Introduction to Neuropsychological Assessment & Psychometrics

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Neuropsychiatry and Behavioral Medicine
Neuropsychology Clinical Training Seminar (NCTS)

Learning Goals

• What is clinical neuropsychology?
• Who is a clinical neuropsychologist?
• What is the purpose of an NP evaluation?
  – Common referral questions
• Components of an NP Evaluation
  – What are we measuring?
• Standardized Testing & Scoring Procedures
  – What is a normative score?
  – Why use normative scores?
  – Score conversion
  – Defining “impairment”
• Words of Caution

What is Clinical Neuropsychology?

• “A specialty in professional psychology that is dedicated to enhancing the understanding of brain-behavior relationships and the application of such knowledge to human problems (American Psychological Association, 2010).

• “Clinicians who specialize in the assessment, diagnosis, treatment, and/or rehabilitation of patients across the lifespan with neurological, medical, neurodevelopmental and psychiatric conditions, as well as other cognitive and learning disorders. The clinical neuropsychologist uses psychological, neurological, cognitive, behavioral, and physiological principles, techniques and tests to evaluate patients’ neurocognitive, behavioral, and emotional strengths and weaknesses and their relationship to normal and abnormal central nervous system functioning (National Academy of Neuropsychology, 2001).

• “Applied science concerned with the behavioral expression of brain dysfunction” (Lezak, 2004)

The Study of...

Behaviour

Cognition

Emotion
Who is a Clinical Neuropsychologist?

- Houston Conference Guidelines on Specialty Education and Training in Clinical Neuropsychology
- Licensed psychologist who:
  - Has completed requisite training which includes:
    - Doctoral degree in psychology from an accredited university
      - Appropriate coursework; including brain-behavior relationships and assessment
    - Internship in a clinically relevant area of professional psychology
      - “Percentage of time in clinical NP should be determined by the training needs of the individual”
    - 2 years of additional specialized training in clinical neuropsychology (i.e., post-doctoral fellowship)
    - Optional: Attainment of the ABCN/ABPP Diploma in Clinical Neuropsychology (i.e., board certification)

- Often work within interdisciplinary context with:
  - Neurologists
  - Neurosurgeons
  - Neuroradiologists
  - Neuropsychologists
  - Psychiatrists
  - Psychiatrists & rehabilitation providers

How did CN come to be?

CLINICAL NEUROPSYCHOLOGY
+ PSYCHOLOGY
  - Cognitive/Intelligence Movement
  - Personality Testing/Gestalt Psychology

What is the Purpose of an NP Evaluation?

Lezak:
1) Diagnosis
2) Patient care & planning
3) Treatment 1 – tx planning & remediation
4) Treatment 2 – tx evaluation
5) Research
6) Forensic CN
Common Referral Questions…

• **Learning and development**: Does this patient have a developmental disorder affecting learning? If so, how can we help him to circumvent these weaknesses and provide the best learning environment for success?

• **Traumatic brain injury**: What are the enduring effects of an injury and what treatment might help?

• **Memory and aging**: Is this normal age-related change or a disease? Or is it something else?

• **Changes in personality and behavior**: Are these symptoms of a psychiatric disorder or do they signify a brain-related/neurological syndrome?

• **For litigation purposes**: whether a person’s cognitive problems are a consequence of some kind of accident?

Components of an NP Evaluation

• **Clinical interview**
  – History of presenting problem
  – Cognitive complaints
  – Functional changes
  – Insight?
  – Medical & psychiatric history
  – Developmental history
  – Social, educational, & occupational history

• **Neuropsychological testing**

• **Other**:
  – Subjective self-report questionnaires
  – Collateral information (e.g., family member’s report)

Two Perspectives

• **Normative assessment**
  – Involves the comparison of the patient’s performance against the general population
  – Goal to investigate/diagnose a problem

• **Individual assessment**
  – Involves serial assessment
  – Goal to measure changes within the individual’s functioning

What are we measuring?

• **Premorbid/ Baseline Estimate**
• **Orientation/ Arousal**
• **IQ**
  – Verbal Comprehension
  – Perceptual Reasoning
• **Attention & processing speed**
  – Simple/ immediate
  – Complex (working memory, sustained, divided, selective)
• **Language**
  – Expressive
  – Receptive
• **Visuospatial functions**
  – Perceptual
  – Synthesis
  – Construction
What are we measuring?

- Sensory-motor functioning
  - Speed/dexterity
  - Strength
  - SPE
  - Motor programming/praxis
- Memory
  - Verbal/visual
  - Learning/recall/ recognition
- Executive functioning
  - Abstract reasoning/problem solving
  - Set-switching/mental flexibility
  - Inhibition
  - Judgement/insight

What are We Measuring?

- Personality & emotional functioning
  - Depression
  - Anxiety
  - Psychosis
  - Sexual behavior
  - Aggression
  - Emotional lability/affect
  - Social propriety/interpersonal sensitivity
  - Motivation/apathy
- Effort/Symptom Validity Tests
  - Cognitive
  - Emotional/psychiatric
  - Exaggeration vs. feigning vs. poor effort

Standardized Testing Procedures

- What does “standardized” mean?
  - Questions, testing conditions, scoring procedures, and interpretations are consistent
  - Administered and scored in a predetermined, standard manner
- Why is this important?
  - Ensures objective results (not subjective)
  - Increases reliability
  - Inter-rater, test-retest
- Why is this problematic?
**Education Coding Rules**

- **High School:**
  - If not completed high school code total number of years completed (0-11); if over 11, code 11.
  - If graduated high school code 12 (regardless of number of years required to do so).
  - If G.E.D. code number of years in school completed (0-11) and mark G.E.D.

- **Junior College:**
  - 2 or more years completed code 14. AA degree not necessary.
  - Maximum of 14 years can be completed at a Junior College.

- **4-year College or University:**
  - If not graduated, code years completed up to 15.
  - If graduated, code 16.

- **Masters:**
  - If at least one year completed, but not graduated, code 17.
  - If graduated with Masters, code 18.

- **Doctoral degree (Ph.D., M.D., D.V.M., D.D.S.):**
  - If no Masters and 2 or > years in doctoral degree program without completion, code 17.
  - If person has Masters degree and at least one additional year, but doctoral degree has not been completed code 19.
  - If doctoral degree completed code 20.
  - If J.D. code 19, unless specialized post-J.D. training then code 20.

> Nursing, vocational, and technical schools do not count—we consider only years of academic education.

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**Score Conversion**

- A standard (normative) score is a measurement that reflects how far away a person's score is from the population mean (average)

\[
\text{Standard Score} = \frac{\text{Raw Score} - \text{Mean Score}}{\text{Standard Deviation}}
\]

**Example (19 year old)**

- **Trails A = 30”**
  \[
z = \frac{(30 - 22.93)}{6.87} = 1.03^*
\]

- **Trails B = 40”**
  \[
z = \frac{(40 - 48.97)}{12.69} = -0.71^*
\]
Using the Heaton Norms

- Raw Score
- Raw Score to Scaled Score (Appendix C)
- Scaled Score to Demographically Adjusted Score (Appendices D & E)
  - Race (Caucasian in "D"; African American in "E")
  - Sex
  - Education
  - Age

Defining “Impairment”

- Arbitrary criterion
  - 1.0, 1.5, or 2.0 SD’s from mean
  - False positives vs. false negatives
- Estimates of premorbid functioning are important to consider
- Consider the pattern of performance
- Consider the base rate of a score/discrepancy
  - Probability estimates
  - Example: If 1% of the public were “medical professionals”, and 99% of the public were not “medical professionals”, then the base rate of medical professionals is simply 1%.
  - Think about statistical significance vs. clinical significance

Qualitative Descriptions

<table>
<thead>
<tr>
<th>T-Score</th>
<th>Behavioral Descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 55</td>
<td>Above Average</td>
</tr>
<tr>
<td>45 – 54</td>
<td>Average</td>
</tr>
<tr>
<td>40 – 44</td>
<td>Low average</td>
</tr>
<tr>
<td>35 – 39</td>
<td>Mildly Impaired</td>
</tr>
<tr>
<td>30 – 34</td>
<td>Mildly to Moderately Impaired</td>
</tr>
<tr>
<td>25 – 29</td>
<td>Moderately Impaired</td>
</tr>
<tr>
<td>20 – 24</td>
<td>Moderately to Severely Impaired</td>
</tr>
<tr>
<td>&lt; 20</td>
<td>Severely Impaired</td>
</tr>
</tbody>
</table>

Nonparametric Distributions

- Score distributions can be markedly skewed
  - Ceiling effects (Digit span)
  - Floor effects (Trails)
- Weight of scores at the far end of a distribution becomes greatly exaggerated, resulting in overblown SD’s
  - When SD’s are too large, performances that would appear to be “impaired” can actually be “within normal limits”
- One solution: use percentiles (consider 5th %ile as boundary for abnormality)
  - Note: percentiles (ranks) are not the same as percent (correct)
### Words of Caution

- Do not confound performance with ability
- A test score can be “impaired” for many different reasons
  - Observations & errors can be very informative
  - Caution against over-interpreting or falling victim to subjectivity
- Consider intra-individual variability
  - 15% of healthy controls may have at least 1 impaired score
- Consider the predictive and/or ecological validity of test data
- Do not over-generalize
- False negatives can happen
- Confirmatory bias
- INTEGRATE your data
  - Interview, observation, test scores, clinical history
  - Don’t over- or -under interpret salient information

### From start to finish…

1. Receive referral
2. Conduct NP evaluation
3. Score results from evaluation
4. Score conversion
   - Raw scores → standard scores → qualitative descriptions
5. Write report & summarize results
6. Make recommendations
   - Safety
   - Medical
   - Housing & future care
   - Finances & IADL’s
   - Psychiatric
   - Substance Use
   - Speech therapy? Physical/Occupational therapy?
   - Cognitive rehabilitation?
   - Support groups? Caregiver resources?