The Use of Brief Assessment Batteries in Multiple Sclerosis

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History of Cognitive Studies in MS

- Since MS is a CNS disorder is there a cognitive component
- What is the severity
- With what frequency does it occur
- Is there a particular pattern or presentation
- Does the pattern or severity vary with subtype of course
Clinical Questions

- Who needs to be assessed
- What cognitive domains need to be covered
- With what frequency should the assessments take place
- Strategies for assessment related to purpose

  - **Comprehensive**: Assessment for rehabilitation, benefits, vocational planning
  - **Detection**: Identification of individuals showing deficits
  - **Monitoring**: Assessing cognitive changes as a treatment outcome

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Neurocognitive Assessment as Review of Systems

- Neurologic
- Musculoskeletal
- Cardiovascular
- Respiratory
• GI
• GU
• Integumentary (skin)
• (Pain)

• Attention
• Immediate memory
• Sustained focused
• Working memory
• divided
• Memory
• Learning
• Recall
• Recognition
• Language
• Fluency
• Comprehension
• Repetition
• Problem Solving
• Executive Functioning
• Processing Speed

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Strategy

• If you have a population where ~50% of the patients may have problems does it make
sense to screen first before embarking on a comprehensive exam?
- Is there sufficient consistency in deficits to permit short screening approaches?
- Can short batteries be used to monitor treatment progression and outcome?

Characteristics of a Screening Examination

- Brief
- Inexpensive
- Sample pertinent disease parameters (domains, constructs, predictability)
- Balance Sensitivity and Specificity
- Sensitivity: ability to make correct identification
- \( (\text{detect true positives}) \)
- Specificity: ability to not identify everything else in the process
- \( (\text{minimize false positives}) \)
Characteristics of a Screening Examination: for sequential monitoring

- Brief
- Inexpensive
- Sample pertinent disease parameters
- Balance Sensitivity and Specificity
- *Repeatable with methods of identifying meaningful change*

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Screening Approaches

- MSNQ (MS Neuropsychological Screening Questionnaire)
- MMSE (Mini Mental Status Examination)
- *BRB-N (Brief Repeetable Battery-Neuropsychological)*
- BNPB (Brief Neuropsychological Battery)
- SEFCI (Screening Examination for Cognitive Impairment)
- RBANS (Repeatable Battery for the
Assessment of Neuropsychological Status

- BSB (Basso Screening Battery)
- MACFIMS (Minimal Assessment of Cognitive Function in MS)
- ANAM (Automated Neuropsychological Assessment Metrics)

Dimensions for Battery Review

- Time
- Yield
- Repeatability
- Sensitivity/Specificity

MSNQ
MS Neuropsychological Screening Questionnaire

- Time
  - 5 min (patient and informant)
- Yield
- Reported symptoms of cognitive and
behavioral problems

- Repeatability
- Utility as change measure not established
- Sensitivity/Specificity (Informant)\(^1\)
  - Sensitivity: .83
  - Specificity: .97


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**MMSE**

Mini Mental Status Examination

- Time
  - 5-10 minutes
- Yield
  - Global summary score
- Repeatability
  - Single form
- Sensitivity/Specificity\(^1\)
  - Sensitivity: 21-36% MS
  - Generally poor with specific or subcortical lesions
  - Specificity: 89-100%
BRB-N
Brief Repeatable Battery-Neuropsychological

- Time
  - 30-35 minutes
- Yield
  - Selective Reminding, 10/36 Spatial Recall, PASAT, Digit Symbol Modalities, COWA
- Repeatability
  - Some measures have alternative forms
  - Not all alternate forms are equivalent

BRB-N
Brief Repeatable Battery-Neuropsychological

- Sensitivity/Specificity (memory)
  - Sensitivity: 93%
Specificity: 48%

Sensitivity

1+ impaired tests: 41.9%

2+ impaired tests: 16.2%

Performance and performance changes correlated with MRI findings


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BNPB

Brief Neuropsychological Battery

- Time
- 20 min
- Yield
- Selective Reminding, 7/24 Spatial Recall, PASAT, COWA
- Repeatability
- Alternate forms available for most measures

Sensitivity/Specificity

- Sensitivity: 71%¹
- Specificity: 94%

- Sensitivity: 68%²
- Specificity: 85%


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SEFCI
Screening Examination for Cognitive Impairment

- Time
  - 20-30 min

- Yield
  - List learning and recall, Symbol Digit Modalities, Shipley ILS

- Repeatability

- Alternate forms not available for all measures

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SEFCI
Screening Examination for Cognitive Impairment

- Sensitivity/Specificity
  - 86% : 1+ cog measure
  - 100%: 3+ cog domains
90%: 0 cog domains

Sensitivity/Specificity^2
- Sensitivity: 74-86%
- Specificity: 90-91%

Sensitivity^3
- 1+ impaired tests: 31.5%
- 2+ impaired tests: 18.5%


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RBANS
Repeatable Battery for the Assessment of Neuropsychological Status

- Time
- 25 Minutes
- Yield
- Index scores
- Individual test norms now available
- Repeatability
- 2 alternate forms
- Supplemental release contains change score information
- Sensitivity/Specificity^1
BSB

Basso Screening Battery

- Time
  - 20 min
- Yield
  - Logical Memory, COWA, Seashore Rhythm, graphesthesia, stereognosis
- Repeatability
- No alternate form for memory measure
- Sensitivity/Specificity\(^1\)
  - Sensitivity: 100% (not independent of criterion)
  - Specificity: 80% (not independent of criterion)

MACFIMS
Minimal Assessment of Cognitive Function in MS

- Time
- 90 Min
- Yield
- Working Memory, Processing Speed, Learning/Memory, Executive Functioning, Perception/Spatial Processing, Word Fluency
- Repeatability
- Alternate forms available for most measures
- Sensitivity/Specificity


ANAM
Automated Neuropsychological Assessment Metrics

- Time
- ~25 Minutes
- Yield
Scores related to processing speed/attention, working memory, memory, executive fx
Repeatability
Multiple computer produced forms
Sensitivity/Specificity

Time 1
Sensitivity: 87.5%
Specificity: 97.5

Time 2
Sensitivity: 85.7%
Specificity: 100%


Sensitivity in Early MS

Classification Agreement MS Patients: Time 1

Computerized Tests

Intact
Impaired

Percent Correct

Traditional Measures

Intact

39

1

97.5

Impaired

1

7

87.5

Overall Rate

95.8
Classification Agreement MS Patients: 6 Month Follow-up

Computerized Tests

Intact

Impaired

Percent Correct

Traditional Measures

Intact

29

0

100

Impaired

1

6

85.7
Overall Rate

97.2

Attention/Processing Construct Validity: Correlation of indicator tests with latent construct

Working Memory Construct Validity: Correlation of indicator tests with latent construct

DS Back
LNS Tot
Math
TP
Arith Tot

Note. Arith Tot = Wechsler Adult Intelligence Scale- III (WAIS-III) arithmetic total score. DS Back = WAIS-III digit span backward. LNS Tot = WAIS-III letter-number sequencing total score. Math TP = ANAM Math TP score.

Working Memory

Construct Validity - Working Memory

N = 65. $c^2(2)=1.94$, GFI = 0.99, RMSEA = .00

Brief NP Assessment-Kane
<table>
<thead>
<tr>
<th>DS Back</th>
<th>LNS Tot</th>
<th>RM TP</th>
</tr>
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<tbody>
<tr>
<td>.</td>
<td>81</td>
<td>60</td>
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<tr>
<td>.</td>
<td>56</td>
<td>63</td>
</tr>
</tbody>
</table>

**Arith Tot**

Note. Arith Tot = Wechsler Adult Intelligence Scale-III (WAIS-III) arithmetic total score. DS Back = WAIS-III digit span backward. LNS Tot = WAIS-III letter-number sequencing total score. RM TP = ANAM Running Memory TP score.

**Working Memory**
Construct Validity - Working Memory

\[ N = 65. \ c^2(2)=1.31, \ GFI = 0.99, \ RMSEA=.00 \]

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Note. CVLT

\[ \text{Sav} = \text{California Verbal Learning Test savings score}; \ \text{HS Loss} = \]

Heaton Story percentage loss

\[ \text{T-score}; \ \text{HF Loss} = \]

Heaton Figure percentage loss T-score; MTS

\[ \text{TP} = \]

WinSCAT Matching to sample

throughput.

CVLT

Sav

HS Loss

HF Loss

MTS

TP

Memory
Memory Construct in a Clinical Sample Matching to Sample Throughput

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Remote ANAM

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Reliable Change Index (RCI)

- RCI = (postest – baseline) / SE_{meas}
- Where SE_{meas} = sd_{baseline} * sqrt(1-r_{xx})
- r_{xx} is the reliability of the measure
- Baseline = sd of last three trials prior to observations of interest
- Assumption: Once stable baseline has been attained, differences among an individual’s scores are due to measurement error
- Changes significantly greater than measurement error reflect true change (<= 95% confidence interval)

Summary
· Compelling reasons to make neurocognitive assessment more obtainable
· Data support the focus on using brief screens to identify individuals in need of further assessment
· Focus should also be on patient monitoring
· Selecting measures that are repeatable
· Developing good procedures for assessing change