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The Use of Brief Assessment Batteries in Multiple Sclerosis

Robert L. Kane, Ph.D. ABPP-Cn

Assoc. Director Communications

VA MSCE East

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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

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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?

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Characteristics of a Screening Examination

- Brief
- Inexpensive
- Sample pertinent disease parameters (domains, constructs, predictability)
- Balance Sensitivity and Specificity
- Sensitivity: ability to make correct identification
- (*detect true positives*)
- Specificity: ability to not identify everything else in the process
- (*minimize false positives*)

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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 Repeatable 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)

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Dimensions for Battery Review

- . Time
- . Yield
- . Repeatability
- . Sensitivity/Specificity

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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

[1] Benedict R et al (2003) Mult Scler. V9 95-101

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MMSE

Mini Mental Status Examination

- . Time
- . 5-10 minutes
- . Yield
- . Global summary score
- . Repeatability
- . Single form
- . Sensitivity/Specificity¹
- . Sensitivity: 21-36% MS
- . Generally poor with specific or subcortical lesions
- . Specificity: 89-100%

- [1] Fischer JS (2001) in SD Cook (Ed) Handbook of MS 3rd ed.

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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
-

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BRB-N

Brief Repeatable Battery-Neuropsychological

- Sensitivity/Specificity (memory)
- Sensitivity: 93%¹

- Specificity: 48%
- Sensitivity
- 1+ impaired tests: 41.9%²
- 2+ impaired tests: 16.2%
- Performance and performance changes correlated with MRI findings³

[1] Dent A & Lincoln NB (2000) Br J Clin Psychol v39 p. 311-5

[2] Solari A. et al. (2002) Mult Scler v8 p. 169-76

[3] Hohol MJ et al (1997) Arch Neurol v54 p. 1018-25

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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%

[1] Rao SM et al. (1991) Neurology v41 p.685-91

[2] Fischer JS (2001) in SD Cook (Ed) Handbook of MS 3rd ed.

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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/Specificity¹
- 86% : 1+ cog measure
- 100%: 3+ cog domains

- 90%: 0 cog domains
- Sensitivity/Specificity²
- Sensitivity: 74-86%
- Specificity: 90-91%
- Sensitivity³
- 1+ impaired tests: 31.5%
- 2+ impaired tests: 18.5%

[1] Beatty WW et al (1995) Neurology v45 p. 718-23

[2] Fischer JS (2001) in SD Cook (Ed) Handbook of MS 3rd ed

[3] Solari et al (2002) Mult Sclr v8 p. 169-76

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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/Specificity¹

- . =MMSE
- . <BNPB
- . <SEFCI

[1] Aupperle RL et al. (2002) Mult Sclr v8 p. 382-9

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BSB

Basso Screening Battery

- . Time
- . 20 min
- . Yield
- . Logical Memory, COWA, Seashore Rhythm, graphesthesia, stereognosis
- . Repeatability
- . No alternate form for memory measure
- . Sensitivity/Specificity¹
- . Sensitivity: 100% (not independent of criterion)
- . Specificity: 80% (not independent of criterion)

[1] Basso MR et al. (1996) Arch Neurol v53 p. 980-4

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

Benedict RHB et al (2002) Clin Neuropsychol v16 p. 381-397

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/Specificity¹
- Time 1
- Sensitivity: 87.5%
- Specificity: 97.5
- Time 2
- Sensitivity: 85.7%
- Specificity: 100%

[1] Wilken J et al. (2003) Mult Sclr v9 p. 119-27

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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

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

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

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DS Back

LNS Tot

Math

TP

•
85

•
49

•
71

•
76

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

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

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DS Back

LNS Tot

RM TP

.

81

.

60

.

56

.

63

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

$N = 65$. $\chi^2(2) = 1.31$, $GFI = 0.99$, $RMSEA = .00$

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Note. CVLT

Sav = California Verbal Learning Test savings score; HS Loss =

Heaton Story percentage loss

T-score; HF Loss =

Heaton Figure percentage loss T-score; MTS

TP =

WinSCAT Matching to sample

throughput.

CVLT

Sav

HS Loss

HF Loss

MTS

TP

Memory

•

52

•

.47

•

42

•

51

$n = 66$ $\chi^2(2)=1.15$, GFI = .99. RMSEA=.00

Memory Construct in a Clinical Sample Matching to Sample Throughput

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Remote ANAM

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Reliable Change Index (RCI)

- $RCI = (\text{posttest} - \text{baseline}) / SE_{\text{meas}}$
- Where $SE_{\text{meas}} = sd_{\text{baseline}} * \sqrt{1 - r_{XX}}$
- 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 ($\leq 95\%$ confidence interval)

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Number of Significant Changes to RCI

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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