Neurobiopsychosocial Model of mTBI: Multidimensional Prediction of Risk & Recovery

Multi-Domain Predictor Variables

Neurobiological
- Pre-Injury Factors
  - Genetics
  - Neurologic Vulnerabilities
- Trauma Burden
  - Injury Severity
  - Repetitive Exposure
  - Polytrauma
- Biomarkers
  - Structural/Functional Imaging
  - Blood Biomarkers

Psychosocial
- Psychological Function
  - Premorbid
  - Post-injury Comorbidities
- Environmental Factors
  - Social Support
  - Life Stressors
  - Iatrogenesis
- Motivational Factors
  - Expectation
  - Secondary Gain

Multi-Dimensional Outcome
- Neurologic Health
- Neurocognitive Function
- Neurobehavioral Function
- Psychological Health and Wellness
- Life Function & Quality
Future Directions: 
**Bringing it all Together**

Understanding the True Natural History of Acute Injury & Recovery
Effect Sizes (Cohen’s d) From Day 1-45
165 concussed, 166 controls

Cohen's $d$: 0.8

**Interpretation**

- **Cohen's $U_3$**: 78.81%
- **% Overlap**: 68.92%
- **Probability of Superiority**: 71.42%
- **Number Needed to Treat**: 3.53

[Source](http://rpsychologist.com/d3/cohend/)
Cohen's d: 1.5

Interpretation

- Cohen's U₃: 93.32%
- % Overlap: 45.33%
- Probability of Superiority: 85.56%
- Number Needed to Treat¹: 1.84

http://rpsychologist.com/d3/cohend/
Symptom Tracking Assessment for Concussion (STAC) Mobile App

New app tackles head trauma

By Marie Rohde  March 9, 2016  HEALTH  CHILDREN'S HEALTH

More than 120,000 young athletes experience a sports-related head injury each year. The University of Wisconsin-Milwaukee App Brewery and the Medical College of Wisconsin’s Brain Injury Research Program are partnering on a free smartphone app that helps athletes, parents and coaches deal with head injuries.
What about Youth Athletes?

Which symptom assessments and approaches are uniquely appropriate for paediatric concussion?

G A Gioia, J C Schneider, C G Vaughan, P K Isquith

Pediatric Sport-Related Concussion: A Review of the Clinical Management of an Oft-Neglected Population

Michael W. Kirkwood, PhD; Keith Owen Yeates, PhD; Pamela E. Wilson, MD

*Department of Physical Medicine and Rehabilitation, Children's Hospital, Denver, Colorado; University of Colorado Health Sciences Center, Denver, Colorado; *Department of Pediatrics, Ohio State University, Columbus, Ohio; *Center for Bioengineering, University of Colorado, Denver, Colorado; *Children’s Hospital Colorado, Denver, Colorado

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Psychometric and Measurement Properties of Concussion Assessment Tools in Youth Sports

Tamara C. Valovich McLeod; William B. Barr; Michael McCrea; Kevin M. Guskiewicz

*Arizona School of Health Sciences, A.T. Still University, Mesa, AZ; †New York University School of Medicine, New York, NY; ‡Waukesha Memorial Hospital, Waukesha, WI, and Medical College of Wisconsin, Milwaukee, WI; §University of North Carolina at Chapel Hill, Chapel Hill, NC
Future Directions in TBI Research: Acute Effects, Recovery, & Outcome

TRUE NATURAL HISTORY OF INJURY

Clinical Recovery:
How long does it take for signs & symptoms to recover?

Physiological Recovery:
How long does it take for the brain to recover?

How Long is Long Enough?
New Frontiers in Brain Injury Science

How Long Does it Take for the Brain to Recover?
GE-NFL HEAD HEALTH CHALLENGE I

A Prospective Study of Advanced MRI Biomarkers to Determine Acute Physiological Effects and Longitudinal Recovery After Sport-Related Concussion

**Investigative Team:**
Michael McCrea, PhD (PI)
Andrew Nencka, PhD; Kevin Koch, PhD; L. Tugan Muftuler, PhD; Yang Wang, MD; Shi-Jiang Li, PhD; Melissa Lancaster, PhD; Lindsay Nelson, PhD

How long does it take for the brain to recover?
PROJECT HEAD TO HEAD II

Comprehensive Study of Acute Effects and Recovery After Concussion:


Funded by U.S. Dept. of Defense Combat Casualty Care Research Program

$6M, 4 years
Future Directions

Sponsored by United States Department of Defense (DoD) & National Collegiate Athletic Association (NCAA)

3 Years, $23M
Current Questions in SRC:

**Acute Effects & Recovery**

- **Clinical Recovery:** Why do individuals vary in recovery?
- **Physiological Recovery:** How long does it take for the *brain* to recover?

**Individual Variability:** Who is at risk for prolonged clinical and physiological recovery?

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Giza & Hovda, 2010
Thank You

Lindsay Nelson, PhD
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Brain Injury Research Program
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