Neuropsychological Assessment Issues in MTBI

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Neuropsychology

• Describe and quantify changes in cognition

• Describe and quantify changes in personality

• Describe and quantify changes in emotional functioning and behavior

• Monitor functioning over time
Executive Functions

Attention

Academic Abilities

Working Memory

Intelligence

Speed of Processing

Executive Functions

Motor Functioning

Memory

Somatosensory

Learning

Receptive Language

Spatial

Expressive Language

Abilities Assessed
As Severity Increases, Accuracy Increases

- Mild TBI
- Depression
- ADHD
- Mild Cognitive Impairment / Prodromal Dementia
- Moderate TBI
- Severe TBI
- Frank Dementia (e.g., moderate AD)
Large Right Frontal Contusion
Stroke
Tumor
Brain Tumor
Pick’s Disease
As severity decreases, the ability to accurately identify TRUE/REAL difficulties decreases.
Why?

Signal-Noise Problem

Psychometrics

Confounds

Expertise
Possible Effects on Cognition

Brain Injury

Medication Side Effects

Depression

Cognitive Diminishment

Insomnia

PTSD

Chronic Headaches

Chronic Pain
Factors Affecting Test Performance

- Malingering
- Poor Effort
- Test Anxiety
- Little “Enthusiasm”
- Motivation
- Strengths & Weaknesses
- Cultural Factors/Ethnicity
- English as a Second Language

Low Test Scores
Adverse Neuropsychological Effects

MTBI: 1-3 Months  Cannabis  Cocaine  Meth  ADHD
Adverse Neuropsychological Effects

MTBI: 1-3 Months
Mod-Severe TBI > 2 Years
Litigation
Depression
Malingering
Signal? Overall Effect on Cognition

[Bar chart showing comparisons between different conditions: "Normal", MTBI, Cannabis, Depression, Meth, ADHD. Each condition has a bar representing a metric with error bars indicating variability.]
Psychometrics

- LEAST sensitive tests are MOST reliable

- Many of the MOST sensitive tests have large “margins of error”
How Do You Define Impairment?

• Scores below the 16\textsuperscript{th} percentile (1 SD)?

• Scores below the 10\textsuperscript{th} percentile?

• 5\textsuperscript{th} percentile?

• 2\textsuperscript{nd} percentile (2 SDs)?
Prevalence of Low Scores in Healthy Adults?

- Most neuropsychologists don’t know
- Higher the cut-off, greater the number of low scores
- More tests you give, the more likely you are to get low scores
Neuropsychological Assessment Battery (NAB)

- Takes approximately 3.5 hours to administer
- 24 tests
- 36 Primary Test Scores
- MANY additional test scores
Impairment = 5\textsuperscript{th} Percentile

- What percentage of healthy adults have one or more low scores? 
  70%

- 3 or more? 
  31%

- 5 or more? 
  16%
Impairment < 1 SD
(16th percentile)

• What percentage of healthy adults have one or more low scores?
  92%

• 3 or more?
  66%

• 5 or more?
  44%
Age-Adjusted Normative Scores

- People with less education have more low scores
- African Americans have more low scores than Caucasians
- Many tests are culturally biased
- Some tests have sex effects
What about Intelligence?

- The most sophisticated normative data is adjusted for sex, age, education, and ethnicity
- Good normative data is adjusted for sex, age, and education
- Many normative sets are adjusted for age only
Low NAB Scores: 5\textsuperscript{th} Percentile

- 1 or more low scores
  
  Below Average Intelligence 90%
  Above Average Intelligence 58%

- 5 or more low Scores
  
  Below Average Intelligence 49%
  Above Average Intelligence 4%
Low NAB Scores: 1 SD (16th Percentile)

• 1 or more low scores
  Below Average Intelligence 99%
  Above Average Intelligence 86%

• 5 or more low Scores
  Below Average Intelligence 78%
  Above Average Intelligence 25%
Implications?

• Misdiagnosis of cognitive impairment (false positive)

• “Missed” diagnosis of cognitive impairment (false negative)
Misdiagnosis of Cognitive Impairment

- Longstanding strengths and limitations
- Pre-existing conditions
- Co-occurring conditions
- Confounds (e.g., effort, fatigue, or cultural factors)
- Low scores are common in healthy adults
- Capitalizing on chance findings
Texas Sharpshooter

- Fabled Marksman
- Shoots rifle randomly at barn
- Studies pattern of bullet holes
- Paints a big bullseye around the best cluster
Bullseye Around Low Scores
Low Scores

• Common

• 2-6 low scores typical

• More tests, more low scores

• Common “patterns” are not so common
“Significant” or “Uncommon” Findings

• “Significant” (actually “reliable”) differences between 2 scores are common

• “Uncommon” findings, in isolation, are uncommon

• But when considering all combinations in a battery of tests—uncommon findings are actually common
Why is this so difficult?

• Cognition is “fragile” and difficult to reliably assess

• After a reasonable recovery period, there is a low probability that a person will have significant, reliably-measurable, cognitive deficits
Methodological Issues

• Choice of tests

• Quality normative data

• Number of tests used

• Cutoff score selected for “impairment”
Factors That Can Confound, Mimic, or Obscure

- Race/Ethnicity
- ESL / Acculturation
- Level Intelligence
- Longstanding strengths and weaknesses
- Pre-Existing Conditions
- Co-Occurring Conditions
- Fatigue, level of effort, enthusiasm
- Malingering
Ongoing, Multi-Year Research Program

To develop and evaluate evidence-based, psychometric criteria for the DSM-IV Axis I Diagnosis: Cognitive Disorder NOS (i.e., Mild Neurocognitive Disorder)
Moving Forward

- Try to use neuropsychological testing descriptively
- Use testing in situations where it is most useful (e.g., monitoring acute injuries, assessing effects of serious injuries)
- Be clear about the limitations of the data
- Conduct research designed to improve the sensitivity, specificity, and predictive accuracy of specific test batteries for identifying cognitive impairment
Thank You