Assessing and Treating Traumatic Brain Injury and Posttraumatic Stress Disorder Within the VA: Unique Opportunities and Challenges

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Traumatic Brain Injury (TBI)

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AVAPL 2009
Focus of Presentation

- Some of these slides refer to TBI sustained in combat, but the impact of cognitive impairment upon tx for PTSD &/or subst. abuse can be extrapolated to TBI caused by other etiologies (e.g., MVC, fall).
- Some of the studies presented concern OEF/OIF veterans but the clinical issues are also evident in other veteran populations.
WHAT IS A TRAUMATIC BRAIN INJURY?
DoD Definition (French & Parkinson, 2008)

• The current definition in the DoD defines TBI as a “traumatically induced structural injury and/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:
At Least One of the Following:

• Any period of loss of, or a decreased level of, consciousness

• Any loss of memory for events immediately before or after the injury***

• Any alteration in mental state at the time of the injury (e.g., confusion, disorientation, slowed thinking)***
...one of the following

- Neurological deficits (e.g., weakness, balance disturbance, praxis, paresis/plegia, change in vision, other sensory alterations, aphasia.) that may or may not be transient
- Intracranial abnormalities (e.g., contusions, diffuse axonal injury, hemorrhages, aneurysms)
ACRM Criteria & DoD Consensus (Oct. 2007)

- Two conditions must be met to diagnose a history of TBI:
  - There must have been an injury event
  - The injury event must have resulted in the person experiencing an alteration of consciousness (ranging from dazed or confused to LOC)

- Note there is no requirement for endorsement of sequelae/symptoms
<table>
<thead>
<tr>
<th>Mild</th>
<th>Complicated Mild</th>
<th>Moderate</th>
<th>Severe</th>
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</thead>
<tbody>
<tr>
<td>LOC $\leq$ 30 min. with normal CT &amp;/or MRI</td>
<td>LOC $\leq$ 30 min. with: 1) abnormal imaging, or 2) abnormal neurological exam</td>
<td>LOC $\leq$ 6 hours with abnormal CT &amp;/or MRI</td>
<td>LOC $\geq$ 6 hours with abnormal CT &amp;/or MRI</td>
</tr>
<tr>
<td>GCS 13-15</td>
<td>GCS 13-15</td>
<td>GCS 9-12</td>
<td>GCS 3-8</td>
</tr>
<tr>
<td>PTA $\leq$ 24hr</td>
<td>PTA $\leq$ 24hr</td>
<td>PTA $\leq$ 7days</td>
<td>PTA $&gt;$ 7days</td>
</tr>
</tbody>
</table>
# Glasgow Coma Scale (GCS)

<table>
<thead>
<tr>
<th>Eye opening</th>
<th>Score</th>
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<tbody>
<tr>
<td>spontaneously</td>
<td>4</td>
</tr>
<tr>
<td>to speech</td>
<td>3</td>
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<tr>
<td>to pain</td>
<td>2</td>
</tr>
<tr>
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<td>1</td>
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<table>
<thead>
<tr>
<th>Verbal response</th>
<th>Score</th>
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<tbody>
<tr>
<td>orientated</td>
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<tr>
<td>confused</td>
<td>4</td>
</tr>
<tr>
<td>inappropriate</td>
<td>3</td>
</tr>
<tr>
<td>incomprehensible</td>
<td>2</td>
</tr>
<tr>
<td>none</td>
<td>1</td>
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<table>
<thead>
<tr>
<th>Motor response</th>
<th>Score</th>
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</thead>
<tbody>
<tr>
<td>obeys commands</td>
<td>6</td>
</tr>
<tr>
<td>localises to pain</td>
<td>5</td>
</tr>
<tr>
<td>withdraws from pain</td>
<td>4</td>
</tr>
<tr>
<td>flexion to pain</td>
<td>3</td>
</tr>
<tr>
<td>extension to pain</td>
<td>2</td>
</tr>
<tr>
<td>none</td>
<td>1</td>
</tr>
</tbody>
</table>

| Maximum score     | 15    |
Breakdown of TBI Severity

- Approximately 80% of patients who sustain TBIs have had a mild TBI (Alexander, 1995).
- 8-10% of TBIs fall into the moderate category (Kraus et al., 1996).
- Fewer than 10% of TBIs are classified as severe (Lezak, 1989; Machamer, Temkin & Dikmen, 2002).
How Does One Distinguish?

- Any loss of memory for events immediately before or after the injury***
- Any alteration in mental state at the time of the injury (e.g., confusion, disorientation, slowed thinking)***
- No requirement for endorsement of sequelae or symptoms
How Does One Distinguish?

• In the context of combat trauma, how does one “tease out” or distinguish a neurological response from what may be an emotional and/or behavioral response to the immediate traumatic event?
Possible TBI in Combat

• **Example:** OIF veteran who had no memory for events just prior to and after the blast/injuries. After a few months of psychotherapy, he recalled what had actually occurred—what he believed was an error in his judgment that led to his own injuries and the death of some of his men.
NATIONAL CENTER FOR INJURY PREVENTION AND CONTROL (2009)
Incidence Rates of TBI

• 95 per 100,000
• CDC estimates that 1.4 million Americans sustain a TBI each year
• 1.1 million are treated and released from an emergency department
• 235,000 are admitted to a hospital
• Of those incurring a TBI, 50,000 will die
More TBI Facts

• Risk is highest among teens, young adults, and those older than 75
• Risk for males is twice that for females
• Falls (28%), MVC (20%), violence (30%)
• > age 65 - leading cause is falls
• Leading cause for 5–64 y.o.: transportation
What is the Financial Cost?

• Direct medical costs and indirect costs such as lost productivity of TBI totaled an estimated $60 billion in the United States in 2000 (Finkelstein et al., 2006).
Causes of TBI

- Falls, 28%
- Motor Vehicle-Traffic, 20%
- Struck By/Against, 19%
- Assault, 11%
- Pedal Cycle (non MV), 3%
- Other Transport, 2%
- Unknown, 9%
- Other, 7%
- Suicide, 1%
Incidence of TBI in Veterans

• “In peacetime, over 7,000 Americans with a diagnosis of TBI are admitted to military and veterans hospitals each year.”

• “In times of combat, TBI comprises at least 14-20% of surviving casualties…”
As of July 2008 (OEF/OIF):
- 8089 service members incurred a TBI
- 71.6% - blast
- 11.3% - a fall
- 6.1% - vehicular incident
- 5.0% - fragments
- 2.3% - bullet
- 3.6% - other causes
CRS Report – TBI in OEF/OIF Army Soldiers

• Of the 5282 cases in the Army:
  – 88% were mild TBI
  – 6% were moderate TBI
  – 6% were severe TBI
  – (3 cases were not recorded)
Take-away Points

• TBI is an event, NOT a constellation of symptoms.
• Symptoms ≠ TBI
• Greater number of symptoms ≠ likelihood of TBI, nor severity of TBI
• Although TBI is fairly common, the large majority fall into the mTBI or concussion category.
RECOVERY FROM TBI
Course of TBI Recovery
Recovery: Mild TBI (mTBI)

• Symptoms of mTBI resolve by 3 months in the majority of individuals (Rutherford et al., 1989; Levin et al., 1987).

• For a minority of individuals, sx persist for a more lengthy period of time and sometimes for life (Binder, 1986; Rutherford, 1989; Bohnen & Jolles, 1992).
Post-concussive Symptoms

- Estimates of frequency of chronic postconcussive symptoms in mTBI range from as low as 5% to as high as 40% in one study.
- BUT, post-concussive symptoms are not specific to TBI.
- Symptoms of PCS also occur in people who have no history of head injury, but who have other medical and psychological complaints.
mTBI: Post-concussion Symptoms (PCS)

• Physical
  – Headache, dizziness, fatigue, noise/light intolerance, insomnia

• Cognitive
  – Memory complaints, poor concentration

• Emotional
  – Depression, anxiety, irritability, lability
More on Post-concussive Symptoms

- In one study, 80% of healthy, uninjured people reported having three or more symptoms similar to those found after concussion (Anderson et al., 2006).

- In another study, 64% of people with TBI met ICD-10 criteria for post-concussion syndrome, but so did 40% of people that had injuries, but not to the head (McCrea, 2008).
Hoge et al. (2008)

• “A re-analysis of the classic studies indicates that persistent PCS occur in about 3-5% of concussion cases, not 15+%.“ [ref. McCrea, 2008]
Suhr & Gunstad (2005)

• Evaluations of the same mild TBI population if conducted under the “explanation” of studying mild TBI results in poorer neuropsychological performance than the same evaluation conducted with a neutral “explanation”

• Unfortunately, the context of the evaluation influences the findings.
Jones, Fear, and Wessely (2007)

• “In other words, strongly held negative beliefs play a part in maintaining symptoms and functioning—exactly the reasoning that led the British Army to ban the use of the term ‘shell shock’ in 1917.”
Effective Interventions?

• What evidence-based treatments are available for mTBI?
  None, …except cognitive education to normalize symptoms and provide the expectation of rapid recovery.
• Provide education on concussion/mTBI.
• Need to FIRST treat other issues (PTSD, sleep, depression, pain) possibly contributing to cognitive complaints.
• Be sensitive and consider the complexity of incurring a mTBI while serving in combat.
• We don’t yet know the cumulative or long-term effects of exposure to multiple IEDs.
Recovery: Moderate to Severe TBI

- Recovery of cognitive abilities after moderate to severe TBI is highly individualized & depends on the initial distribution & degree of injury.
- Individuals w/ moderate to severe TBI frequently never recover to pre-injury functional levels & may have behavioral difficulties.
Long-term Outcomes of TBI (Thurman et al., 1999)

- CDC estimates that at least 5.3 million Americans, approximately 2% of the U.S. population, currently have a long-term or lifelong need for help to perform activities of daily living as a result of a TBI.
Corrigan et al. (2004)

• About 40% of those hospitalized with a TBI had at least one unmet need for services one year after their injury. The most frequent unmet needs were:
  – Improving memory and problem solving
  – Managing stress and emotional upsets
  – Controlling one's temper
  – Improving one's job skills
Functional Changes and TBI

- Thinking (i.e., memory and reasoning);
- Sensation (i.e., touch, taste, and smell);
- Language (i.e., communication, expression, and understanding); and
- Emotion (i.e., depression, anxiety, personality changes, aggression, acting out, and social inappropriateness).
Common Cognitive Sequelae: Moderate to Severe TBI

- Attention and concentration problems*
- New learning and memory deficits*
- Executive control dysfunction*
- Impairment in orientation
- Mental and behavioral slowing
- Communication problems
- Visual-perceptual changes
- Psychomotor problems

* Most common sequelae
TREATMENT FOR TBI
VA Polytrauma Rehabilitation System of Care

• Polytrauma Centers (PRC) (4)
• Polytrauma Network Sites (PNS) (22)
• Polytrauma Support Clinics (PSC) (72)
• Polytrauma Point of Contact (PPOC) (60)
Component I: PRCs

- Minneapolis
- Palo Alto
- Richmond
- Tampa
- San Antonio (in development)
Psychology FTEE
Polytrauma – San Antonio

**PRC Inpatient Unit**
- 12 beds
- 1.0 FTEE Neuropsychologist
- 1.0 FTEE Counseling Psychologist w/ PTSD training

**PRC Outpatient Clinic**
- 1.0 FTEE Neuropsychologist

**Polytrauma Transitional Rehabilitation Program**
- 10 beds, 2 apartments
- 1.0 FTEE Neuropsychologist
- 1.0 FTEE Counseling Psychologist w/ PTSD training
Component II: PNS

- Boston
- Syracuse
- Bronx
- Philadelphia
- Washington DC
- Richmond
- Augusta
- Tampa
- San Juan
- Lexington
- Cleveland
- Indianapolis
- Hines (Chicago)
- St. Louis
- Houston
- Dallas
- Tucson
- Denver
- Seattle
- Palo Alto
- West Los Angeles
- Minneapolis
Comorbid Conditions & TBI

Posttraumatic Stress Disorder
RAND Corporation Survey (2008)

- Surveyed 1,965 service members by telephone
- 10% reported that they were injured and required hospitalization
- 18.5% met criteria for either PTSD or depression
- 19.5% reported a probable mTBI
- 37.4% of those individuals with a history of mTBI also had either PTSD or depression
Rand: Rates of PSTD, Depression & TBI
Overall Rates of Probable PTSD, Major Depression & TBI with Co-Morbidity (N=1,965)

**Overall Rates**
- Probable PTSD 13.8%
- Probable major depression 13.7%
- Probable TBI 19.5%

**Co-Morbidity**
- No condition 69.3%
- PTSD only 3.6%
- Depression only 4.0%
- TBI only 12.2%
- PTSD & Depression 3.6%
- PTSD & TBI 1.1%
- TBI & Depression 0.7%
- PTSD, Dep. & TBI 5.5%
Lew et al. (2007)

- 42% of OEF/OIF veterans with a history of mTBI also had PTSD symptoms.
Mild TBI & PTSD in Returning Soldiers (Hoge et al., 2008)

- 2525 Army soldiers surveyed 3-4 months after return to U.S – 15.2% LOC or AOC
  - 43.9% with LOC met criteria for PTSD
  - 27.3% with AOC met criteria for PTSD
  - 16.2% with other injuries met criteria
  - 9.1% with no injuries met criteria
- Controlling for PTSD & Dep., only headache was assoc. with mTBI
Hoge et al. (2008)

• “PTSD is strongly associated with somatoform and post-concussive symptoms due to neuroendocrine, autonomic nervous system, and immune system disregulation; as well as altered perception of symptoms.”
PCS and PTSD Symptom Overlap

- Postconcussion Symptoms (PCS)
  - Insomnia
  - Impaired memory
  - Poor concentration
  - Depression
  - Anxiety
  - Irritability
  - Headache
  - Dizziness
  - Fatigue
  - Noise/light intolerance

- PTSD
  - Insomnia
  - Memory problems
  - Poor concentration
  - Depression
  - Anxiety
  - Irritability
  - Stress symptoms
  - Emotional numbing
  - Avoidance
Symptoms that Distinguish mTBI from PTSD

• Concussion
  – Cognitive difficulties immediately following the event
  – Cognitive problems remain stable or improve with time
  – Poor cognitive endurance
  – Sensitivity to light

• PTSD
  – Flashbacks/ intrusive memories
  – Increased startle response
  – Hypervigilance, physiological arousal
  – Nightmares, night terrors
  – **Cognitive complaints increase over time**

Borrowed with permission from Dr. Shalanda Gordon
Neurocognition Deployment Study (Vasterling et al., 2006)

- 600+ soldiers tested before and after Iraq deployment
- “Neuropsychological compromise” on sustained attention, verbal learning, and visuospatial memory
- Increased negative state affect
- History of mild TBI had no effect on neuropsychological findings
Vasterling Conclusions…

• “Deployment is associated with a neurobehavioral advantage in reacting quickly and efficiently to simple targets.”

• Such “physiological responses occur in preparation for life-preserving action.”
More Conclusions…

• “Neurotransmitter systems associated with increased arousal (e.g., noradrenergic system) become activated, while neuroendocrine responses become altered via the hypothalamic-pituitary-adrenal axis.”
More Conclusions…

• “Such neurobiological alterations can result in heightened behavioral reactivity (e.g., quickened response times) but *dampened* attention, learning, and memory for non–threat-relevant stimuli and events.”
Take-away Points

• Fairly common for PTSD and mTBI to co-occur.
• PTSD has an impact on neuropsychological functioning
• Depression, sleep problems, pain, medications (e.g., narcs, Seroquel) may also affect cognitive functioning.
PTSD Symptoms and Moderate or Severe TBI

- Studied more extensively with mTBI
- **BUT**, PTSD has been documented in people with moderate or severe TBI with LOC and little to no conscious memory of the event.
- Prevalence in moderate or severe TBI is controversial and methodology of studies is sometimes questionable.
Can PTSD & TBI Coexist?

- Several studies have reported a 0% rate of PTSD following TBI (e.g., Mayou et al., 1993; Sbordone & Liter, 1995).
- Others have documented the coexistence of PTSD and TBI (e.g., Bryant, 1996; King, 1997).
Larger Studies

• Majority of studies based upon reasonably large samples of consecutively admitted patients report rates of PTSD in TBI ranging from 20-40% (e.g., Bryant & Harvey, 1995; Hickling et al., 1998; Ohry et al., 1996).
Misdiagnosis of PTSD After Severe TBI (Sumpter & McMillan, 2005)

• 34 participants recruited from community outpt & rehab services
• All had history of severe TBI (PTA > 1 day)
• TBI at least 3 months prior to interview
• MMSE < 27 were excluded (as were those “with severe dysphasia or dyslexia, or current treatment for psychosis.”)
Sumpter & McMillan (2005)

• More “cases” were found with the self-report questionnaires than with the CAPS.
• CAPS-“without judgment” requires DSM–IV criteria B–F to be fulfilled.
• CAPS-“with clinical judgment” required the clinician to judge that the symptoms were related to the traumatic event.
Sumpter & McMillan (2005)

- Only one participant (3%) was diagnosed with PTSD using CAPS-with clinical judgment.
- And, of the 20 “cases” identified with questionnaires, 19 were false positives, as were 5/6 identified using the CAPS-without clinical judgment.
Glaesser et al. (2004)

• “…pathological memory formation is a prerequisite for PTSD…it has been argued that loss of consciousness prevents the formation of the traumatic memory constellation.”

• “Thus, PTSD and TBI might be mutually exclusive.”

• “…loss of consciousness may even have a protective effect with regard to the development of PTSD.”
PTSD in Patients with TBI (Glaesser et al., 2004)

- 46 neuro rehab patients with TBI due to accident
- 27% who were not unconscious for an extended period of time dx’d with PTSD.
- Only 3% who were unconscious for > 12 hrs. dx’d with PTSD.
- Conclusion: LOC has a protective effect with regard to developing PTSD.
PTSD Sx 6 Months After TBI (Bombardier et al., 2006)

- 125 subjects (consecutive admissions to trauma hospital)
- Complicated mTBI, moderate or severe TBI (all with radiological evidence)
- Cumulative incidence: 11.3% met PTSD criteria at some point in the first 6 months.
- Only 5.6% met all criteria (including F)
- Prevalence decreased over time, suggesting relatively short duration of PTSD.
Bombardier et al.

- 85.7% that met PTSD criteria also had at least one other psychiatric disorder.

- PTSD vs. remainder of sample:
  - MDD: 71.4% vs. 15%
  - Panic Disorder: 21.4% vs. 4.5%
  - Other Anxiety Disorders: 71.4% vs. 18.2%
WHAT MAKES VETERANS DIFFERENT?
TBI, PTSD and Combat Veterans

• Even if a veteran has no recall of the injury event that caused the TBI, he or she likely experienced combat during their deployment.

• OEF/OIF veterans may have been deployed multiple times, further increasing the odds of exposure to combat situations.
Conclusions About TBI & PTSD in the Veteran Population

• Moderate or severe TBI may have occurred after PTSD has already developed.
• If so, there would be no protective effect involved.
• The veteran population is also unique in that many of them have had multiple traumatic events.
Increased PTSD Risk With Combat-Related Injury (Koren et al. 2005)

- 60 injured and 40 uninjured soldiers who took part in same combat situations
- 16.7% of injured soldiers met criteria for PTSD
- Only 2.5% of the uninjured met criteria for PTSD
- Conclusion: bodily injury is a major risk factor for PTSD.
Comorbid Conditions & TBI

Substance Abuse
ETOH & TBI

• Alcohol is the predominant risk factor for TBI (Kolakowsky-Hayner et al., 1999).

• Estimates of pre-injury ETOH abuse range from 16-66% (Burnett et al., 2000; Corrigan et al, 1999).

• Pre-TBI substance abuse is assoc. with poorer TBI treatment outcomes (Corrigan et al., 1999; Sherer et al., 1999).
ETOH & TBI

• ETOH abuse/dependence is the 2nd most common Axis I d/o in people with TBI (MDD is most common) (Hibbard et al., 1998; Koponen et al., 2002).

• Early in TBI recovery, rates decline, become comparable to general population (Dikmen et al., 1995; Kreutzer et al. 1996).
Kreutzer et al. (1996)

- Multicenter, 4-year follow up study.
- Drinking increased with time since injury.
- Most abstained at all follow-up periods.
- Moderate & heavy drinkers remained so over the course of 4-year study
- 25% of abstinent began drinking—10% of those became moderate or heavy drinkers.
Problems Associated with ETOH after TBI

• Heavy drinking after TBI can contribute to seizures, increase the risk for another TBI, magnify behavioral and cognitive deficits, and/or decrease return to work rates (Corrigan et al., 1995).
Patterns of ETOH Use One Year after TBI (Horner et al., 2005)

• Stratified random sample of South Carolina residents age 15 or older who sustained a TBI requiring hospital admission.

• 4519 participants selected; 2118 completed interviews; response rate=55.7%

• Under 18 were excluded, leaving 1606.
Horner et al...

- 15.4% heavy drinkers
- 14.3% moderate drinkers
- 70.3% infrequent/light drinkers or abstinent
- Risk factors for heavy drinking: male, younger, hx of SA tx, dx of dep since TBI, fair/mod MH, and better physical fx.
- 94% of ALL participants reported drinking the same or less than before TBI.
Horner et al.

• One of the strongest predictors of heavy drinking 1 yr later was history of substance abuse prior to TBI.

• 6% reported drinking more than before TBI:
  – Young, single, uninsured, depressed, lower life satisfaction and poorer mental health

• Consistent assessment & follow-up are needed for comorbid TBI & hx of SA.
How Does this Play Out in Veterans?

- Although TBI due to blast injury implies that ETOH was not involved in occurrence of TBI, it does not preclude heavy use or abuse of ETOH/substances prior to and after TBI.
- If TBI occurs outside of combat conditions, substance abuse is as much (if not more) of a factor as it is in non-veterans.
Take-away Points

- Significant number of combat veterans have sustained at least a mild TBI/concussion.
- Rates of PTSD are higher with TBI.
- Physical injury (e.g., TBI) is associated with an increased risk for PTSD.
- Rate of ETOH use/abuse tends to stay the same after TBI (does not consider PTSD).
- ETOH creates additional risks after TBI.
Questions?
Evidence-Based Treatment Approaches for PTSD

Will they work for veterans with significant cognitive impairments?
Evidence-based Treatment Approaches for PTSD

- Developed for people without brain injuries
- May be overwhelming emotionally and/or cognitively for those with brain injury
- Too complex or wordy
- Relies heavily on free auditory recall and requires memory skills for homework assignments
- May not consider motivation to change
Cognitively Modified Approach to the Treatment of PTSD

Tiffanie Sim PhD¹, Ellen Crouse PhD², Carey Pawlowski PhD¹, Kelly Petska PhD³, and Pamela Fitzpatrick PhD⁴

¹VA Palo Alto Health Care System, ²VA Medical Center at Memphis, ³Minneapolis Veterans Affairs Medical Center, ⁴South Texas Veterans Health Care System
Rationale for CMAP

- Combined brain injury + PTSD in service member population (estimated range: 18% – 40%)
- Cognitive difficulties associated with PTSD and with brain injury (e.g. attention, concentration, memory, processing speed, etc.)
Rationale for CMAP…

• Emotional dysregulation typical in this population
• Traditional PTSD treatment does not always take these issues into account
• Frequent drop-out from treatment due to poor tolerance, limited skills
How is CMAP Different?

• Presented in multiple sensory modalities to enhance memory for & understanding of material
• Draws from evidence-based tx for children, older adults & those with severe mental illness
• Incorporates skills-building & psychoeducational components prior to therapy
  – Emphasis on regulation of affect & cognition
  – Focus on mindfulness practice
All Aspects of Project Modified

- Ongoing review and recap of what’s been covered
- Use of simpler language
- More graphics & visual cues to aid new learning
- Demonstrations & active involvement by patients
Modifications…

- Written directions vs. only verbal
- Attention to the structure and organization of materials
- More direct feedback to patients
- Family-based interventions & education – family may play a larger role due to cognitive impairments
CMAP Treatment Components

• **Part I:** Psychoeducation on brain injury & PTSD
• **Part II:** Skills Building & Mindfulness Practice
• **Part III:** Therapy (depending on veteran/site)
  – Prolonged Exposure (PE)
  – Cognitive Processing Therapy (CPT)
  – Acceptance & Commitment Therapy (ACT)
  – Dialectical Behavioral Therapy (DBT)
Example of a Modified Handout

Adapted for CMAP from Linehan (1993), *Cognitive-Behavioral Treatment of BPD*, p.60