASD
  - 6 months (n=63) for PTSD
  - 2 years (n=50) for PTSD
- Of the total initial group, 73% diagnosed with ASD had PTSD at 2 years.
mTBI and PTSD

• Prospective study of the relationship between TBI and PTSD
  – 120 subjects with mild TBI who were hospitalized for observation
  – Assessed immediately after accident, and at 1 week, 3 months, and 6 months
  – 17 subjects (14%) meet criteria at 6 months
    • Subjects with memory of the event were more likely to develop PTSD than those with no memory – Differences between the groups primarily resulted from the re-experiencing cluster

Analysis revealed that memory of the traumatic event within the first 24 hours was a strong predictor of PTSD at 6 months

Gil et al. 2005
Can individuals with moderate to severe TBI develop PTSD?

- Memory Reconsolidation – those with TBI reconstruct memories
- Post-amnesia resolution – experiencing traumatic events post-amnesia
Period of Unconsciousness

- 46 patients - questionnaires and structured interviews
  - 27% of the sub-sample who were not unconscious for an extended period were diagnosed with PTSD
  - 3% of the sub-sample (1 patient) with a loss of consciousness greater than 12 hours was diagnosed with PTSD

Relationship between period of unconsciousness and meeting criteria for PTSD

Glaesser et al. 2004
### Frequency and Quality of Intrusions Depending on Consciousness

<table>
<thead>
<tr>
<th></th>
<th>conscious (N = 10)</th>
<th>unconscious (N = 8)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Rank sum</td>
</tr>
<tr>
<td>Frequency of intrusions during the last week</td>
<td>5.95</td>
<td>120</td>
</tr>
<tr>
<td>Intrusions of the accident itself</td>
<td>3.3</td>
<td>115.5</td>
</tr>
<tr>
<td>Visual intrusions</td>
<td>3.3</td>
<td>104.5</td>
</tr>
<tr>
<td>Acoustic intrusions</td>
<td>2.7</td>
<td>113.5</td>
</tr>
<tr>
<td>Olfactory intrusions</td>
<td>1</td>
<td>95</td>
</tr>
<tr>
<td>Bodily sensations during intrusions</td>
<td>2.7</td>
<td>119</td>
</tr>
<tr>
<td>Same feelings as during the event</td>
<td>2.9</td>
<td>123</td>
</tr>
<tr>
<td>Impression that event is happening at this moment</td>
<td>2.3</td>
<td>115</td>
</tr>
<tr>
<td>Internal narrative about the sequence of events</td>
<td>1</td>
<td>67.5</td>
</tr>
<tr>
<td>Intrusions of the space of time before the accident</td>
<td>1.7</td>
<td>97.5</td>
</tr>
<tr>
<td>Intrusions of the space of time after the accident</td>
<td>2.4</td>
<td>86.5</td>
</tr>
<tr>
<td>Intrusions about reports by others</td>
<td>1.3</td>
<td>79.5</td>
</tr>
<tr>
<td>Intrusions based on imaginations</td>
<td>1.4</td>
<td>97.5</td>
</tr>
<tr>
<td>Ruminations without an image of the event</td>
<td>1.78</td>
<td>90.5</td>
</tr>
</tbody>
</table>

Only those were included in the analysis. * $p \leq 0.05$; ** $p < 0.01$. Note: "Frequency" is the number of intrusions during the last week. Only patients with intrusions were included in the analyses.

Glaesser et al. 2004
PTSD after Severe TBI

• Patients with severe TBI (n=96) were assessed for PTSD at 6 months

PTSD diagnosed in 27.1% (n=26)
Rates of PTSD Symptoms in Patients With and Without PTSD 6 Months After Severe Traumatic Brain Injury

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Patients With (N=26)</th>
<th>Patients Without (N=70)</th>
<th>Predictive Power</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Intrusive memories</td>
<td>5</td>
<td>19.2</td>
<td>0</td>
</tr>
<tr>
<td>Nightmares</td>
<td>6</td>
<td>23.1</td>
<td>0</td>
</tr>
<tr>
<td>Sense of reliving trauma</td>
<td>8</td>
<td>30.8</td>
<td>3</td>
</tr>
<tr>
<td>Emotional reactivity</td>
<td>25</td>
<td>96.2</td>
<td>4</td>
</tr>
<tr>
<td>Physiological reactivity</td>
<td>13</td>
<td>50.0</td>
<td>6</td>
</tr>
<tr>
<td>Avoidance of thoughts</td>
<td>17</td>
<td>65.4</td>
<td>15</td>
</tr>
<tr>
<td>Avoidance of places</td>
<td>17</td>
<td>65.4</td>
<td>14</td>
</tr>
<tr>
<td>Diminished interest</td>
<td>19</td>
<td>73.1</td>
<td>23</td>
</tr>
<tr>
<td>Detachment</td>
<td>19</td>
<td>73.1</td>
<td>24</td>
</tr>
<tr>
<td>Restricted affect</td>
<td>17</td>
<td>65.4</td>
<td>19</td>
</tr>
<tr>
<td>Sense of foreshortened future</td>
<td>19</td>
<td>73.1</td>
<td>23</td>
</tr>
<tr>
<td>Insomnia</td>
<td>18</td>
<td>69.2</td>
<td>17</td>
</tr>
<tr>
<td>Irritability</td>
<td>22</td>
<td>84.6</td>
<td>22</td>
</tr>
<tr>
<td>Concentration deficits</td>
<td>24</td>
<td>92.3</td>
<td>32</td>
</tr>
<tr>
<td>Hypervigilance</td>
<td>19</td>
<td>73.1</td>
<td>19</td>
</tr>
<tr>
<td>Startle response</td>
<td>19</td>
<td>73.1</td>
<td>11</td>
</tr>
</tbody>
</table>

<sup>a</sup> Probability of PTSD when symptom is present.

<sup>b</sup> Probability of absence of PTSD when symptom is absent.
mTBI patients were more likely to develop PTSD than non-mTBI patients

In the acute phase longer PTA was inversely associated with intrusive memories

The association between PTA and re-experiencing symptoms was weaker at follow-up – reconstructive memory?
Can individuals with moderate to severe TBI develop PTSD?

• Fear Conditioning – fear elicited during a traumatic event results in conditioning in which subsequent reminders of the trauma elicit anxiety
  – Extreme sympathetic arousal at time of TBI results in a release of neurochemicals –
    • Mediating an over consolidation of trauma memories

Bryant 2011
Fear Conditioning

• Patients (n=68) with severe TBI
  – Resting heart rate assessed at one week and one month after injury
  – Assessed for PTSD at 6 months
• 23% of the sample met criteria for PTSD
• Those with PTSD had higher heart rates at 1 week (but not 1 month) after trauma

Researchers propose that “fear conditioning” can occur outside the level of awareness and contribute to the development of PTSD

Bryant et al. 2004
“Does TBI confer additional risk of PTSD development or symptom exacerbation following psychological trauma exposure?”

If so, why?

Vasterling, Verfaille, & Sullivan, 2009
Increased Rates of PTSD in those with Mild TBI

Increased Rates of PTSD in those with Mild TBI

“Patients with mild TBI were twice as likely to develop PTSD [or other anxiety disorders]…”

“The New England Journal of Medicine

Mild Traumatic Brain Injury in U.S. Soldiers Returning from Iraq

Cheryl A. Hoge, M.D., Derick Nurnberg, Ph.D., Jeff E. Thomas, Ph.D., Anthony L. Cox, M.S.W., Charles C. Engel, Ph.D., Edward I. Rabin, M.D., and Carl A. Castro, Ph.D.

ABSTRACT

An important medical concern of the Iraq war is the potential long-term effect of mild traumatic brain injury (i.e., concussions) on combat veterans. However, the epidemiology of combat-related mild traumatic brain injury is poorly understood.

METHODS

We surveyed 2,235 U.S. Army personnel within 1 to 4 months after their return from a combat deployment to Iraq. Mild traumatic brain injury was defined as an injury with loss of consciousness or altered mental status (e.g., confused or disoriented) with soldiers exposed to other injuries.

RESULTS

Of 2,235 soldiers, 12.4% reported injuries with loss of consciousness, 25.0% reported injuries with altered mental status, and 45.1% reported other injuries during deployment. Of those reporting loss of consciousness, 4.8% were injured with post-traumatic stress disorder (PTSD), as compared with 7.3% of those reporting altered mental status, 16.9% of those who were injured, and 9.0% of those with no injury. Soldiers with mild traumatic brain injury, primarily those who lost consciousness, were significantly more likely to report post-traumatic stress, combat-related depression, and a higher number of somatic and somatoformic symptoms than were soldiers with other injuries. However, after controlling for PTSD and depression, mild traumatic brain injury was no longer significantly associated with these physical health outcomes or symptoms, except for headaches.

CONCLUSIONS

Mild traumatic brain injury (i.e., concussion) occurring among soldiers deployed in Iraq is strongly associated with PTSD…"
Why?

- Impaired emotional regulation resulting from damage to the medial pre-frontal cortex
- Impaired cognitive strategies that limit management of emotional stress
- Additional stressors that occur after mTBI

Bryant, Creamer, O'Donnell, Silove, Clark, and McFarlane, 2009
PTSD and mTBI – Challenges Associated With Differential Diagnosis

Does more (TBI plus PTSD) = more symptoms?
Mild TBI and PTSD: Overlapping Symptoms and Diagnostic Clarification

- **PTSD**
  - Insomnia
  - Impaired memory
  - Poor concentration
  - Depression
  - Anxiety
  - Irritability
  - Emotional Numbing
  - Hypervigilance
  - Flashbacks/Nightmares
  - Avoidance

- **Mild TBI**
  - Insomnia
  - Impaired memory
  - Poor concentration
  - Depression
  - Anxiety
  - Irritability
  - Fatigue
  - Headache
  - Dizziness
  - Noise/Light intolerance
Potential Clinical Presentation

PTSD
- Flashbacks
- Nightmares

TBI
- Headaches
- Dizziness

Attentional problems
- Depression
- Anxiety
- Irritability
Case Example: Co-Occurring PTSD and mTBI

March 2004

Deployed to Iraq

Exposed to traumatic stressor

Sustained mild blast TBI with mTBI symptoms (headache, irritability, etc)

Diagnosed with PTSD and receives treatment (medication)

July 2004

November 2004

March 2005

July 2005

November 2005

March 2006

July 2006

Return to the United States
Still experiencing mTBI related symptoms which seem to be getting worse

Screens negative for PTSD

Redeployed to Iraq
Brief Report

Association of Posttraumatic Stress Disorder With Somatic Symptoms, Health Care Visits, and Absenteeism Among Iraq War Veterans

Charles W. Hoge, M.D.
Armin Tschakronic, M.D.
Carol A. Castro, Ph.D.
Stephen C. Messer, Ph.D.
Charles E. Engel, M.D., M.P.H.

Objectives: Studies of soldiers from prior wars conducted many years after combat have shown associations between combat-related posttraumatic stress disorder (PTSD) and physical health problems. The current Iraq war has served as a considerable PTSD risk, but the association with physical health has not been well studied.

Research has established a strong relationship between combat-related posttraumatic stress disorder (PTSD) and physical health among soldiers who experienced increased rates of physical symptoms in all domains in the first 3-4 months after returning from deployment (7, 8, 10). Compared to military personnel who were not stationed in the war zone, 1901 Gulf War veterans showed significantly higher rates of somatic symptoms, more psychological distress, worse general health status, and greater health-related physical and psychosocial functional impairment (11). The major limitations of these studies were that they were conducted many years after the veterans returned from combat, were based largely on self-reports, and did not control for various confounds.

Research conducted on veterans from the current war in Iraq has already established the presence of a high prevalence of PTSD (12-14) during the first 3-4 months after their return home (17). One study conducted among severely injured and hospitalized veterans showed that PTSD was strongly correlated with the level of injury (18). However, to date the relationship between PTSD and physical health has been explored among highly motivated veterans. This study evaluated the association of PTSD with physical health among Iraq war veterans 1 year after their return from deployment with control for combat injury.

Method

This study is based on self-report survey data derived from 2,903 soldiers from four Army combat infantry battalions surveyed 1 year after their return from combat duty in Iraq.

The study population was抽出 from the larger cohort of deployed soldiers that were screened for PTSD at a follow-up visit. The study was designed to assess the prevalence of PTSD and its association with physical health problems among Iraq war veterans. The study included participants from four Army combat infantry battalions who were screened for PTSD at a follow-up visit. The study used a questionnaire that included questions about physical symptoms, health care visits, and absenteeism. The results indicated a significant association between PTSD and physical health problems, with soldiers with PTSD reporting higher rates of somatic symptoms, more health care visits, and more absenteeism compared to those without PTSD.

The study was conducted in collaboration with the National Institute of Mental Health and the Department of Veterans Affairs. It was supported by grants from the Department of Veterans Affairs, the National Institutes of Health, and the Department of Defense.

Results: Among all participants, 16.8% met criteria for PTSD. PTSD was significantly associated with lower ratings of general health, more sick call visits, more missed workdays, more physical symptoms, and high somatic symptom severity. These results remain significant after controlling for having wounded or injured.

Conclusions: The high prevalence of PTSD and its strong association with physical health problems among Iraq war veterans have important implications for delivery of medical services. The medical care of PTSD includes physical health problems, constant vigilance with somatic symptoms among veterans should be evaluated for PTSD.
“Among all participants, 16.6% met screening criteria or PTSD. PTSD was significantly associated with lower ratings of general health, more sick call visits, more missed workdays, more physical symptoms, and high somatic symptom severity. These results remained significant after control for being wounded or injured.”
Increased Symptoms with TBI + PTSD

“In Soldiers with histories of physical injury, mTBI and PTSD were independently associated with PC symptom reporting. Those with both conditions were at greater risk for PC symptoms than those with either PTSD, mTBI, or neither.”
Total No. of Soldiers: N = 1,247

<table>
<thead>
<tr>
<th>TBI &amp; PTSD Status</th>
<th>n</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total w/ mTBI</td>
<td>878</td>
<td></td>
</tr>
<tr>
<td>Total w/ PTSD</td>
<td>405</td>
<td></td>
</tr>
<tr>
<td>No PTSD and no mTBI</td>
<td>287</td>
<td>23</td>
</tr>
<tr>
<td>Had PTSD but no mTBI</td>
<td>82</td>
<td>7</td>
</tr>
<tr>
<td>Had mTBI but no PTSD</td>
<td>555</td>
<td>45</td>
</tr>
<tr>
<td>Had mTBI and PTSD</td>
<td>323</td>
<td>26</td>
</tr>
<tr>
<td>Total</td>
<td>1247</td>
<td>100</td>
</tr>
</tbody>
</table>

Brenner et al., 2009
Symptom-Exposure: Any Symptoms (n = 389)

- No mTBI & no PTSD: Adjusted (PR) = 1.00
- Had PTSD but no mTBI: Adjusted (PR) = 2.74
- Had mTBI but no PTSD: Adjusted (PR) = 4.03
- Had mTBI & PTSD: Adjusted (PR) = 6.27

Total no. of soldiers (N = 1247)

*Adjusted for age, gender, education, rank, and MOS

Brenner et al., 2009
Symptom-Exposure: 
*Headache* (n = 204)

Adjusted for age, gender, education, rank, and MOS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Adjusted (a) (PR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No mTBI &amp; no PTSD</td>
<td>1.00</td>
</tr>
<tr>
<td>Had PTSD but no mTBI</td>
<td>2.79</td>
</tr>
<tr>
<td>Had mTBI but no PTSD</td>
<td>4.26</td>
</tr>
<tr>
<td>Had mTBI &amp; PTSD</td>
<td>5.91</td>
</tr>
</tbody>
</table>

Total no. of soldiers (N = 1247)

\(a\)Adjusted for age, gender, education, rank, and MOS
Symptom-Exposure: 
**Dizziness (n = 51)**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Adjusted a (PR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No mTBI &amp; no PTSD</td>
<td>1.00</td>
</tr>
<tr>
<td>Had PTSD but no mTBI</td>
<td>4.37</td>
</tr>
<tr>
<td>Had mTBI but no PTSD</td>
<td>3.00</td>
</tr>
<tr>
<td>Had mTBI &amp; PTSD</td>
<td>6.48</td>
</tr>
</tbody>
</table>

Total no. of soldiers (N = 1247)

---

aAdjusted for age, gender, education, rank, and MOS

Brenner et al., 2009
Symptom-Exposure:
Memory Problems (n = 154)

Adjusted\(^a\) (PR)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Adjusted (PR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No mTBI &amp; no PTSD</td>
<td>1.00</td>
</tr>
<tr>
<td>Had PTSD but no mTBI</td>
<td>4.00</td>
</tr>
<tr>
<td>Had mTBI but no PTSD</td>
<td>6.22</td>
</tr>
<tr>
<td>Had mTBI &amp; PTSD</td>
<td>12.70</td>
</tr>
</tbody>
</table>

\(^a\) Adjusted for age, gender, education, rank, and MOS

Total no. of soldiers (N = 1247)

Brenner et al., 2009
Symptom-Exposure: 
*Balance Problems (n = 62)*

<table>
<thead>
<tr>
<th>Condition</th>
<th>Adjusted(^a) (PR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No mTBI &amp; no PTSD</td>
<td>1.00</td>
</tr>
<tr>
<td>Had PTSD but no mTBI</td>
<td>5.31</td>
</tr>
<tr>
<td>Had mTBI but no PTSD</td>
<td>6.04</td>
</tr>
<tr>
<td>Had mTBI &amp; PTSD</td>
<td>12.91</td>
</tr>
</tbody>
</table>

\(^a\)Adjusted for age, gender, education, rank, and MOS

Total no. of soldiers (N = 1247)
Symptom-Exposure: 
**Irritability (n = 215)**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Adjusted (PR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No mTBI &amp; no PTSD</td>
<td>1.00</td>
</tr>
<tr>
<td>Had PTSD but no mTBI</td>
<td>3.19</td>
</tr>
<tr>
<td>Had mTBI but no PTSD</td>
<td>3.45</td>
</tr>
<tr>
<td>Had mTBI &amp; PTSD</td>
<td>6.61</td>
</tr>
</tbody>
</table>

**Total no. of soldiers (N = 1247)**

*aAdjusted for age, gender, education, rank, and MOS*
Factors that can influence post-concussion-like symptom reporting post-acutely or long after a mild traumatic brain injury in service members.

Iverson, Langlois, McCrea, Kelly, 2009
Predisposing Factors  Causative Factors  Perpetuating and Mitigating Factors

Psychiatric Conditions  Medical Iatrogenesis  Psychiatric Conditions
Personality Traits  Litigation Iatrogenesis  Personality Traits
Medical Conditions  Self-Expectation  Medical Conditions
Intelligence Level  Acute Symptoms  Intelligence Level
Demographic Characteristics  mTBI  Coping Abilities
Coping Abilities  Chronic Symptoms  Social Support

Rodney Vanderploeg, Ph.D.
Current Issue: *Trauma, Brain Injury, and Post-traumatic Stress Disorder*

Neuropsychological and Neuroimaging Findings in Traumatic Brain Injury and Post Traumatic Stress Disorder
<table>
<thead>
<tr>
<th>Brain Region</th>
<th>Function</th>
<th>PTSD and/or TBI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amygdala</td>
<td>Generation and maintenance of emotional responses</td>
<td>PTSD (^1); TBI (^1)</td>
</tr>
<tr>
<td>Cerebellum</td>
<td>Movement and motor coordination; processing fear memories (^7)</td>
<td>PTSD (^7); Chronic mild TBI (^9)</td>
</tr>
<tr>
<td>Corona Radiata</td>
<td>Attentional processes (^3)</td>
<td>Chronic mild TBI (^4)</td>
</tr>
<tr>
<td>Corpus Collosum</td>
<td>Intra-hemispheric communication (^6)</td>
<td>Acute and chronic mTBI (^6); TBI (^1)</td>
</tr>
<tr>
<td>Hippocampus</td>
<td>Explicit and declarative memory, working memory, episodic/autobiographical memory, contextual learning (^3); Control of stress responses and contextual aspects of fear conditioning (^9)</td>
<td>PTSD (^7); TBI (^1)</td>
</tr>
<tr>
<td>Insula</td>
<td>Core affect, associated consciousness of subjective feelings, developing and updating motivational states, autobiographical memory, cognitive control, affective processing, pain, and conveyance of homeostatic information (^8)</td>
<td>PTSD (^1)</td>
</tr>
<tr>
<td>Internal Capsule</td>
<td>Motor and sensory communication</td>
<td>Acute and chronic mTBI (^6)</td>
</tr>
<tr>
<td>Medial Temporal Lobe</td>
<td>Declarative memory</td>
<td>Chronic mild TBI (^1); TBI (^1)</td>
</tr>
<tr>
<td>Parietal Cortex</td>
<td>Volitional and avolitional allocation of attentional resources during the retrieval of episodic memories (^6)</td>
<td>PTSD (^6)</td>
</tr>
<tr>
<td>Prefrontal Cortex</td>
<td>Manipulation of emotions and memories (^6); Extinguishing conditioned fear (^3); Inhibitory action on the amygdala (^6)</td>
<td>PTSD (^3); (^2); (^4); (^1); TBI (^3); (^6)</td>
</tr>
<tr>
<td>Anterior Cingulate Cortex</td>
<td>Processing of cognitive and emotional interactions (^4) including interference from emotional stimuli and performance monitoring, response selection, error detection, and decision making (^6); Conflict monitoring, attention and pain (^7)</td>
<td>PTSD (^3); (^2); (^4); (^1)</td>
</tr>
<tr>
<td>Uncinate Fasciculus</td>
<td>Working memory (^6)</td>
<td>Chronic mild TBI (^4)</td>
</tr>
<tr>
<td>Cognitive Domain</td>
<td>Mild</td>
<td>Moderate to Severe</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------</td>
<td>--------------------</td>
</tr>
<tr>
<td></td>
<td>Acute/Chronic</td>
<td>Study</td>
</tr>
<tr>
<td>Attention</td>
<td>Acute/Chronic</td>
<td>Frenchem et al; Peskind et al</td>
</tr>
<tr>
<td>Sustained Attention</td>
<td>Chronic</td>
<td>Kraus et al</td>
</tr>
<tr>
<td>Emotional Processing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Executive Dysfunction</td>
<td>Acute/Chronic</td>
<td>Frenchem et al; Peskind et al</td>
</tr>
<tr>
<td>Working Memory</td>
<td>Acute/Chronic</td>
<td>Frenchem et al; Peskind et al</td>
</tr>
<tr>
<td>Intelligence</td>
<td></td>
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<tr>
<td>Language and</td>
<td></td>
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</tr>
<tr>
<td>Communication</td>
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<td></td>
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<tr>
<td>Learning</td>
<td>Acute</td>
<td>Frenchem et al</td>
</tr>
<tr>
<td>Processing Speed</td>
<td>Acute/Chronic</td>
<td>Frenchem et al; Niogi et al; Peskind et al</td>
</tr>
<tr>
<td>Verbal Memory</td>
<td>Acute/Chronic</td>
<td>Frenchem et al; Fan et al</td>
</tr>
<tr>
<td>Visual Memory</td>
<td>Acute</td>
<td>Frenchem et al</td>
</tr>
</tbody>
</table>

Neuropsychological Findings Often Discussed Among those with TBI or PTSD.
Treatment: Co-Occurring TBI and PTSD
Psychological treatment for anxiety in people with traumatic brain injury (Review)

Soo C, Tato R

THE COCHRANE COLLABORATION®

This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in The Cochrane Library 2007, Issue 3

http://www.thecochranelibrary.com

WILEY
Publishers Since 1907
Corresponding group comparisons were as follows.

- CBT versus supportive counseling (SC) (Bryant 2003)
- Interpersonal process recall (IPR) therapy versus controls with no feedback on interpersonal functioning (Helffenstein 1982)
- CBT combined with neurorehabilitation (NR) versus no psychological intervention controls (Tiersky 2005)
Total # of Subjects

60
Findings

• Cognitive behavioral therapy (CBT) techniques following TBI effective in comparison to supportive counseling (n=24) (Bryant 2003)

• Combining CBT and neurorehabilitation for targeting general anxiety sx for mild to mod TBI (n=16) (Helffenstein 1982)

• Limited empirical support for Interpersonal process recall (n=20) (Helffenstein 1982)
Executive Summary:

The Special Committee on PTSD in FY2008 recognized the dilemma of increasing numbers of Veterans presenting with PTSD and co-morbid Mild Traumatic Brain Injury (mTBI) faced by VA clinicians and recommended a consensus conference be planned and convened. The Undersecretary for Health concurred and in the VA response to the Committee’s 2008 Report, charged the National Center for PTSD to develop a multidisciplinary workgroup to proceed with plans. The group was asked to propose treatment recommendations within the context of current programs and processes that could be rapidly disseminated to VA clinicians.

A conference planning committee was organized in October 2008, with membership from VA’s Office of Mental Health Services, National Center for PTSD, National Center for Women Veterans, and National Center for Injury Prevention and Control.

The new clinical practice guideline for concussion/mTBI focuses on promoting a recovery expectation, noting that a vast majority of patients will improve without lasting effects and that mTBI is a common injury with a time-limited, predictable course. It states that education of patients and families is the best available intervention for veterans starting treatment. For ongoing or chronic post-concussive symptoms, the guidelines take the clinician through each symptom profile step-by-step for recommended assessments and treatments.
“In summary, there was agreement that Veterans who experience mTBI and/or pain, along with PTSD, should have the opportunity to receive the two best evidence-based treatments in the VA/DoD practice guidelines for PTSD, prolonged exposure therapy or cognitive processing therapy.”
EDUCATION: Expectation of Recovery

BEHAVIORAL HEALTH ISSUES

IRRITABILITY / IMPULSIVITY

SOMATIC COMPLAINTS

COGNITIVE ISSUES

SELF-CARE ROUTINES*

† Begin each encounter at the bottom of the pyramid and progress upward
* Includes sleep hygiene, diet, exercise, and avoiding further TBI

Terrio 2009
mTBI and PTSD: Symptoms, Functioning and Outcomes

• What would recovery look like for this veterans?
• Could this be accomplished even if symptoms persisted?
• How can therapists help veterans track symptoms, functioning, and outcomes?
The is more work to be done!
Use Your Smartphone to Visit the VISN 19 MIRECC Website

Requirements:
1. Smartphone with a camera
2. QR scanning software (available for free download just look at your phones marketplace)

www.mirecc.va.gov/visn19