



# Combat-Related mTBI: Patient Subtypes, Empirical Evidence, and Treatment Implications

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# Disclosures



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I have no financial relationships to disclose



# Mild Traumatic Brain Injury



- In the Military, mild Traumatic Brain Injury (mTBI) is common....
  - 15-30% of troops engaged in active combat in Afghanistan and Iraq sustained a mTBI





# Military and mTBI



- Commanders required to ensure mandatory evaluation for any Service Member (SM) in a “mandatory event”:
  - Any SM in a vehicle associated with a blast event, collision, or rollover
  - Any SM within a specified distance of a blast (inside or outside)
  - A direct blow to the head or witnessed loss of consciousness
  - Command-directed, especially in a case with exposure to multiple blast events.
- Advanced Treatment of Concussion in Combat Arenas
  - i.e., Concussion Restoration Care Center (CRCC) in Afghanistan



# Traumatic Brain Injury (TBI)



- A traumatically induced structural injury and/or physiological disruption of brain injury following an external force
  - With at least one of the following *immediately* after:
    - Loss or decreased level of consciousness
    - Any loss of memory of events surrounding the injury
    - Alteration in mental status (e.g., confusion)
    - Neurological deficits (weakness, loss of balance, dizziness, praxis, paresis/plegia, sensory loss, aphasia)
    - Intracranial lesion

(DOD/VA 2009 Clinical Practice Guideline)



# Traumatic Brain Injury (TBI)



- Mild Traumatic Brain Injury (mTBI)
  - Loss of consciousness (LOC) less than 30 minutes
  - Alteration of consciousness (AOC) for less than 24 hoursand/or
  - Post-traumatic amnesia (PTA) less than 24 hours



# Mild TBI: Subtype Classification



- Symptoms of Mild TBI vary widely across patients:
  - forgetfulness, poor attention, slow processing speed, impaired problem-solving, poor concentration, fatigue, abnormal sleep, hearing loss, dizziness, balance problems, visual changes, headaches, fatigue, depression, irritability, anxiety....



# Mild TBI: Subtype Classification



- Are there sub-types of combat-related Mild TBI
  - Miserable Minority versus Good Recovery?
  - Psychiatric Subtype?
    - Emotional symptoms following mTBI are similar to post-traumatic stress (PTS)
    - Emotional disorders have a large impact on post-concussive symptoms
    - Depression (Lange et al., 2011)
    - PTSD (Belanger et al., 2010)





# Identification of Subtypes



## ■ Participants

- $n = 1,341$
- Recruited from 6 MTFs
- Combat-Related Mild TBI
  - 73.7% OIF, 26.3% OEF
  - 54.0% within 3 months of injury
  - 83.8% blast related injury

## ■ Measures

- Neurobehavioral Symptom Inventory (NSI)
  - 22 items
  - Post-Concussive Symptoms
    - affective, vestibular, cognitive, physical, sensory
- PTSD Checklist (PCL-C)
  - 17 items
  - Post-traumatic stress
    - Hyperarousal, re-experiencing, avoidance



# Identification of Subtypes



## ■ Data Reduction

- 39 Self Reported Symptoms
- Exploratory Factor Analysis
  - Hyperarousal
    - 1 NSI, 10 PCL items
  - Dissociation/Depression
    - 4 NSI, 6 PCL items
  - Cognitive/Headaches
    - 8 NSI, 1 PCL items
  - Neurological
    - 9 NSI, 0 PCL items

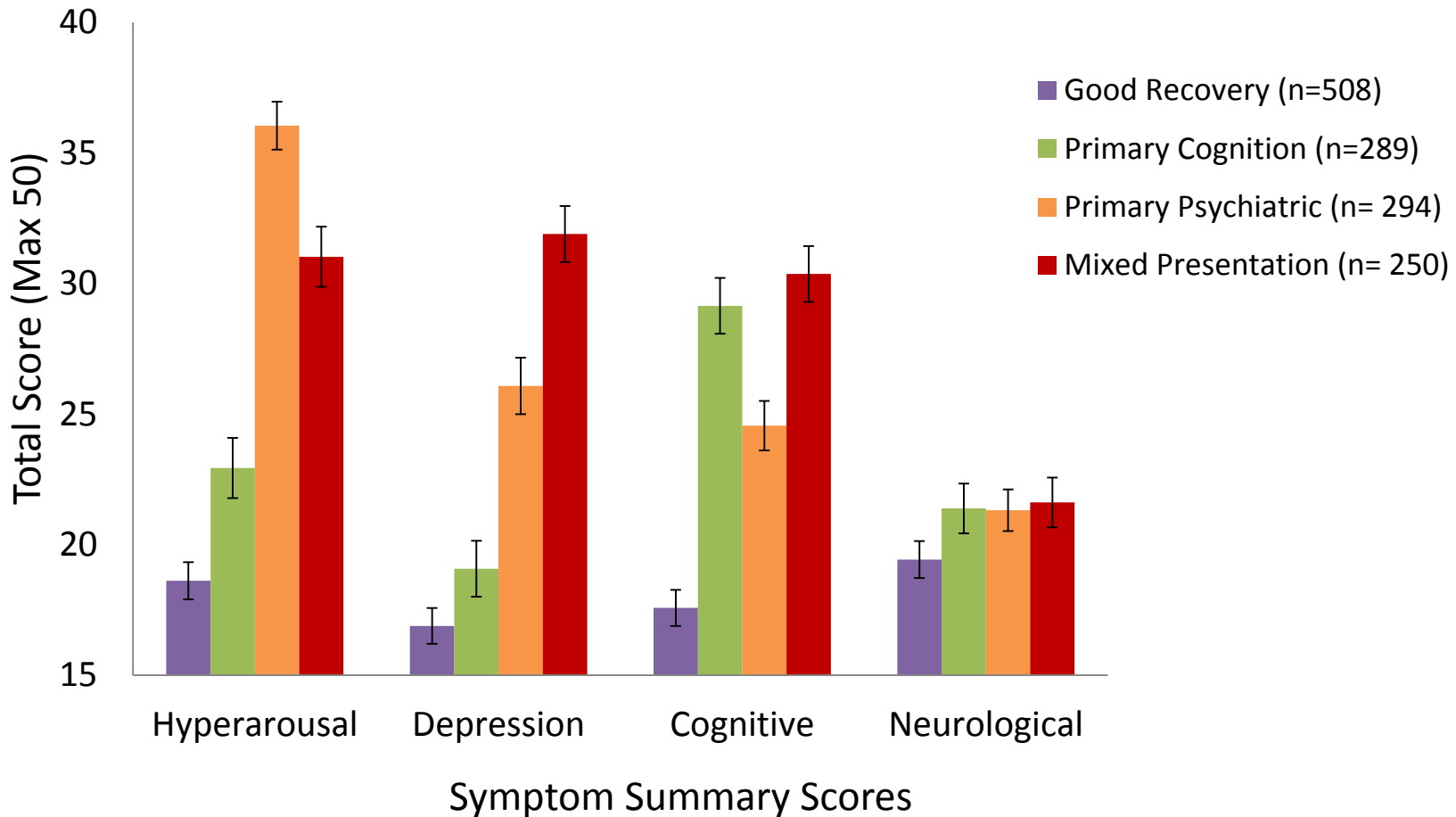
## ■ Symptom Profile Analysis

- Internal Validation
  - 2-Step Cluster Analysis Procedure
    - Replication across methods
      - » hierarchical
- External Validation
  - Resulting Profiles compared on demographic and injury related variables.



# Results

## Combat Mild TBI: Symptom Profiles



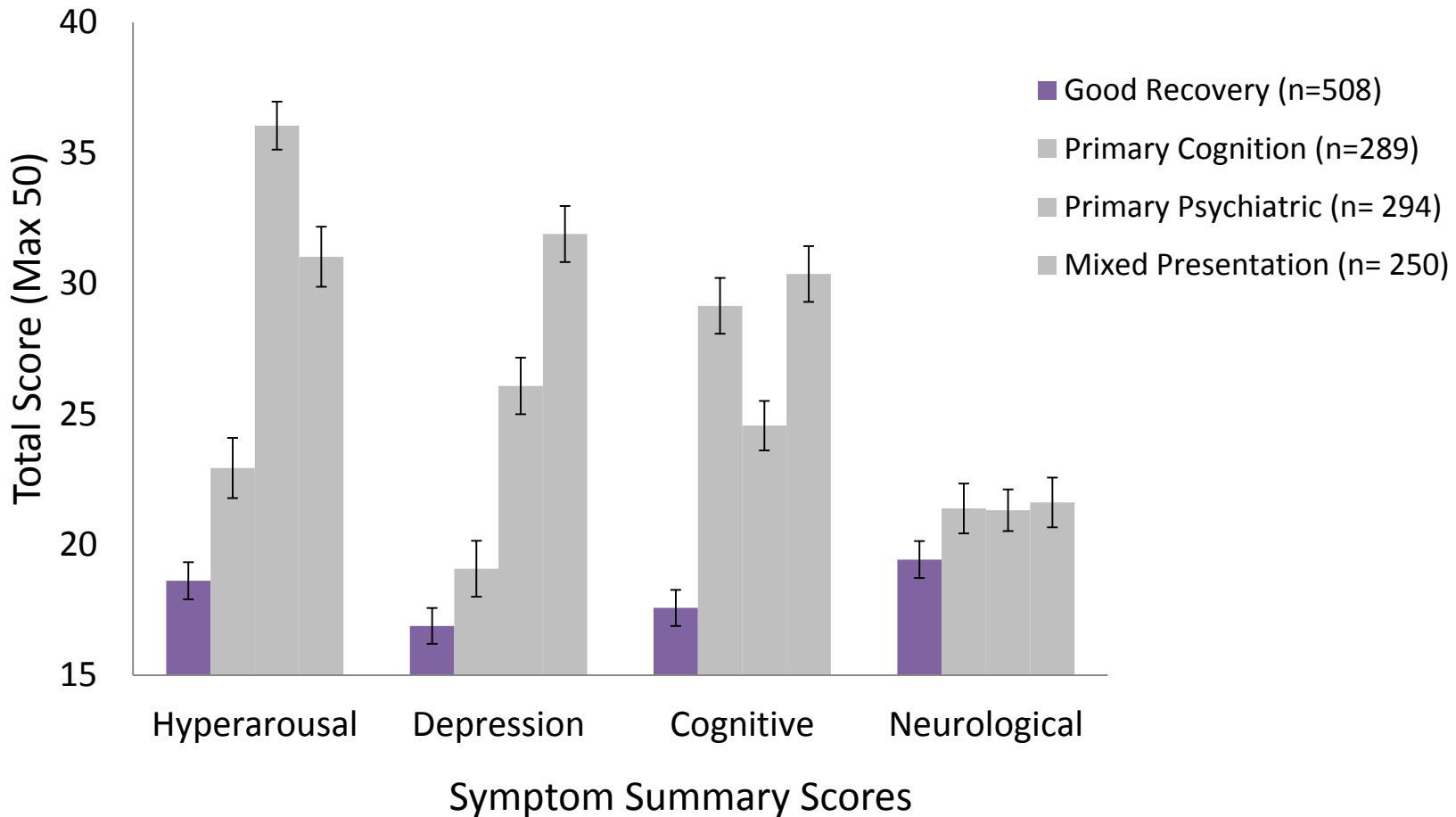
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# Results



## Combat Mild TBI: Symptom Profiles



Error bars represent 2 SEM



# Good Recovery Group

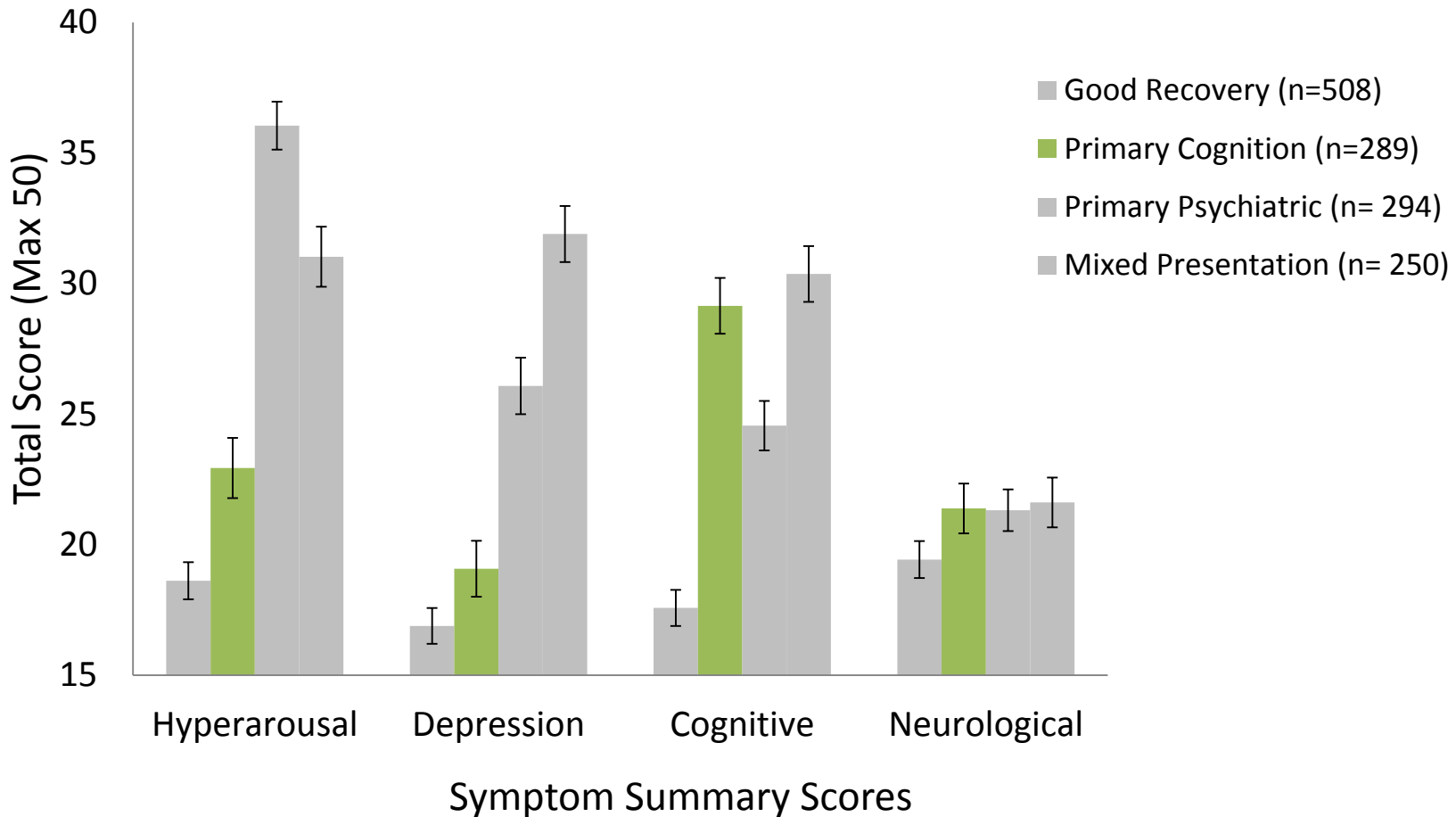


- Frequently Experienced Severe Symptoms
  - Poor Sleep (22%-28%)
- 65% of this group had normal rates of post-concussive symptoms



# Results

## Combat Mild TBI: Symptom Profiles



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# Primary Cognition/Headaches

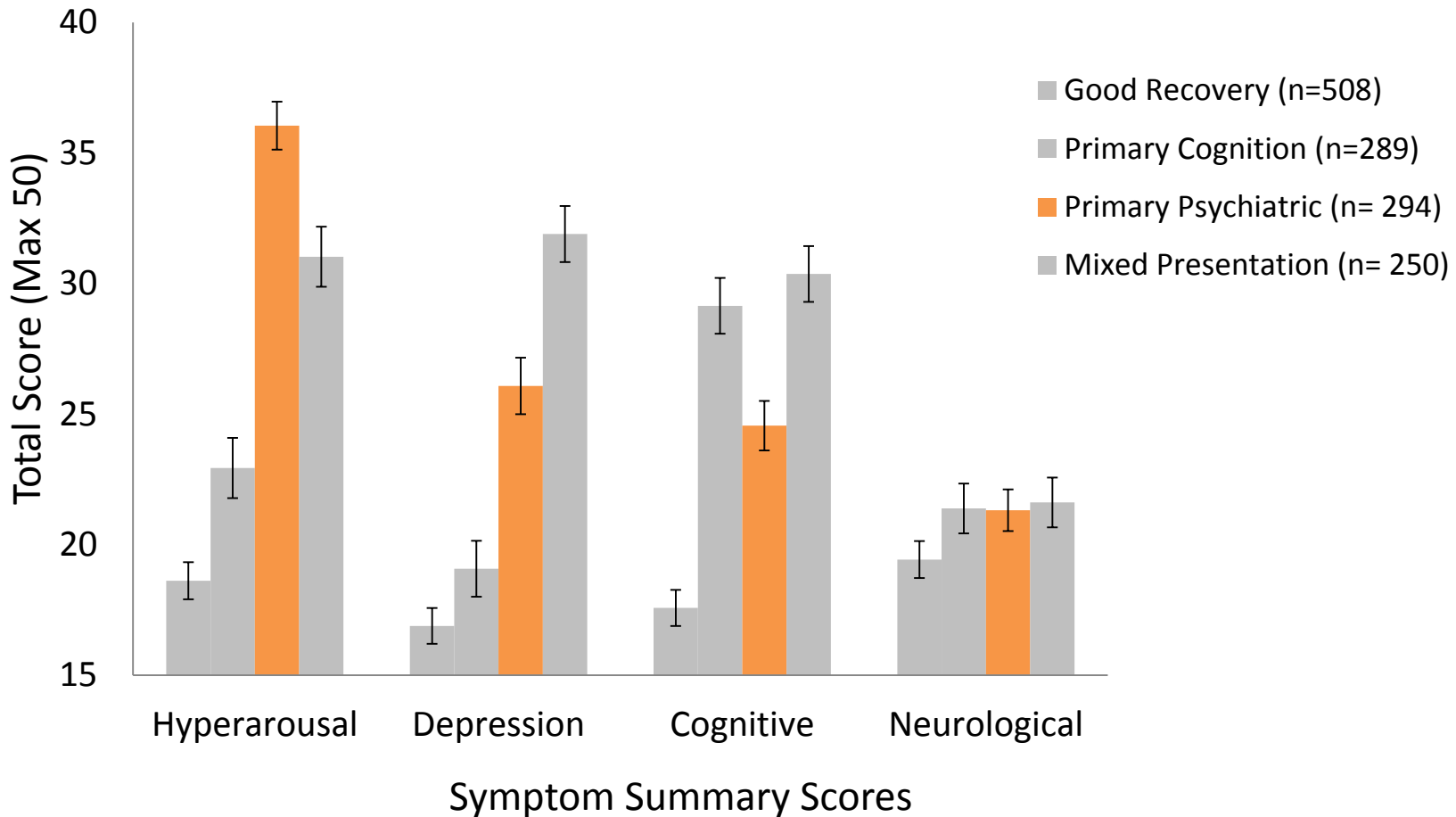


- Frequently Experienced Severe Symptoms
  - Headaches (52.2%)
  - Forgetfulness (46%)
  - Poor Sleep (39%-42%)
  - Poor Concentration (36%)
  - Slowed Thinking (26%)



# Results

## Combat Mild TBI: Symptom Profiles



Error bars represent 2 SEM





# Primary Psychiatric



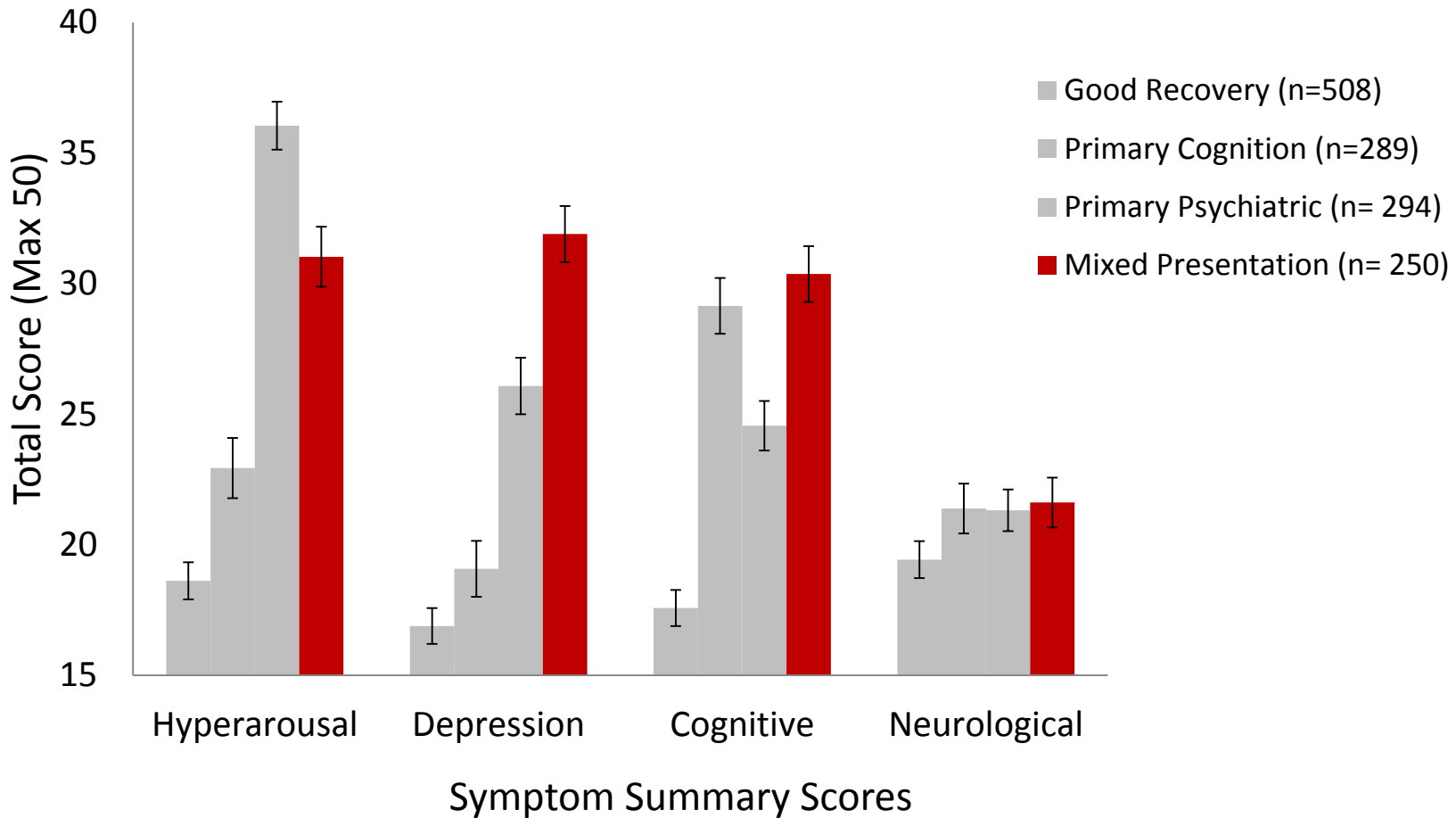
- Frequently Experienced Severe Symptoms
  - Poor Sleep (68%-85%)
  - Repeated Memories of Event (72%)
  - Repeated Dreams of Event (68%)
  - Easily Startled (61%)
  - Feeling On Guard (59%)
  - Avoiding Thinking of Event (58%)
  - Feeling Upset when Reminded (55%)



# Results



## Combat Mild TBI: Symptom Profiles



Error bars represent 2 SEM



# Mixed Psychiatric/Cognitive



- Frequently Experienced Severe Symptoms
  - Poor Sleep (57%-68%)
  - Poor Concentration (63%)
  - Irritability (57%-63%)
  - Forgetfulness (55%)
  - Feeling Distant/Cut-Off (53%)
  - Feeling On Guard (54%)
  - Easily Startled (50%)



# Cluster Subtype Validation



- Internal Validation:
  - Multi-profile multi-method correlation matrix
  
- External Validation:
  - Differences between groups on key variables
    - Demographic Information
    - TBI Characteristics (e.g., duration PTA)
    - Associated Medical Information (e.g., other non-TBI physical injuries)



# Key Mild TBI Subtype Characteristics



- “Good Recovery” Type (37.9%)
  - Lowest symptom profile
  - More likely sub-acute phase (< 3 months)
  - Injured later in conflicts (2008-2011)
  - More physical injuries and higher rates of pain medication use



# Key Mild TBI Subtype Characteristics



- “Primary Cognition/Headache” Type (21.5%)
  - Complaints of poor attention, forgetfulness, headaches and light sensitivity
  - Second highest return to duty rate
  - Lowest anti-depressant use
  - Highest rate of central nervous system (CNS) abnormality (e.g., subdural hematoma)



# Key Mild TBI Subtype Characteristics

- “Primary Psychiatric” Type (21.9%)
  - Prominent symptoms of hyperarousal and dissociation/depression
  - High rate of antidepressant usage
  - Typically injured earlier in conflicts (2004-2007)



# Key Mild TBI Subtype Characteristics

- “Mixed Presentation” Type (18.6%)
  - Notable complaints of hyperarousal, depression, as well as cognitive complaints and headaches
  - Lowest rates of CNS abnormality (similar to Primary Psychiatric type)
  - High rate of antidepressant use and low rate of pain medication use
  - Delayed engagement in treatment
  - Highest return-to-duty percentage





# Conclusions



- Four distinct subtypes of combat-related Mild TBI
  - Unique symptoms profiles that were validated by external variables (demographic and injury characteristics)
- Majority of patients had a relatively low symptom profile
- Psychiatric symptoms, typically associated with PTSD, were notable features of two identified sub-types
- Neurological symptoms (e.g., sensory changes) had a minimal effect ( $\eta_p^2 = 0.02$ ) on subtype identification



# Treatment Implications



# Treatment Implications



- One size fits all?
  - Comprehensive pathways involving multi-disciplinary treatment team (i.e., every patients see every provider):
    - Vestibular Therapy
    - Physical Therapy
    - Occupational Therapy
    - Speech Therapy
    - Psychology (e.g., Neuropsychology, Health Psychology)
    - Psychiatry
    - Medical (e.g., Neurology, Physiatry, Sports Medicine)
  - Cost? Time? Iatrogenic Effects?



# Treatment Implications



- Individualized Symptom Based Treatment Programs:
  - Decisions of rehabilitation based specifically on symptom presentation
  - Comprehensiveness of treatment plan development may be sacrificed
  - Reliant on the patient's ability/willingness to report symptoms
    - Insight into the relationship between symptom and mTBI



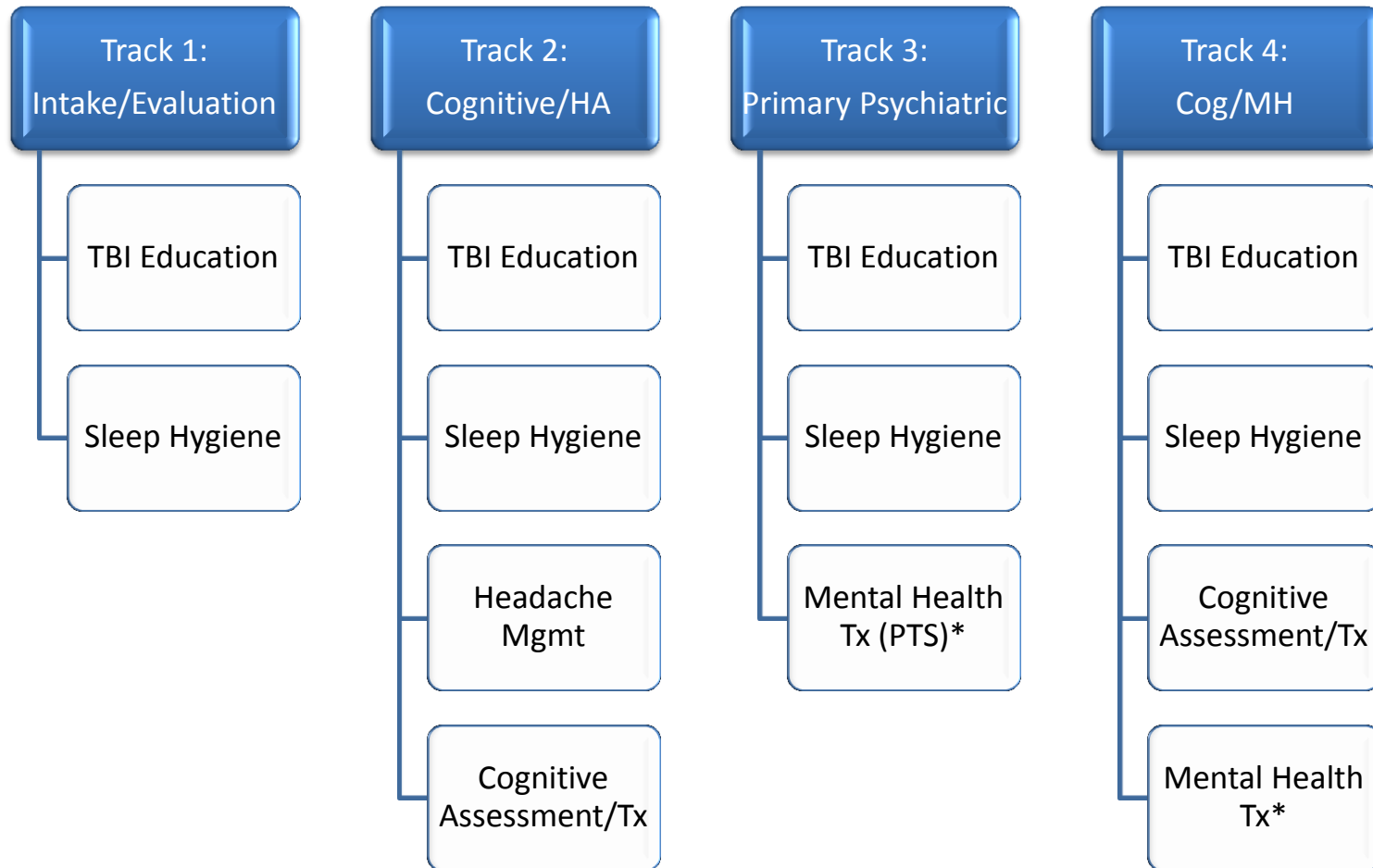
# Treatment Implications



- Development of Treatment Tracks
  - Not every patient needs every specialty service, but most patients require similar services
  - Based on symptomatology at intake, it may be possible to develop broad treatment tracts that meet the needs of most patients while maintain efficient use of resources



# Treatment Pathways



\*Consider referral to primary mental health services



# Treatment Implications



- Continue identification of subtypes
  - Treatment Outcome? Prognosis?
    - Early evidence suggests the Primary Cognitive Group and Mixed Presentation Group have statistically better response to multi-disciplinary TBI treatment.
  - Return to duty rates? Disability?
  - Biomarker differentiation?
- Would empirically based Treatment Tracks improve treatment efficiency and outcome?



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