

Neuropsychological Testing Methods

in

ECT Studies

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Introduction to Talking Texan

“Y’all” = YOU + ALL

Means “you,” singular or plural

e.g., “Y’all going to the movie?”

Introduction to Talking Texan

When addressing a LARGE group, use:

“All- y’all”

Goals for talk: I

NACT Theme: *ECT och kognition*

- Review common neurocognitive measurement tools
 - Used in ECT studies and clinical practice
 - Discussed in talks at NACT conference
 - To provide a concrete reminder of what we are doing to measure cognition

Goals for talk: II

Review factors relevant to neurocognitive:

- Test selection
- Test administration & scoring
- Test interpretation
- Effects of depression
- Future directions in assessment

Neuropsychological Assessment

- Examination of brain-behavior relationships
- Measurement of cognitive abilities
- Involves principles of neurology, psychology, cognitive neuroscience
- Impact of cognitive dysfunction

Neurocognitive Assessment

- Quantifiable samples of cognition
 - Standardized tests
 - Valid & Reliable
- Regional sensitivity*
- Most sensitive means of assessing human cognition

Utility of Objective Cognitive Assessment

- Demonstrate functional implications of neuropsychiatric syndromes, brain lesions
- Document level of functioning
- Identify cognitive strengths & weaknesses
- Identify changes over time
- Assist with differential diagnosis
- Assessment of Rx effects (ECT, meds, surg)

Neuropsychological Testing

- Accepted as appropriate neurodiagnostic procedure
- Class II evidence to support
 - Critical in epilepsy surgery patients
 - Useful in suspected dementia, MS, PD, TBI, stroke, and HIV encephalopathy

Neuropsychiatry & Behavioral Neurology Training Requires Familiarity with:

1. The content, sensitivity, and specificity of neuropsychological assessment methods (e.g. fixed assessment batteries, flexible batteries, projective testing, personality assessment tools).

Neuropsychiatry & Behavioral Neurology Training Requires Familiarity with:

2. The influence of age, education, cultural background, fatigue, drugs, sensory impairment, and primary psychiatric illness on test performance.

Neuropsychiatry & Behavioral Neurology Training Requires Familiarity with:

3. The role of and indications for neuropsychological testing in evaluation and treatment planning related to neurobehavioral and neuropsychiatric disorders.

Neuropsychiatry & Behavioral Neurology Training Requires Familiarity with:

4. The relationship between neuropsychological test results and bedside or office-based screening mental status examinations.

Neuropsychiatry & Behavioral Neurology Training Requires Familiarity with:

5. The anatomical and disease correlates of neuropsychological test abnormalities.

Joint Advisory Committee on Subspecialty Certification of the American Neuropsychiatric Association and The Society for Behavioral and Cognitive Neurology. J Neuropsychiatry Clin Neurosci, 2006, 18, 6-13.

Interpretation of neurocognitive tests

- Demographic influences
- Psychometric properties
- Traditional “cutoff” scores
- Level of performance
- *Pattern* of performance

Neurocognitive Domains

- Global Functioning / IQ
- Language
- Visuospatial
- Attention/ Concentration
- Learning & Memory
- Executive Functioning

Neurocognitive Testing

- Question-answer, pencil-paper tasks (some computerized)
- Samples of cognitive ability
- *Indirect* measures of brain function
 - Require effort & cooperation
 - Standard administration & scoring
 - Careful interpretation
 - Regional sensitivity*

Neurocognitive Evaluation vs. Cognitive Screening

- Neuropsychological evaluation represents the most sensitive means of assessing human cognition.
- Cognitive screening attempts to approximate this, albeit to a limited extent.

Common Cognitive Screening Tools

- **MMSE** (Folstein et al, 1975)
- **Mini-Cog** (Borson, et al., 2000)
- **MoCA** (Nasreddine, 2004)
- **ADAS-Cog** (Rosen et al., 1984)
- **Short Test of Mental Status** (Kokmen et al., 1987)
- **Memory Impairment Screen** (Buschke et al., 1999)
- **7 Minute Screen** (Solomon et al., 2000)
- **Six Item Screener** (Callahan et al., 2002)
- **GPCOG** (Brodaty et al, 2002)

Cognitive Screening Example: MMSE

• Orientation	10
• Registration	3
• Attention	5
• Recall of 3 items	3
• Language	8
• Copying	1
• Total	30

MMSE Sensitivity derives from:

1. Orientation to time, place
2. 3 Word Recall

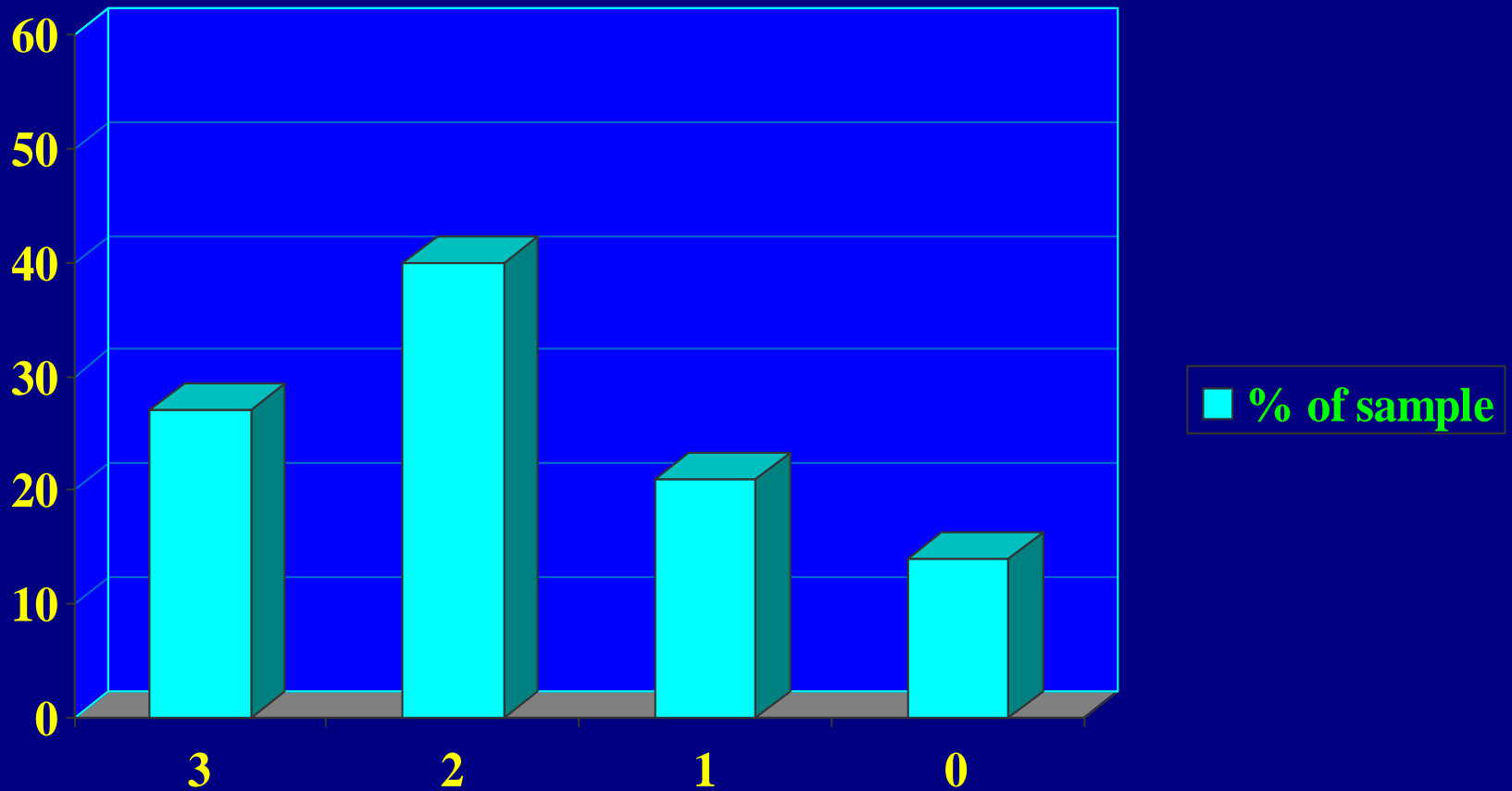
How reliable are these tasks?

3 Word Recall Study

Cullum et al., 1993

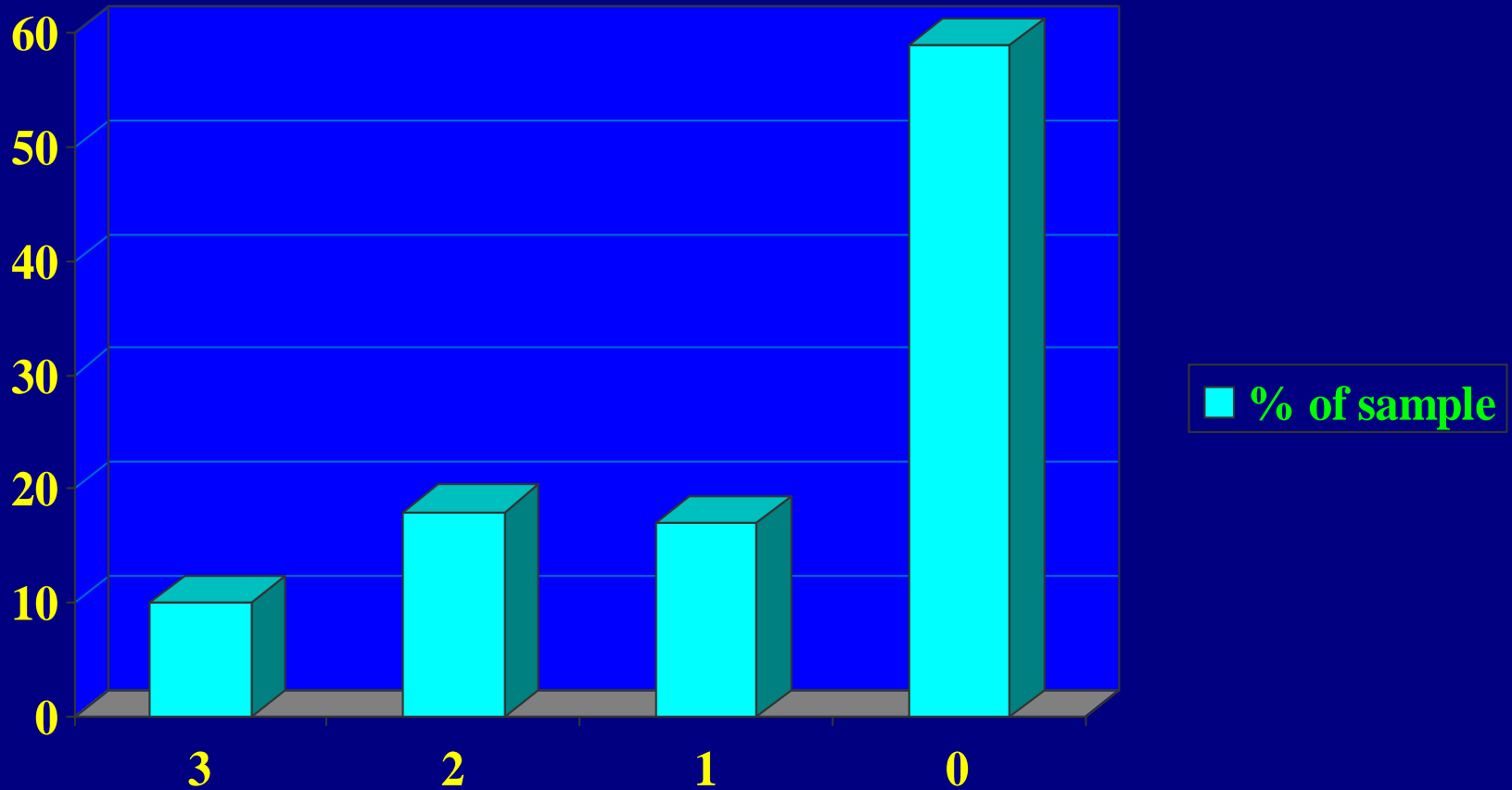
- Selected healthy Ss age 50-90
- Screened to be cognitively intact and show normal memory abilities
- Two versions of 3 word recall (implicit)
- % of Ss obtaining 0-3/3 words at delayed recall

3 Word Recall 1: Rose, Ball, Key



Cullum, Thompson & Smernoff (1993) J Clin & Exper Neuropsychology, 15, 321-329.

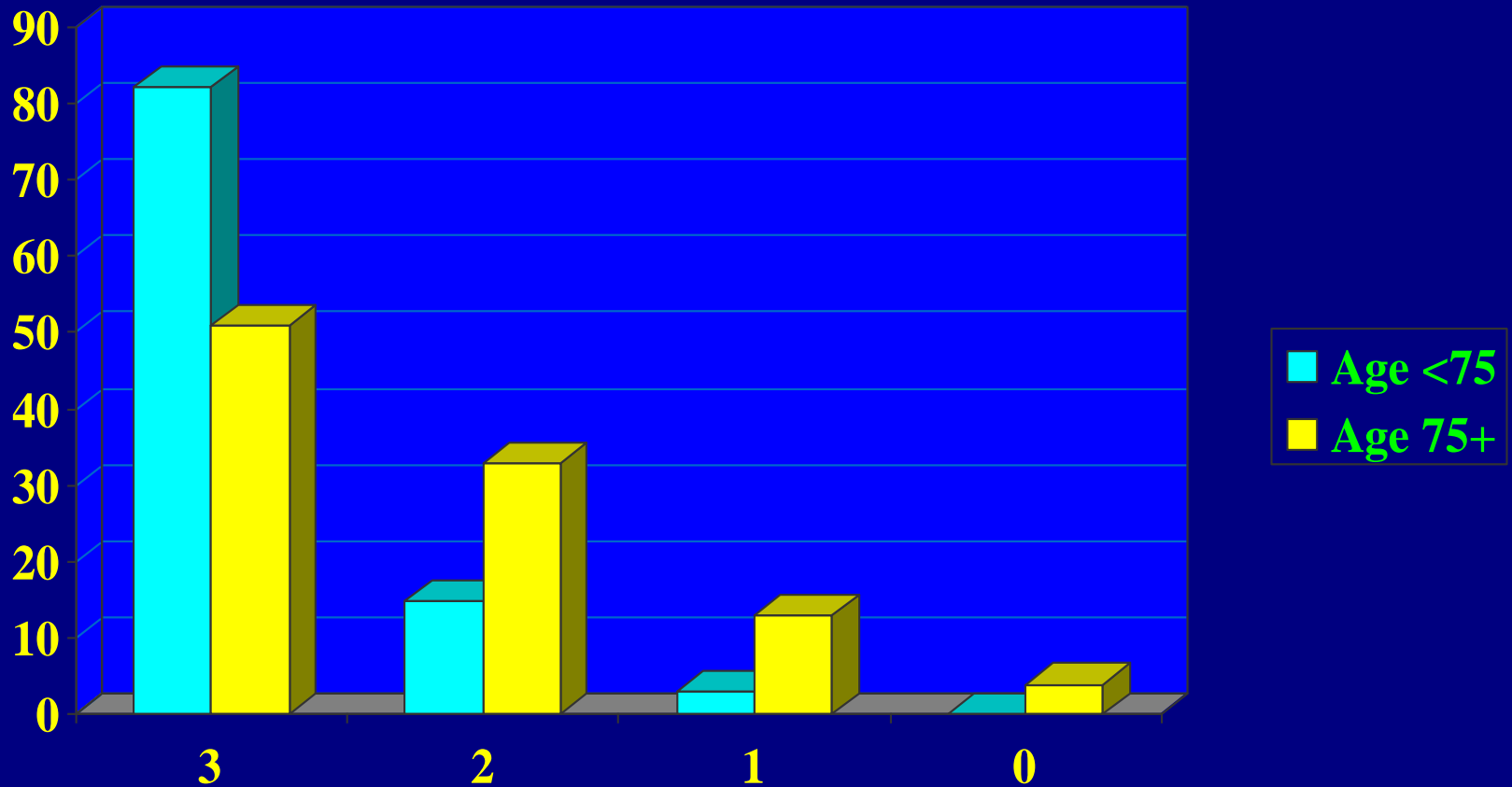
3 Word Recall 2: Brown, Honesty, Tulip



Cullum, Thompson & Smernoff (1993) J Clin & Exper Neuropsychology, 15, 321-329.

3 Word Recall: Explicit Recall

Apple, Table, Penny



From Lacritz, Cicerello, Chapman, Honig, Weiner & Cullum (1998). Arch Clin Neuropsych,

Limitations of Cognitive Screens

- Most are language-oriented
- Few memory or visuospatial tasks
- Brief recall tasks can be unreliable
- Susceptible to demographic effects
- Insensitive to subtle deficits
- “Normal” score does not rule out cognitive dysfunction

Cognitive Screening Caveats

- Know your tests & their limitations
- Standard administration & scoring*
- Psychometric properties
- Demographic influences
- When & how to supplement

Recommendations for Cognitive Screening

- Use standardized procedures
- Utilize appropriate norms
- Consider sensitivity/specificity for purpose
- Do not over-rely upon scores or “cut” scores
- Use caution interpreting “change” when no adequate alternate forms exist

Factors to Consider in Interpreting Test Scores over Time

- Practice effects
- Change in clinical state of pt
- Reliability of the test
- Availability of norms
- Availability of alternate forms*
- Magnitude of change
 - statistical vs clinical significance

Test Overview

Global Cognitive/

Intellectual:

- Wechsler Adult Intelligence Scale – 4th Edition (WAIS-4)

Premorbid Estimation

- Sight Word Reading Tests
 - Test of Premorbid Function
 - NART-R, AMNART
 - WRAT Reading

WAIS-IV Domains

Eliminated VIQ-PIQ

- Verbal Comprehension
- Perceptual Reasoning
- Working Memory
- Processing Speed
- Full Scale IQ
- *Pro-rating can be done*

Word-Reading-based Premorbid IQ Estimation

➤ *Pronounce the following:*

- acquiesce
- syncope
- hegemony
- demesne

- Reading scores correlate $> .75$ with IQ
- Most accurate in average range
- Hold up reasonably well in dementia

Test Overview

Simple Attention

- Digit Span Forward
 - 5 – 9 – 1 – 7 – 4 – 2
- Spatial Span Forward

Processing Speed

- Digit Symbol/Coding
- Trail Making A

Test Overview

Working Memory

- Digits Backward
 - 3-5-2-9-7-4-1
- Spatial Span Backward
- WAIS-3 Letter-Number Sequencing
 - 3 - N - 7 - H - 2 - L - 4

Test Overview

Executive Function & Cognitive Flexibility

- Sorting Tests
- Trail Making Test- Part B
- Stroop Color-Word
- Verbal fluency / Controlled Oral Word Association Test

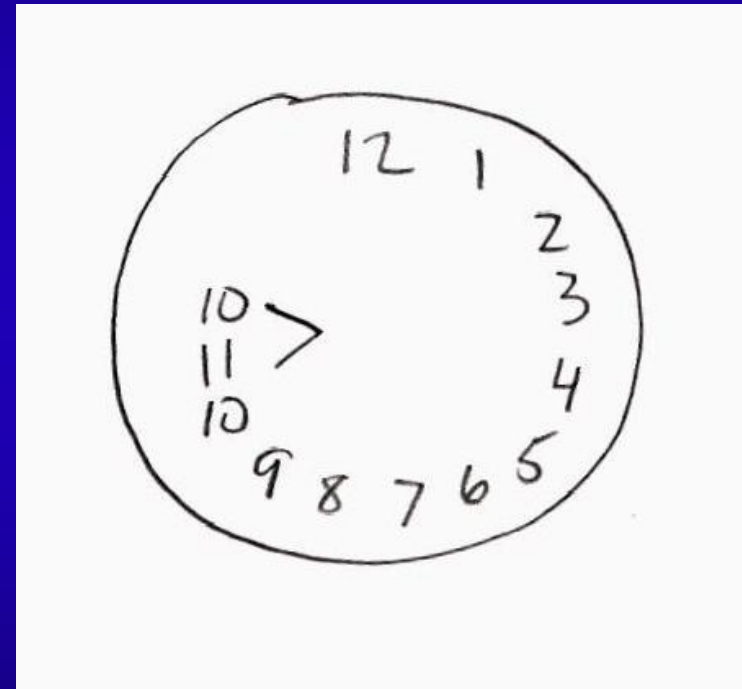
Test Overview

Visuospatial

- WAIS-4 Block Design
- Rey-Osterrieth Complex Figure
- Clock Drawing

Clock Drawing

- ⇒ Circular face
- ⇒ Correctness and Symmetry of numbers
- ⇒ Placement of hands at “10 after 11”



Test Overview

Memory:

1 cognitive complaint > ECT

- What to measure?
- How to measure?

Test Overview

Memory: Many different processes

- Episodic / declarative
- Semantic
- Explicit / implicit
- Working
- Procedural

Test Overview

Verbal Learning & Memory:

- California Verbal Learning Test (CVLT-2)
- Rey Auditory Verbal Learning Test (RAVLT)
- Hopkins Verbal Learning Test
- Wechsler Memory Scale-4
 - Logical Memory (stories)
 - Paired Associate Learning

Memory Assessment

Free Recall

Cued Recall

Recognition

Test Overview

Visual or
Nonverbal

Learning &
Memory

- Wechsler Memory Scale-4
 - Visual Reproduction
 - Designs
- Rey-Osterrieth Complex Figure
- Brief Visuospatial Memory Test (BVMT)
- Benton Visual Retention Test

Test Overview: Other domains

Language

- Boston Naming Test
- Verbal fluency
- Aphasia batteries

Psychomotor

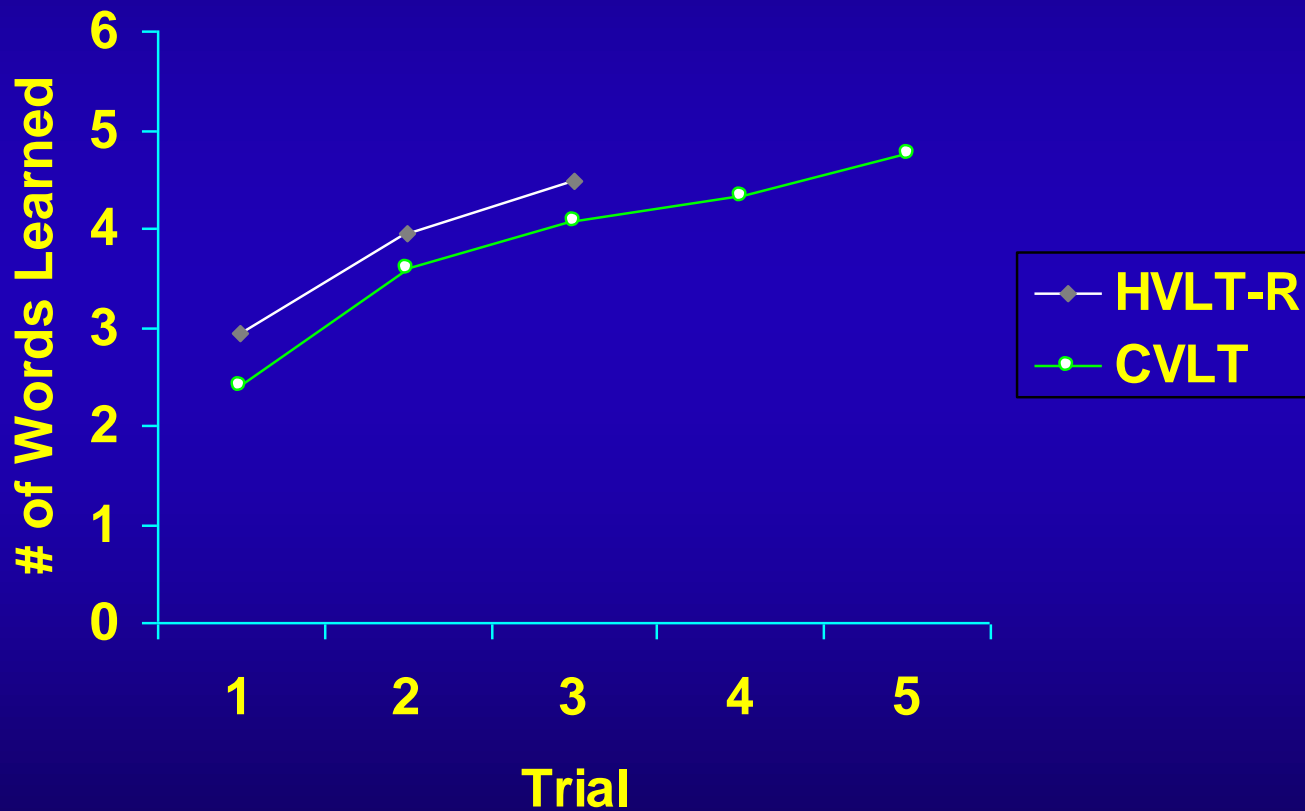
- Finger tapping
- Grooved pegboard
- Hand dynamometer

Selection of Neurocognitive Tests for ECT Research

- **Sensitivity for purpose**
- **Efficiency (time, cost)**
- **Clinical state of subjects***
- **Alternate forms (test-retest)**
- **Adequate norms**
- **Short form appropriate?**

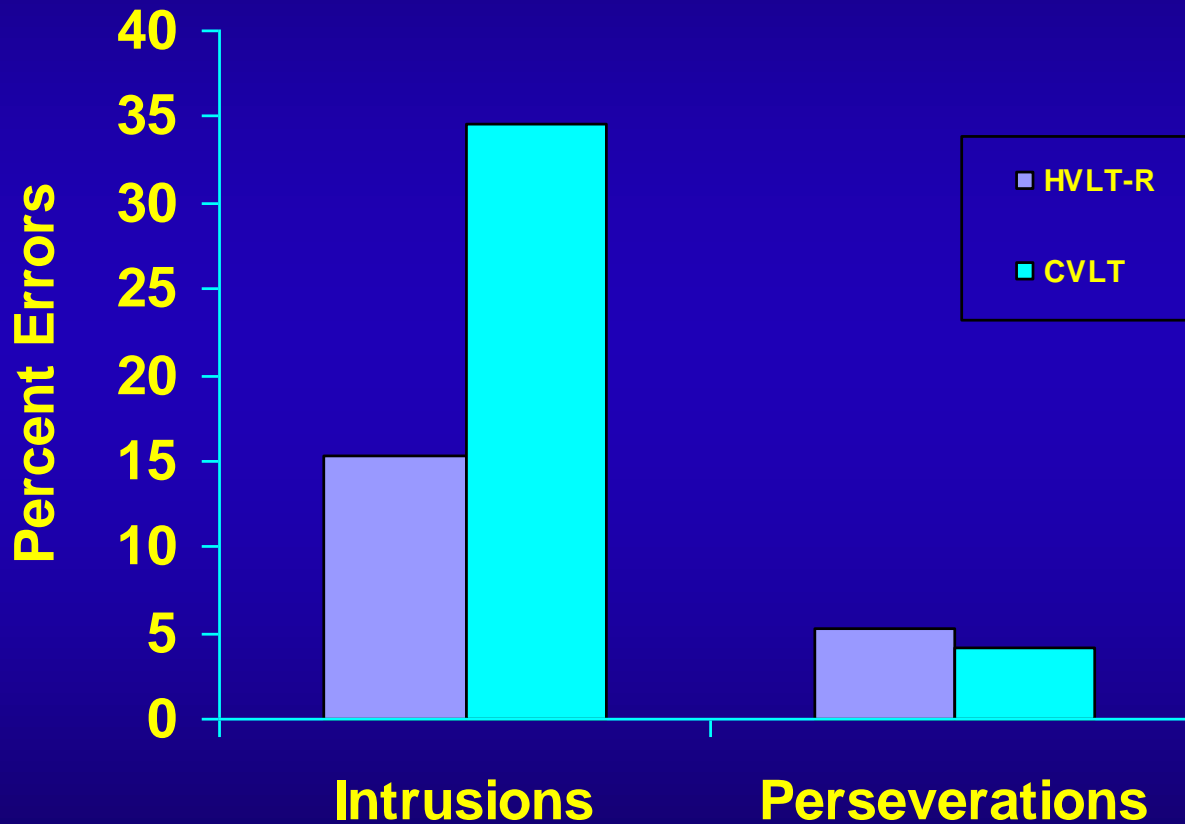
HVLT-R & CVLT Learning in AD

(from Lacritz et al., 2001)



AD Errors: HVLT-R & CVLT

(from Lacritz et al., 2001)



Association Between Depression Severity and Neurocognitive Function in Major Depressive Disorder: A Review and Synthesis

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The effects of major depressive disorder (MDD) on neurocognitive function remain poorly understood. Results from published studies vary widely in terms of methodological factors, and very little is known about the effects of depression severity and other clinical characteristics on neurocognitive function. The purpose of this review was to synthesize prior research findings regarding neurocognitive functioning in patients with MDD and varying levels of depression severity and to provide recommendations for future directions. Overall, this review suggests that MDD has been inconsistently associated with neurocognitive functioning and there is limited understanding regarding the relationship between depression severity and neurocognitive sequelae. There was much heterogeneity on depression severity-related factors across studies assessing neurocognitive function in MDD, as well as substantial variability in the consideration of depression severity among studies, which suggests a need to further explore this important issue.

Keywords: major depressive disorder, neuropsychology, depression severity, neurocognitive function

Neurocognitive Function in Depression

- **With good effort, effects often minimal in individual cases**
- **Many depressed pts score normally**
- **When deficits are seen, gen. mild**
- **Attention/concentration, learning & memory, executive functioning**

Neurocognitive Effects of Depression

- **Varies across studies**
- **Heterogeneous groups (psychosis, # episodes, duration, age)**
- **Different measures used to assess depression & neurocognition**
- **Methodologic differences abound**

Neurocognitive Effects of Depression: Recommendations for Research

- **Comprehensive characterization of Ss**
- **Use standard research Dx criteria**
- **Detail depression characteristics & utilize clinician- and self- ratings**
- **Neurocognitive testing using well validated & standardized tests**

Evaluation of the Effects of Severe Depression on Global Cognitive Function and Memory

Shawn M. McClintock, PhD, C. Munro Cullum, PhD, Mustafa M. Husain, MD, A. John Rush, MD, Rebecca G. Knapp, PhD, Martina Mueller, PhD, Georgios Petrides, MD, Shirlene Sampson, MD, and Charles H. Kellner, MD

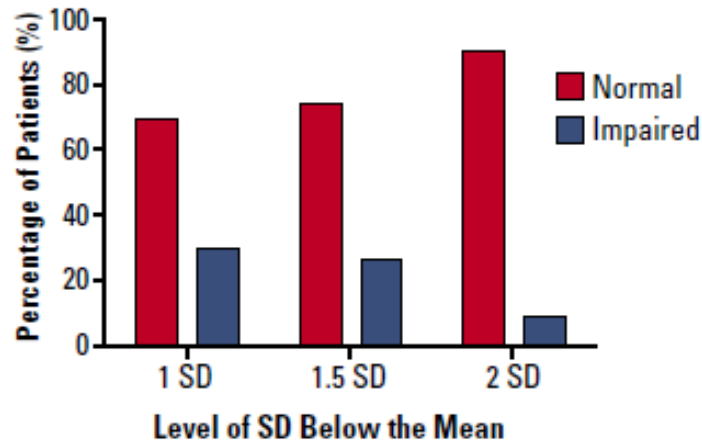
Demographic-Adjusted Neuropsychological Scores

<i>Measure</i>	<i>Standard Score</i>
MMSE	44.0 (12.6)
RAVLT	
Learning	45.6 (10.3)
List B	47.1 (8.4)
Immediate Recall	45.4 (11.9)
Delayed Recall	41.3 (12.8)
Perseverations	3.6 (4.5) [†]
Intrusions	2.8 (3.7) [†]
CFT	
Immediate Recall	42.4 (14.2)
Delayed Recall	40.0 (13.3)
WRAT-3 Reading Subtest	100.5 (11.0)

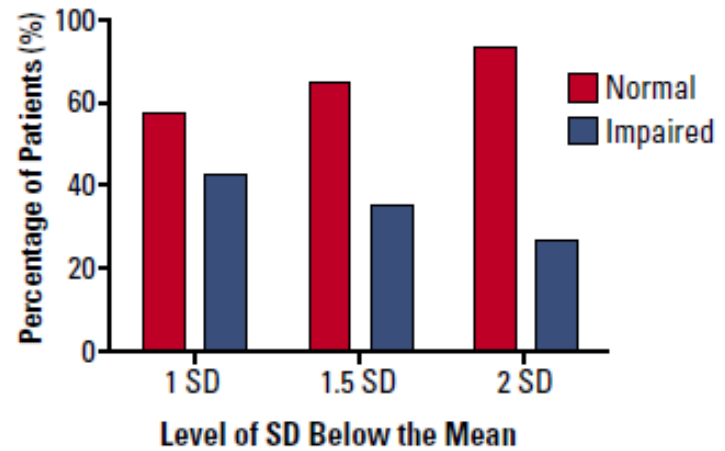
FOCUS POINTS

- The relationship between major depressive disorder (MDD) and neurocognitive function is complex. Studies of this relationship should include controlled methods with psychometrically sound clinical and neurocognitive instruments.
- Depression severity may not affect global cognitive function, verbal learning and memory, or visual learning and memory in patients with severe MDD.
- Research focused on the interactions between other depressive characteristics and neurocognitive function is needed.

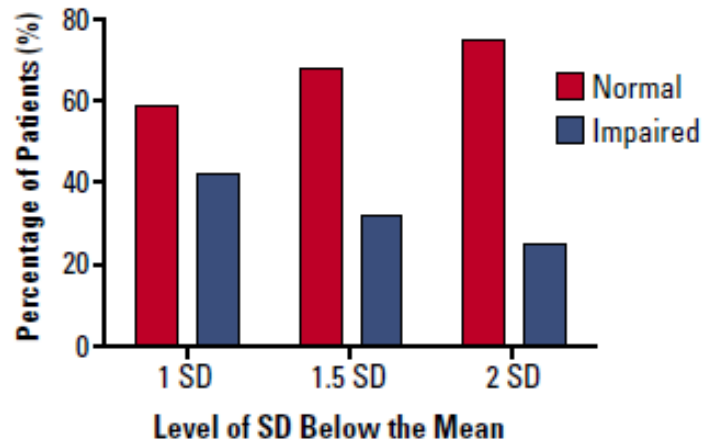
Performance on RAVLT Immediate Recall



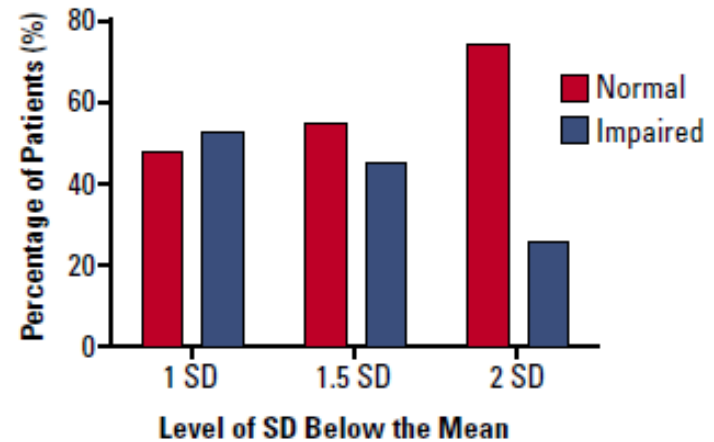
Performance on RAVLT Delayed Recall



Performance on CFT Immediate Recall

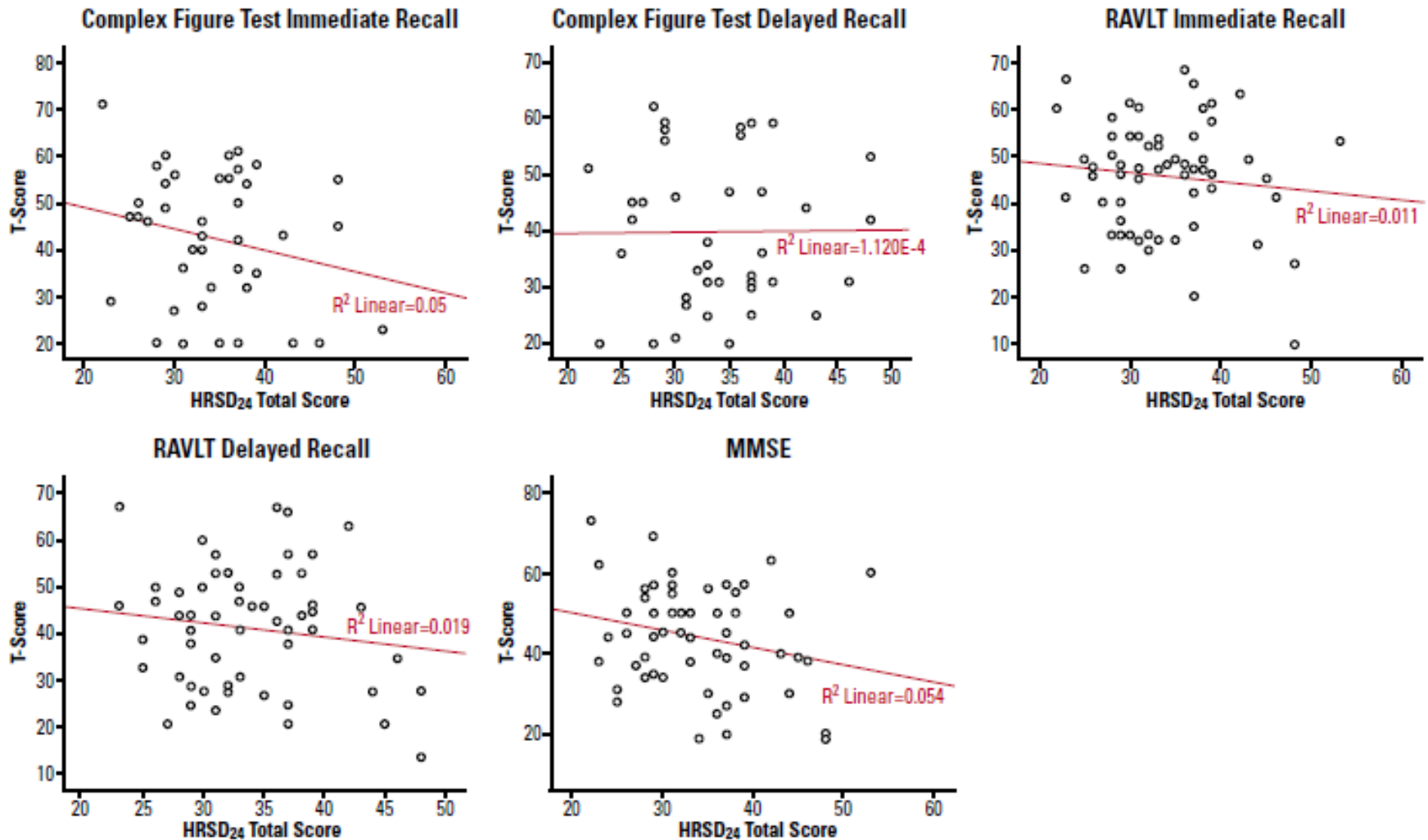


Performance on CFT Delayed Recall



Scatterplots of neurocognitive performance by depression severity

(a) HRSD₂₄



Neurocognitive Effects of Severe Depression

- Mean learning & immediate recall scores were in the average range, though 30% - 40% scored at least in the mild range of clinical impairment.
- Delayed recall scores were borderline impaired on average, with 40% - 45% of Ss showing at least mild impairment. 25% showed moderate impairment.
- Severity of depressive episode was not significantly related to level of cognitive functioning

Neurocognitive Effects of ECT: To be Reviewed Tomorrow

- Recent meta-analysis by Semkowska & McLoughlin (2010), to be presented tomorrow by the authors
- Results from the Kellner et al. CORE lead placement and C-ECT vs C-PHARM studies will be presented tomorrow

Directions for Neurocognitive Assessment

- Briefer evaluations using more advanced cognitive screening tests that maintain good sensitivity/specificity*
- Development of alternate, *equivalent* forms
- Improved norms
- Increased use of technology (eg telemedicine, Computerization of measures (eg NIH Toolbox))

Directions for Neurocognitive Assessment in ECT

- Cross-cultural norms, different language forms
- Careful examination of cognitive fx vs:
 - Subject demographics
 - Depressive hx & episode details
 - Comorbid conditions
 - ECT characteristics

Directions for Neurocognitive Assessment in ECT

- Further exploration and development of autobiographic memory assessment tools
- Detailed profile analysis (e.g. vs different types of dementias & other disorders)
- *Multidimensional* cognitive analysis (e.g. beyond total scores alone)

Directions for Neurocognitive Assessment

- Phenotyping in relation to treatment response & outcome prediction
- Standardization of an ECT battery (as done in schizophrenia, HIV, MS) or a Minimum Data Set (MDS) as done in Alzheimer Centers