Performance Validity Testing and Management of Prolonged Recovery (in Youth)

Michael W. Kirkwood, PhD, ABPP/CN

Background

- Clinical neuropsychologist at Children's Hospital Colorado
- Founded Concussion Program in 2003
  - Pediatric focused
  - Not sport specific (~50% athletes)
  - Interdisciplinary (neuropsychology, sports medicine, rehabilitation medicine, athletic training, psychology, physical therapy, emergency medicine, neurosurgery, etc.)
- Interest in validity testing arose out of concerns that certain kids were not providing adequate effort on neuropsychological exam
  - Using and researching validity tests in kids with mild TBI for last 10 years

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Acknowledgements

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External Mild TBI Collaborators & Influences
- Bill Barr, PhD, ABPP/CN
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- Grant Iwerson, PhD
- Mike McCrea, PhD, ABPP/CN
- Chris Randolph, PhD, ABPP/CN
- Gary Taylor, PhD, ABPP/CN
- Keith Yeates, PhD, ABPP/CN
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- No relevant conflicts of interest
  
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Objective Methods to Detect Noncredible Responding by Examinee

- Performance Validity Tests (PVTs): Used to detect inadequate effort or noncredible performance during testing

- Symptom Validity Tests (SVTs): Used to detect noncredible responding during self-report measures


Relevance

- Over last several decades, noncredible performance has become a major area of focus in psychology/neuropsychology
  
  More than 1,000 scientific articles, 20 comprehensive reviews, a dozen meta-analytic studies, and a dozen textbooks have appeared in adult literature

- Multiple practice organizations have taken position that neuropsychological evaluations should routinely include validity tests

- Two primary areas of relevance for sports settings

1) Baseline testing: Sandbagging

   - Motivation
     
     * Look worse than you are in the preseason in hopes of being allowed to return to play more quickly after concussion
     
     * Reasonably well studied (in older athletes)

2) Post-injury testing

   - Motivation
     
     * Look worse than you are after concussion for any number of reasons…
     
     * Poorly studied in sports setting. Some work with youth generally. Impressively well studied in non-sport settings with adults.
Baseline Testing

- Computerized cognitive baseline testing
  - Popular
  - Controversy around whether adds incremental value or modifies risk (e.g., Randolph, 2011; Randolph v. Lovell, 2011; Echemendia et al., 2013)

- If used, reasons can see invalid or unreliable test scores need to be understood including….
  - Unplanned / unintentional
    - Psychometric properties of the test (Randolph et al., 2005; Mayers & Redick, 2012; Reach et al., 2013)
    - Group size during testing (Moser et al., 2011; Womble et al., 2012)
    - Supervised vs. unsupervised administration (Rohling, 2011)
    - Aspects of the testing environment (e.g., noise level)
  - Planned by examinee
    - Sandbagging

Sandbagging

- Multiple studies have documented evidence of sandbagging using variety of tests across high school, college, and professional athletes (Rohling et al., 2015)

- How often is it seen?
  - 11% - Hunt et al. (2007)
  - 14% - Darby et al. (2011)
  - 11% - Erdal et al. (2012)
  - 12% - Schatz & Glatts (2013)
  - 18% - Szabo et al. (2013)
  - 13% - Hill et al. (2014)

- Using more liberal criteria to determine invalidity (i.e., failure on one PVT rather than multiple)
  - 26% average across studies

Post-injury Testing

- Much of the concussion clinical management literature has focused on injury-related explanations for persistent postconcussive symptomatology
  - Assumption: when problems seen post-injury, neurologically related to the injury

- Yet, methodologically rigorous outcome studies suggest injury-related difficulties for most people are relatively short-lived when evaluated using objective performance-based tests

- Multiple studies have also now highlighted the importance of non-injury variables in understanding subjectively reported symptoms after mild TBI
• One noninjury reason problems persist after mild TBI is noncredible effort on exams and feigned or exaggerated symptom report

• Arguments I’ve heard why this doesn’t matter for cognitive assessment with athletes or kids:
  • athletes are motivated to return to play so don’t provide noncredible effort
  • kids aren’t sophisticated enough to deceive
  • kids wouldn’t deceive a doctor or if they did it would be obvious

Can children deceive?

• Deception not unique to humans, as also occurs widely in plants and nonhuman animals
• Exists because it has had advantages from an evolutionary perspective and has evolved under strong natural selection pressures

Childhood Deception

• Numerous studies indicate deception is common in childhood, especially in school-aged years
• Great deal of experimental work on topic

<table>
<thead>
<tr>
<th>Age (in years)</th>
<th>Developmental Trends in Childhood Deception</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-6</td>
<td>Minimal evidence to suggest deceptive behavior occurs.</td>
</tr>
<tr>
<td>2-5</td>
<td>Across preschool years, deception increases, primarily to deny transgressions. Fairly basic and unsophisticated lies.</td>
</tr>
<tr>
<td>6-12</td>
<td>Deceit grows more common. Underlying skills needed for more sophisticated deception improve. Kids better able to maintain consistency following lies to avoid self-incrimination.</td>
</tr>
<tr>
<td>13-18</td>
<td>More and more sophisticated lies, consistent with ongoing maturation of higher order cognitive abilities. Likely indistinguishable from adult deception in later teen years.</td>
</tr>
</tbody>
</table>

Adapted from:
So, children can deceive. How often do noncredible presentations actually happen in pediatric neuropsychological evaluations?

Commonplace? Uncommon? Rare? Exist at all?

General Pediatric Clinical Case Series

<table>
<thead>
<tr>
<th>Source</th>
<th>Population</th>
<th>N</th>
<th>Age</th>
<th>PVT</th>
<th>% Noncredible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donkers (2005)</td>
<td>Mixed Neuro</td>
<td>100</td>
<td>6 – 16</td>
<td>TOMM</td>
<td>2%</td>
</tr>
<tr>
<td>Carone (2008)</td>
<td>Moderate- Severe Brain Injury</td>
<td>38</td>
<td>(mean: 11.8)</td>
<td>MSVT</td>
<td>5%</td>
</tr>
<tr>
<td>MacAllister, Nakhchiva, Bender, Karantzoulis, &amp; Carlson (2009)</td>
<td>Epilepsy</td>
<td>60</td>
<td>6 – 17</td>
<td>TOMM</td>
<td>3%</td>
</tr>
<tr>
<td>Green et al. (2010)</td>
<td>Mixed Neuro/Dev</td>
<td>380</td>
<td></td>
<td>WMT</td>
<td>5%</td>
</tr>
<tr>
<td>Green et al. (2010)</td>
<td>Mixed Neuro/Dev</td>
<td>265</td>
<td></td>
<td>MSVT</td>
<td>3%</td>
</tr>
<tr>
<td>Kirk, Harris, Hutaff-Lee, Koelmaj, Immink, &amp; Kirkwood (2011)</td>
<td>Mixed Neuro/Dev</td>
<td>100</td>
<td>5 – 16</td>
<td>TOMM</td>
<td>4%</td>
</tr>
<tr>
<td>Brooks (2012)</td>
<td>Mixed Neuro</td>
<td>100</td>
<td>6 – 19</td>
<td>VSVT</td>
<td>5%</td>
</tr>
<tr>
<td>Plotz, Mosiewicz, Kirkwood, Sherman, &amp; Brooks (in press)</td>
<td>Mixed Neuro</td>
<td>266</td>
<td>5 – 18</td>
<td>TOMM</td>
<td>3%</td>
</tr>
</tbody>
</table>

Pediatric Mild TBI

<table>
<thead>
<tr>
<th>Source</th>
<th>Population</th>
<th>N</th>
<th>Age</th>
<th>PVT</th>
<th>% Noncredible Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children’s Hospital Colorado</td>
<td>All Cause Mild TBI / Concussion (clinical)</td>
<td>1500+ total</td>
<td>8 – 17</td>
<td>MSVT + TOMM Rey FIT Various embedded measure</td>
<td>12 – 19% No difference between sport and nonsport etiology</td>
</tr>
<tr>
<td>Kirkwood &amp; Kirk (2011); Kirkwood et al. (2011); Kirkwood et al. (2012); Kirkwood et al. (2013); Baker et al. (2013); Green et al. (2014); Kirk et al. (2014); Kirkwood et al. (2014)</td>
<td>All Cause Mild TBI / Concussion (clinical)</td>
<td>382</td>
<td>8 – 16</td>
<td>RD6 Digit Span</td>
<td>20% No difference between sport and nonsport etiology</td>
</tr>
</tbody>
</table>
Multiple studies with adults indicate performance on PVTs has significant effect on other tests
- Green et al., 2001; Constantinou et al., 2005; Green, 2007; Lange et al., 2010; Meyer et al., 2011
- In mostly compensation-seeking samples, ~50% variance in neuropsychological test scores explained by PVT performance
- Much more variance than explained by brain injury severity, education, age, etc.

No historic studies in pediatric populations: similar effect?
- Examined in Children's Hospital Colorado mild TBI dataset
- PVT performance accounted for ~40% of the variance on abbreviated neuropsychological battery

### Validity test failure in pediatric sample

**SO WHAT?**

- Multiple studies with adults indicate performance on PVTs has significant effect on other tests
  - Green et al., 2001; Constantinou et al., 2005; Green, 2007; Lange et al., 2010; Meyer et al., 2011
  - In mostly compensation-seeking samples, ~50% variance in neuropsychological test scores explained by PVT performance
  - Much more variance than explained by brain injury severity, education, age, etc.

**No historic studies in pediatric populations: similar effect?**
- Examined in Children's Hospital Colorado mild TBI dataset
- PVT performance accounted for ~40% of the variance on abbreviated neuropsychological battery

### The Implications of Symptom Validity Test Failure for Ability-Based Test Performance in a Pediatric Sample

<table>
<thead>
<tr>
<th>Background and Injury Characteristics of All Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Age (yrs)</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Education</td>
</tr>
</tbody>
</table>

### Support for idea PVT measures effort rather than ability

- No background or injury-related variable differentiated those who passed from those who failed including sport vs. nonsport

### Table 5: Descriptive Statistics and Comparisons Between Medical Symptom Validity Test Pass and Fail Groups on Ability-Based Tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean Pass</th>
<th>SD Pass</th>
<th>Mean Fail</th>
<th>SD Fail</th>
<th>t-value</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAIS Full Scale IQ</td>
<td>75.3</td>
<td>10.6</td>
<td>76.5</td>
<td>10.9</td>
<td>-0.25</td>
<td>6.75</td>
<td>0.00</td>
</tr>
<tr>
<td>Similarities T score</td>
<td>140.2</td>
<td>13.6</td>
<td>140.5</td>
<td>14.0</td>
<td>-0.15</td>
<td>5.25</td>
<td>0.00</td>
</tr>
<tr>
<td>Picture Arrangement score</td>
<td>6.4</td>
<td>0.9</td>
<td>6.4</td>
<td>0.9</td>
<td>-0.01</td>
<td>0.05</td>
<td>1.00</td>
</tr>
<tr>
<td>Digit Symbol Test (DST)</td>
<td>86.8</td>
<td>8.9</td>
<td>87.0</td>
<td>8.8</td>
<td>-0.20</td>
<td>5.45</td>
<td>0.00</td>
</tr>
<tr>
<td>Letter-Number Test (LNT)</td>
<td>76.2</td>
<td>10.2</td>
<td>76.5</td>
<td>10.5</td>
<td>-0.28</td>
<td>6.75</td>
<td>0.00</td>
</tr>
<tr>
<td>Vocabulary Test</td>
<td>111.7</td>
<td>14.9</td>
<td>111.9</td>
<td>15.0</td>
<td>-0.25</td>
<td>5.75</td>
<td>0.00</td>
</tr>
<tr>
<td>Information G-Scale</td>
<td>38.3</td>
<td>7.2</td>
<td>38.5</td>
<td>7.3</td>
<td>-0.26</td>
<td>5.75</td>
<td>0.00</td>
</tr>
<tr>
<td>Information L-Scale</td>
<td>38.0</td>
<td>7.3</td>
<td>38.2</td>
<td>7.4</td>
<td>-0.19</td>
<td>5.35</td>
<td>0.00</td>
</tr>
<tr>
<td>Letter-Number Reading Test</td>
<td>53.4</td>
<td>6.4</td>
<td>53.6</td>
<td>6.5</td>
<td>-0.24</td>
<td>5.45</td>
<td>0.00</td>
</tr>
<tr>
<td>Digit Symbol Test</td>
<td>56.2</td>
<td>5.8</td>
<td>56.5</td>
<td>6.0</td>
<td>-0.30</td>
<td>5.95</td>
<td>0.00</td>
</tr>
<tr>
<td>Coding Test</td>
<td>16.8</td>
<td>2.1</td>
<td>16.9</td>
<td>2.2</td>
<td>-0.30</td>
<td>5.95</td>
<td>0.00</td>
</tr>
<tr>
<td>Sentence Comprehension Test</td>
<td>43.0</td>
<td>5.7</td>
<td>43.2</td>
<td>5.8</td>
<td>-0.32</td>
<td>6.05</td>
<td>0.00</td>
</tr>
<tr>
<td>Paced Auditory Serial Reaction</td>
<td>24.4</td>
<td>3.0</td>
<td>24.6</td>
<td>3.1</td>
<td>-0.65</td>
<td>11.45</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Implications

• Research
  - No identified pediatric mild TBI outcome study has used PVTs
  - Raises questions about previous studies that have documented persistent postconcussive cognitive deficits or cases of "postconcussion syndrome"

• Clinical
  - Noncredible presentations occur in children and teens
  - Need to be considered as one possible factor (among many) in the face of persistent problems after concussion, including sport-related concussion

Why do youth provide noncredible effort?

• Largely unexplored in the pediatric literature
• Compensation-seeking behavior is the most often discussed reason adults provide noncredible effort
• Many fewer children are apt to display biased responding for compensation specifically
• Innumerable other external and psychological incentive scenarios still exist including
  - change sport or social situation
  - avoid school/homework
  - get extra assistance school/mental health
  - change family dynamics
  - etc., etc., etc.
• How to manage youth who display prolonged recovery after concussion?
• It's as easy as figuring out…..

Complexity facing practitioners in the face of lingering postconcussive problems

Adapted from Iverson et al. (2008)

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