Today is PTSD Awareness Day

This webinar is sponsored by the Department of Veterans Affairs Employee Education System, Palo Alto Health Care System, and Office of Public Health

Diagnosis & Treatment of TBI and PTSD

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VA Palo Alto Health Care System

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National Center for PTSD

Moderated by

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War-Related Injuries and Illnesses Study Center (WRIISC)
Disclaimer

The views expressed in this presentation are those of the authors and Do NOT reflect the official policy of the Department of Veterans Affairs or the United States Government.
Background- TBI

- Traumatic brain injury (TBI)
  - Injury to the intracranial structures following physical trauma to the head
  - vs. Head Injury both intracranial and extra-cranial structures (scalp and skull)

- Epidemiology
  - >1.5 million Americans suffer a TBI each year
  - >57 million individuals worldwide hospitalized by 1 or more TBI
  - It is referred as the “signature injury” of OEF/OIF
  - TBI is the major cause of disability in young adults
A traumatically induced structural injury AND/OR physiologic disruption of brain function as a result of an external force with a new onset or worsening of at least one of the following clinical signs immediately following the event:

- Any period of loss of consciousness
- Any loss of memory for events immediately before or after injury
- Any alteration in mental state at the time of injury
- Neurologic deficits
- Intracranial lesion
Background - TBI Classification

- Mild, moderate, or severe based on simple cognitive and motor evaluations such as the Glasgow Coma Scale (GCS)
  - GCS 13-15: Mild
  - GCS 8-12: Moderated
  - GCS <8: Severe

- Mechanism:
  - Primary injuries - direct result of trauma
  - Secondary injuries - complications of 1° lesions

- Location
  - Penetrating/open
  - Blunt/closed
Background - mild TBI (mTBI)

FIGURE 2-1  Severity of TBI cases treated at DVBIC Sites, 2005–2007.  
Source: Labutta, 2008.
Approximately 18% of returning soldiers have been identified as having mild Traumatic Brain Injury, primarily due to exposure to blasts (see Hoge et al, 2008)
Posttraumatic Stress Disorder (DSM IV criteria)

- Re-experiencing /intrusive symptoms (1 of 4)
  - Flashbacks
  - Nightmares
  - Intrusive recollections of trauma
  - Intense psychological distress or physiological reactivity

- Avoidance/Numbing symptoms (3 of 7)
  - Avoid thoughts, feelings, or conversations related to trauma
  - Avoid situations related to trauma
  - Social withdrawal
  - Emotional numbing

- Hyper-arousal symptoms (2/5)
  - Sleep disturbance
  - Poor concentration
  - Outbursts of anger, irritability
  - Exaggerated startle response

- Duration >1 month
### TBI and Rates of PTSD

2525 Army infantry soldiers 3-4 months after return from year long deployment

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<thead>
<tr>
<th>Injury category</th>
<th>Percentage</th>
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<td>43%</td>
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* Hoge et al, 2008 NEJM
Traumatic Brain Injury

Steven Z. Chao, MD, PhD
Department of Neurology
VA Palo Alto Health Care System
Background-mild TBI

- Head Injury Interdisciplinary Special Interest Group of the American Congress of Rehabilitation Medicine - mTBI
  - Any period of loss of consciousness
  - Any loss of memory for events immediately before or after the accident
  - Any alteration in mental state at the time of the accident
  - Focal neurologic deficits that may or may not be transient

- American Academy of Neurology - concussion
  - Grade 1
    - Transient confusion with no loss of consciousness and concussion symptoms that resolve in less than 15 minutes
  - Grade 2
    - Similar, except that symptom resolution occurs beyond 15 minutes
  - Grade 3
    - Any loss of consciousness
Background-mTBI

- mTBI - “silent epidemic”
  - Diffuse changes resulting in disruptions of the axolemma and neurofilament organization
  - Multifocal lesions are labeled diffuse axonal injury or traumatic axonal injury (TAI).
How do we diagnosis TBI

- **Clinical history**
  - Witness/medical records
  - Self report

- **Residual symptoms**
  - Cognitive impairment
  - Physical limitation
  - Mood/Anxiety

- **Biomarkers**
  - Blood/CSF
  - Imaging
  - Pathology
Complicated Mild TBI

- When clinical neuroimaging findings are present following a mTBI, the classification changes to “complicated mTBI,” which has a 6-month outcome more similar to moderate TBI


From Belanger, 2009
Imaging Classification of TBI

Primary injury

Extra-axial injury
- Epidural hematoma
- Subdural hematoma
- Sub-arachnoid hemorrhage

Intra-axial injury
- Axonal injury
- Cortical contusion
- Intra-cerebral hematoma

Vascular injury
- Dissection
- Carotid cavernous fistula
- Arterio-venous dural fistula
- Pseudoaneurysm
Imaging Classification of TBI
Secondary injury

**Acute**
- Diffuse cerebral swelling/dysautoregulation
- Brain herniation
- Infarction
- Infection

**Chronic**
- Lepiolmeningeal cyst
- Hydrocephalus
- Encephalomalacia
- Cerebrospinal fluid leak
Neuroimaging in TBI

- X-ray
- CT
- MRI
- Functional study
Neuroimaging- X-Ray

- Poor predictors of intracranial pathology
- mTBI - rarely demonstrate significant findings
- Severe TBI - Negative findings may mislead medical management
Neuroimaging in TBI

- X-ray
- CT
  - Indication
  - Limitation
- MRI
- functional study
Neuroimaging - CT

- **Indication**
  - Moderate and severe TBI (GCS < 12)
  - Mild TBI
    - Age > 60 years
    - Persistent neurological deficit
    - Headache or vomiting
    - Amnesia, loss of consciousness longer than 5 minutes
    - Depressed skull fracture
    - Penetrating injury
    - Bleeding diathesis or anticoagulation therapy

Le and Gean. Mount Sinai J Med 2009
Neuroimaging - CT

- Modality of choice in acute setting
  - Fast, widely available
  - Highly accurate for skull fractures and intracranial hemorrhage
  - Life-support and monitoring easier than MR
  - Better at radio-opaque foreign bodies
  - Non-contrast CT first for hemorrhage
  - CT angiography has better resolution

Le and Gean. Mount Sinai J Med 2009
Neuroimaging - CT

- Limitation: Low sensitivity for mild TBI
  - abnormal findings on clinical computed tomography
  - 5% GCS 15
  - 20% GCS 14
  - 30% GCS 13

Borg et al. J Rehabil Med 2004
Neuroimaging in TBI

- X-ray
- CT
- MRI
  - Indication
  - Compare to CT
  - FLAIR
  - GRE (T2*)
  - DTI
- Functional study
Neuroimaging - MRI

- Indication
  - acute TBI
    - neurological findings are unexplained by the CT findings
  - subacute
  - chronic TBI
Neuroimaging - MRI

- T2/Fluid Attenuated Inversion Recovery (FLAIR)
  - Focal cortical injuries (e.g. contusions)
  - White matter shearing injuries
  - SAH by suppressing the bright CSF signal (FLAIR)
  - Diffuse axonal injury (DAI) particularly can be seen in the corpus callosum and the fornix
    - Sagittal and coronal FLAIR
Neuroimaging - MRI

Greenwood, J Neurol Neurosurg Psychiatry 2002
Neuroimaging - MRI

- Gradient-Recalled-Echo (GRE)/ T2*-Weighted /Susceptibility weighted imaging (SWI)
  - Highly sensitive to ferritin & hemosiderin (breakdown products of blood)
  - Hemosiderin can persist indefinitely- good for remote TBI
  - Limited in the evaluation of cortical contusions of the inferior frontal and temporal lobes because of the inhomogeneity artifact induced by the sinuses and mastoid air cells.
Neuroimaging - MRI
MRI vs. CT

- Comparable
  - Acute epidural hematoma (EDH)
  - Subdural hematoma (SDH)
- More sensitive (43-68% mTBI has negative scan)
  - Subtle extra-axial smear collections (blood)
  - Nonhemorrhagic lesions
  - Brainstem injuries
  - Subarachnoid hemorrhage (SAH)
  - 93% of nonhemorrhagic lesions were detected by MRI but only 18% were appreciated on CT
  - Among TBI patients with normal CT scans 30% had abnormal MRI (Bazarian 2007)

Hughes et al, Neuroradiology 2004
Gentry et al, AJR Am J Roentgenol 1988
MRI still misses many lesions

- Post concussive syndrome
  - Headaches, dizziness, fatigue
  - Anxiety
  - Attention deficits and memory problems
  - Mild encephalopathy (a few days to weeks)
  - 30% continue to have persistent syndrome
  - 43-68% mTBI has negative MRI scan
Neuroimaging – MRI-DTI

- **Diffusion Tensor Imaging (DTI)**
  - Identify and quantify the microstructural changes that cannot be detected by CT and conventional MRI
  - Certain DTI parameters may serve as a biomarker for microstructural white matter injury
  - May serve as better assess mTBI at both acute and chronic stages.
Changes in DTI metrics at acute and chronic time points in symptomatic TBI patients

<table>
<thead>
<tr>
<th></th>
<th>Acute TBI</th>
<th>Chronic TBI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fractional anisotropy</td>
<td>↑</td>
<td>↓</td>
</tr>
<tr>
<td>Radial diffusivity</td>
<td>↓</td>
<td>↔ or ↑ or ↓</td>
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Niogi & Mukherjee, J Head Trauma Rehabil 2010
Abnormalities revealed on DTI with mTBI

None had detectable intracranial injury on CT head

In 18 of the 63 subjects with TBI, a significantly greater number of abnormalities were found on DTI.

Follow-up DTI scans in 47 subjects showed persistent abnormalities

Mac Donald et. Al. NEJM 2011
Neuroimaging in TBI

- X-ray
- CT
- MRI
- Other functional study
  - PET
  - SPECT
  - f-MRI
Neuroimaging – PET

- **Positron Emission Tomography**
  - Measures regional brain metabolism with 2-Fuoro-deoxy-glucose (FDG)
  - In animal studies
    - Acutely injured show increased glucose metabolism
    - Followed by a prolonged period of regional hypometabolism lasting up to months
  - Human studies has no consistent results
    - Both hypermetabolism and hypometabolism in the same regions across different TBI patients
Neuroimaging - PET

- 16 WRIISC pt with TBI histroy
- 4 abnormal MRI
- 5 abnormal PET
Neuroimaging - SPECT

- Single Photon Emission Tomography (SPECT)
  - Nuclear medicine study that measures cerebral blood flow (CBF)
  - Potentially provide a better long-term prognostic predictor
  - Worse prognosis
    - multiple CBF abnormalities
    - larger CBF defects
    - involve the basal ganglia, temporal and parietal lobes, and brainstem
  - less sensitive in detecting small lesions that are visible on MRI
  - SPECT imaging is complementary to MRI
Functional MRI - Resting state

(i) ‘Executive’ Network
Identified in Simon task fMRI data using model-free ICA analysis

(ii) ‘Executive’ Resting State Network
Identified in resting state fMRI data using model-free ICA analysis
Neuroimaging - What else?

- Diffusion-Weighted Imaging
- Diffusion-Spectrum Imaging
- Magnetic Resonance Spectroscopy
- Magnetization Transfer Imaging
- Magnetic Source Imaging
- Functional MRI
Thank you for your attention!
mTBI and PTSD: Applicability of Skills Training in Affect and Interpersonal Regulation (STAIR)

Marylene Cloitre, PhD
Associate Director of Research,
National Center for PTSD
Professor,
Department of Psychiatry
New York University Medical Center
### Traumatic Brain Injury: Defined by severity of injury at time of event

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<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
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<td>Altered or Loss of Consciousness (LOC)&lt;30 minutes with normal CT and/or MRI</td>
<td>LOC&lt;6 hours with abnormal CT and/or MRI</td>
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<td>Glasgow Coma Scale (GCS) 13-15</td>
<td>GCS 9-12</td>
<td>GCS&lt;9</td>
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<td>Post Traumatic Amnesia PTA) &lt;24 hours</td>
<td>PTA&lt;7 days</td>
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Post-Concussive Syndrome (ICD-10 Criteria)

- History of Traumatic Brain Injury
- Three or more of the following:
  - Headache
  - Dizziness
  - Fatigue
  - Irritability
  - Insomnia
  - Concentration difficulty
  - Memory Difficulty
  - Intolerance of alcohol or emotion
Post-Concussive Syndrome (DSM-IV Criteria)

- History of Traumatic Brain Injury
- Cognitive Deficit
  - Attention (focus, sustained tracking)
  - Memory
- Symptoms persist more than 3 months
- Symptoms that begin/worsen after injury
- Exclusion of dementia from other cause
Approximately 18% of returning soldiers have been identified as having mild Traumatic Brain Injury, primarily due to exposure to blasts (see Hoge et al, 2008)
Prevalence, Duration and Characteristics of mTBI in OIF/OEF Veterans

- Majority of cases resolve in 4-12 weeks (Collins, 1999; Moore, 2006)
- However, longer duration of post-concussive symptoms have been noted with substantial numbers having symptoms from 12 to 36 months.
- Longer recovery associated with presence of comorbid psychiatric disorders including Posttraumatic Stress Disorder, Depression, Pain and Substance Abuse
Posttraumatic Stress Disorder
(DSM IV criteria)

- **Re-experiencing /intrusive symptoms (1 of 4)**
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- **Avoidance/Numbing symptoms (3 of 7)**
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- Duration >1 month

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* Hoge et al, 2008 NEJM
TBI and Rates of PTSD: Most frequently reported (percent endorsed) postconcussive symptoms

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Hoge et al, 2008 NEJM
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PM – PTSD mediated  
Hoge et al, 2008 NEJM
Distinct and Overlapping Symptoms

**PTSD**
- Flashbacks
- Nightmares
- Avoidance of Trauma Cues
- Startle Response

**TBI**
- Ringing in Ears
- Balance Problems
- Headaches

- Irritability
- Memory problems
- Concentration Problems
mTBI and PTSD share associated problems

- Depression
- Anxiety
- Interpersonal problems (aggression)
- Physical health problems (muscle, joint, back pain; gastric distress)
## Significance of Comorbidity: Physical Health and Service Utilization (percent endorsing)

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<td>25 *</td>
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**PDM** – PTSD and Depression mediated
Treatment Recommendations
VA Consensus Conference on Practice Recommendations for Treatment of Veterans with Comorbid PTSD, Pain and PTSD (2010)

- For TBI
  - Education to normalize symptoms and provide expectation of rapid recovery
  - Symptom-specific relief

- For TBI and PTSD
  - Interdisciplinary Treatment Planning
  - Family Engagement
  - Use current clinical practice guidelines for mTBI and PTSD in an integrated way
Treatment Recommendations based on Evidence

- Cognitive-Behavioral Treatment (CBT) is widely accepted as treatment for PTSD (Foa et al, 2008).

- Two case studies support use of CBT for patient With PTSD After TBI (Batten, & Pollack, 2008; McGrath, 1997).

- One RCT of mild TBI with ASD. Patients were able to complete and benefit from CBT and was superior to supportive therapy (Bryant et al, 2003).
Domains of Cognitive-Behavioral Techniques

- Exposure Procedures
- Anxiety Management Procedures
- Cognitive Restructuring
Cognitive Processing Therapy

- Psychoeducation
- Written exposure
  - impact of trauma on thoughts about self and others
  - interpretations about traumatic event(s)
- Challenging patient’s interpretations about traumatic event(s)
- Cognitive restructuring of more generalized beliefs disrupted by traumatic event(s)
Exposure Therapy

- Techniques to promote confrontation with feared objects, situations, memories, and images

- Prolonged Exposure
  - Psychoeducation
  - Breathing retraining
  - Prolonged, repeated exposure to the trauma memory (imaginal reliving)
  - Repeated *in vivo* exposure to objectively safe situations being avoided due to trauma-related fear
Other Considerations in the use of CBT

- CBT may be of particular value to people with cognitive impairments because of structured, educative and interactive nature.

- VA Consensus Conference on Practice Recommendations for Treatment of Veterans with Comorbid PTSD, Pain and PTSD (2010) acknowledged the potential value of skills training and recommend continued research.

- Application of enhanced CBT treatments which focus on emotion dysregulation may be relevant.
Complex PTSD

DSM IV: “Associated Features of PTSD”

- Criterion A: Chronic, repeated, prolonged traumas, often beginning in early life and of an interpersonal nature
  - Childhood Abuse
  - Domestic Violence
  - Prisoner of War
  - Exposure to civil war (genocide)
  - Prostitution Brothels/Global Slave Trade
Emotion Regulation Difficulties

DSM-IV “Associated Features of PTSD”

- Easy provocation, high reactivity to emotionally evocative stimuli, difficulty calming down
- Examples:
  - fear/dissociation
  - anger
  - anxiety
  - sadness

McDonough-Coyle et al, 2001
Orsillo et al, 2004
Protopopescu et al, 2005
Tull et al, 2007
Interpersonal Problems
DSM-IV “Associated Features of PTSD”

- Martial and dating problems
- Low satisfaction in relationships
- Parenting problems
- Poor functioning at work
- Social isolation
- Low perceptions of support

Briere et al, 2004
Claussen et al, 2002
Punumaki et al, 2004
PTSD as an Emotion Dysregulation Disorder

- Alternating symptoms of hyperarousal and emotional avoidance/numbing (affect dysregulation)
- Detachment and constricted affect vs. outbursts of anger and aggressive behaviors
Consequences of Emotion Regulation Difficulties

- Among problems that PTSD (veterans) patients complain about, anger is common and distressing to patients (Pitman et al, 1987).
- It has been directly linked to interpersonal disturbances:
  - In intimate and social relationships (Riggs et al, 1992).
  - In parent functioning and relationships with children (Bosquett & Egeland, 2006; Weems & Silverman, 2006).
Treatment Implications: Hybrid of DBT and PE

Two-Phase Treatment:

I. Skills Training in Affective and Interpersonal Regulation (STAIR)
   8 weekly sessions

II. Narrative Story Telling (NST)
    a modified version of prolonged exposure (PE) via repeated narration of events,
    meaning analysis, self-other schema analysis 8 weekly sessions
PHASE I: STAIR
SKILLS TRAINING IN AFFECT AND INTERPERSONAL REGULATION

THE RESOURCE OF HOPE
Session 1: Introduction to Treatment

THE RESOURCE OF FEELINGS
Session 2: Emotional Awareness and the Power of Naming
Session 3: Emotion Regulation
Session 4: Emotionally Engaged Living

THE RESOURCE OF CONNECTION
Session 5: Understanding Relationship patterns (Schemas)
Session 6: Changing Relationship Patterns (Alternative Schemas and Role)
Session 7: Agency in Relationships (Assertiveness and Control)
Session 8: Flexibility in Relationships (Multiple Working Models)
Definition of Emotion Regulation

**NOT** Anxiety Reduction
Definition of Emotion Regulation

- Processes by which an individual monitors, modifies, and expresses emotions to achieve goals (Thompson, 1994)

- The capacity to manage internal arousal within a performance optimizing range (Cicchetti et al., 1991)

- The ability to inhibit or control emotions as well as activate behaviors guided by feelings for a particular purpose (Valiente & Eisenberg, 2006)
Definition of Emotion Regulation

- A “Comfort Zone” that allows the individual to live in the moment and engage fluidly with the environment
- Involves not only down-regulation of negative affect
- But also enhancement of positive affect
Assessment of Emotion Regulation: Negative Mood Regulation Scale (NMR)

When I’m upset I believe that:

Physiological Domain:
If take a walk I’ll feel better
I can breathe my way through

Cognitive Domain:
I tell myself it will last only a little while
I distract myself

Behavioral/ Interpersonal Engagement Domain:
I can call a friend
I do something nice for some one

“That’s not like me…”
“That’s a lot like me”

Score of 100 = Community Average

Negative Mood Regulation Scale
Cantanzaro & Mearns, 1990
Emotion Regulation Strategies

- **Breathe** – Entraining cognitive and bodily processes (decrease disorganization)
- **Problem Solving Skills** – create boundaries around problems they become manageable, not overwhelming (cognitive-somatic-behavioral strategies to targeting problems)
- **Enhance Self-Soothing Skills** – exercise, walking, listening to music, quiet places, shower (learn triggers/be proactive)
- **Learn Distress Tolerance** in service of identified goals (identify goals, use all of the above to reach them).
Impact of Emotions on Relationships and Social Functioning

- Education about patterns of relationships/role of emotions
- Role play in practicing alternatives in sessions
- Practice at home
- Different actions are required in different settings and different relationships (learn what they are)
Study Design: RCT with Three Treatment Conditions

- STAIR
- Support
- STAIR Support

- NST
- NST Support
OUTCOMES
CAPS Diagnoses at Post Treatment

PTSD-free

Cloitre et al, 2010, AJP, 167:915-924
PTSD (n= 104)

ITT

PSS-SR

Emotion Regulation Problems

ITT (N=104)

Interpersonal Problems

ITT (N=104)

Cloitre et al, 2010, AJP, 167:915-924
Dropout Rate by Treatment Condition

χ² (2) = 4.94, P = .04

STAIR/NST > SC//NST

Cloitre et al, 2010, AJP, 167:915-924
SYMPTOM WORSENING: A clinically meaningful deterioration (7 points worse than previous period)

<table>
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<tr>
<th>Assessment Period</th>
<th>STAIR/NST (n)</th>
<th>STAIR/SC (n)</th>
<th>SC/NST (n)</th>
<th>Sig (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-to-Post</td>
<td>3.6% (1)</td>
<td>7.4% (3)</td>
<td>15.0% (5)</td>
<td>ns</td>
</tr>
<tr>
<td>Post-to-6Mo FU</td>
<td>0% (0)</td>
<td>22.7% (5)</td>
<td>31.3% (5)</td>
<td>.006</td>
</tr>
</tbody>
</table>

Benefits of Phase-Based Treatment

- Reduces Dropout relative to exposure focused treatment
- Provide good outcomes in multiple domains:
  - PTSD, Emotion Regulation and Interpersonal Functioning
- Makes a difference in distress during trauma memory work
- Provides continued improvement after treatment ends compared to both treatments
Posttraumatic Amnesia

Thanks John Kirk, PhD
Lisa Brenner, PhD
Explanations for PTSD despite loss of consciousness

- Fear conditioning occurs automatically (nonconsciously) and can explain distress upon exposure to trauma related cue (Criterion B)
- There are “islands” of traumatic memories
- Traumatic nature of memories post-event experiences (dead bodies, surgery)
- Inferencing of an event, and reconstruction of memory
Alternative:

Using STAIR alone or in stepped-fashion with Exposure?

- Exposure targets re-experiencing symptoms (intrusive thoughts) and avoidance and has typically required that client required patient to have at least one clear memory of trauma.

- Many of the shared symptoms of PTSD and mTBI are “hyperarousal” symptoms (irritability, poor concentration) that skills training is intended to directly address.
Using STAIR alone or in stepped-fashion with Exposure?

- If patient has no or few re-experiencing symptoms (possibly related to lack of memory of trauma):
  - Begin with and complete skills training
  - Re-evaluate presence of PTSD and mTBI symptoms
  - Add exposure or cognitive processing of trauma if PTSD is still present
- Research needed comparing STAIR alone versus Exposure or in step based algorithm
Summary of STAIR/Ex Research and Activities

- **Published Trials**
  - STAIR/Ex vs. WL (Cloitre 2002, JCCP)
  - Comparison Study (Cloitre 2010, AJP)
  - Flexible Application of STAIR/Ex with 9-11 PTSD (Levitt et al. 2007, BRAT)

- **Ongoing Trials**
  - STAIR+PE vs. STAIR+EMDR (Ehring et al, Amsterdam)
  - STAIR+Rescripting vs. Rescripting alone (Olff et al, Amsterdam)
  - Open Trial (n=31) w fMRI scans obtained before and after treatment

- **Next Steps**
  - Multi-site study in Civilian Public Sector Clinics in U.S. (NIMH)
  - Web-based Training for STAIR (NCPTSD)
Questions?

Steven Chao MD, PhD

Marylene Cloitre, PhD

J. Wesson Ashford, MD, PhD
Thank you

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and
www.ptsd.va.gov
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Primary Care Physicians complete a consult request in our computerized record system or contact the WRIISC nearest you.

More information @ www.warrelatedillness.va.gov