

# UDS 3.0 New Neuropsychological Tests: *Quick* Update

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# New Cognitive Tests Implementation

1. Why switched?
  - (1) Cost
  - (2) Need more sensitive tests to identify MCI
2. Cross walk results: Presented by Sarah Monsell at NACC @ Spring ADC meeting --correlations were all around 0.75
3. One question yet to be answered : Did new tests improve in discriminatory ability ?

UDS 2.0	UDS 3.0
MMSE	MoCA
Logical Memory Story	Craft Story
Boston Naming Test	MINT
Digit Span	Number Span

# ROC COMPARISONS

## CDR=0, 0.5, $\geq 1.0$

- Sample size as of September 10 from 24 Centers: 955

MMSE range	Sample size
26-30	692
21-25	143
16-20	64
10-15	43
<10	13

- 108 initial visit subjects from 17 Centers
- 418 men, 537 women
- Median visit number is 4<sup>th</sup> visit
- Median age 75
- 460 Old Battery administered first, 495 New Battery administered First

# Correlations

## Using a rank correlation (Spearman):

	Fist visit only	Over all sample
MMSE, MoCA (raw)	0.74	0.77
BNT, MINT	0.70	0.76
Logical Memory Immediate Recall Craft Story 21 immediate VRS	0.77	0.75
Logical Memory Immediate Recall Craft Story 21 immediate URS	0.78	0.73
Logical Memory Delayed Recall Craft Story 21 delayed DVR	0.88	0.79
Logical Memory Delayed Recall Craft Story 21 delayed DRE	0.83	0.78
Digit/Number Span Forward — trials correct	0.71	0.75
Digit/Number Span Forward — length	0.66	0.68
Digit/Number Span Backward — trials correct	0.74	0.78
Digit/Number Span Backward — length	0.70	0.72

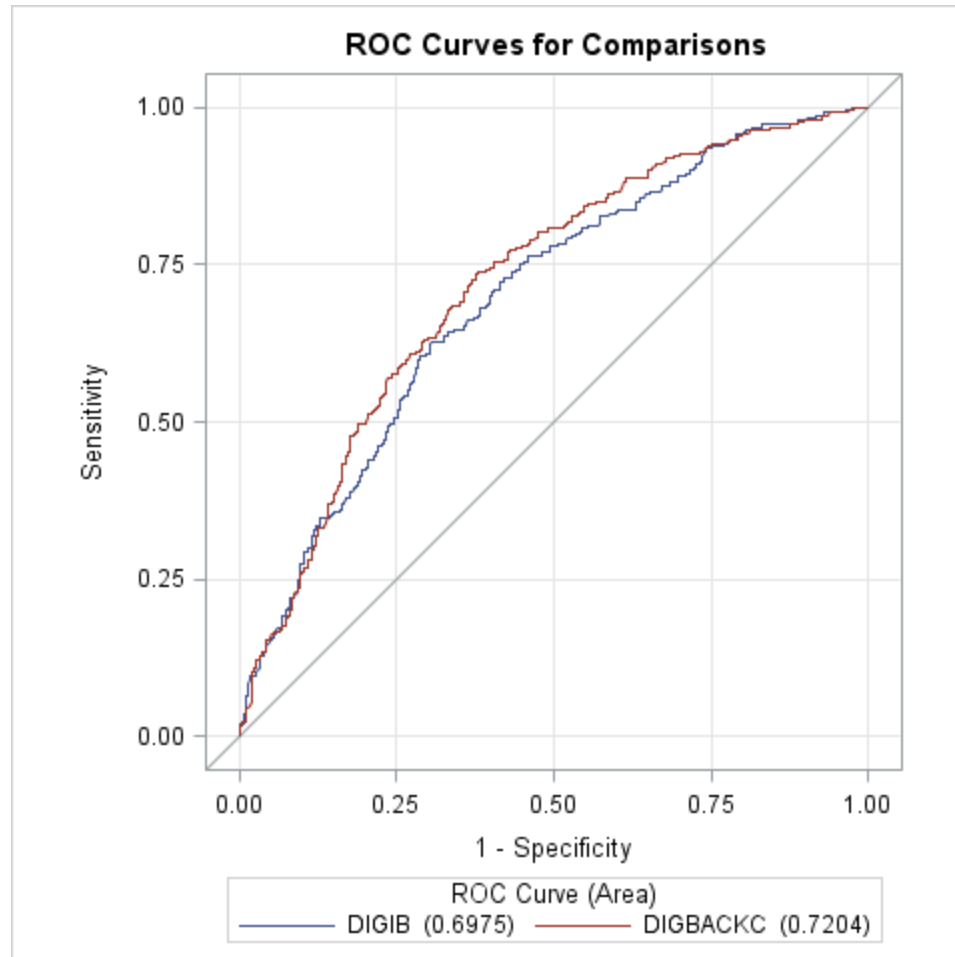
# ROC Results

# CDR=0.5 vs. CDR=0, All Visits (N=744)

	AUC		AUC	ROC test p-value
MMSE	0.82	MOCATOTS	0.82	0.88
LOGIMEM	0.82	CRAFTVRS	0.81	0.57
	0.82	CRAFTURS	0.80	0.28
MEMUNITS	0.84	CRAFTDVR	0.83	0.57
	0.84	CRAFTDRE	0.82	0.40
DIGIF	0.69	DIGFORWC	0.69	0.63
DIGIFLEN	0.68	DIGFORWS	0.69	0.34
DIGIB	0.70	DIGBACKC	0.72	<b>0.02</b>
DIGIBLEN	0.69	DIGBACKS	0.70	0.36
BOSTON	0.74	MINTTOTS	0.74	0.90

**CRAFTVRS: Craft Story Verbatim (0-44), CRAFTURS: Craft Story Paraphrase (0-25), MEMUNITS: Logical Memory Delayed Recall**

# CDR=0.5 vs. CDR=0



**DIGIB vs. DIGBACKC**

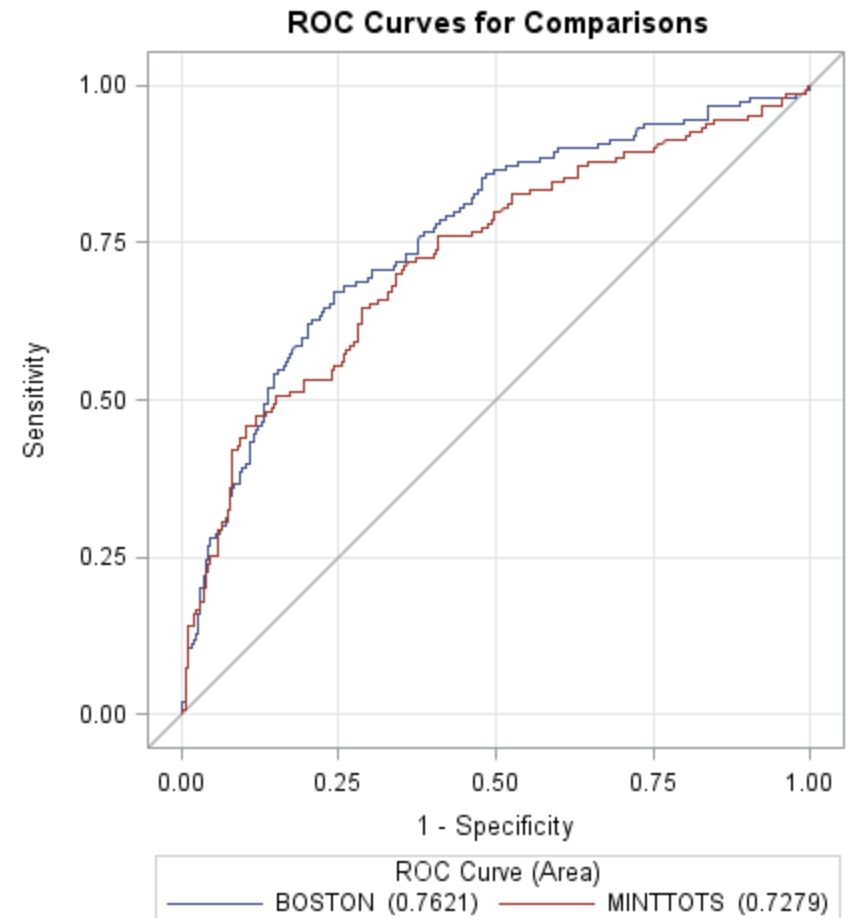
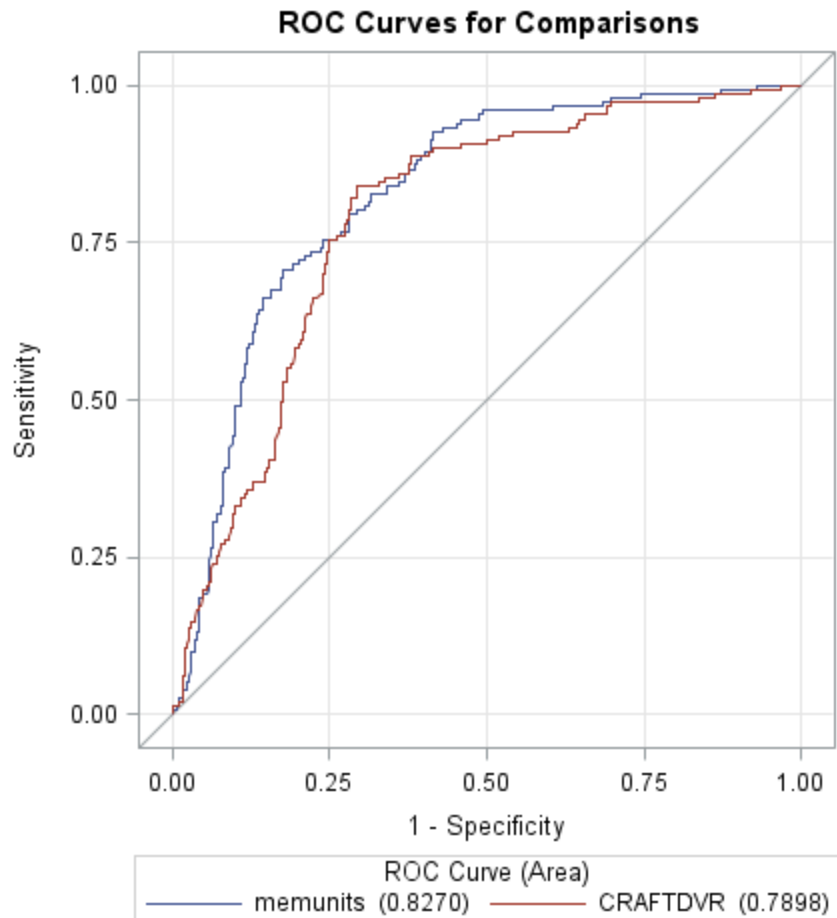
# CDR $\geq$ 1.0 vs. CDR=0.5, All Visits (n= 417)

	AUC		AUC	ROC test p-value
MMSE	0.89	MOCATOTS	0.88	0.43
LOGIMEM	0.82	CRAFTVRS	0.80	0.13
	0.82	CRAFTURS	0.80	0.21
MEMUNITS	0.83	CRAFTDVR	0.79	0.02
	0.83	CRAFTDRE	0.80	0.08
DIGIF	0.64	DIGFORWC	0.64	0.93
DIGIFLEN	0.63	DIGFORWS	0.62	0.53
DIGIB	0.76	DIGBACKC	0.74	0.28
DIGIBLEN	0.74	DIGBACKS	0.73	0.58
BOSTON	0.76	MINTTOTS	0.73	0.02

**CRAFTVRS: Craft Story Verbatim (0-44), CRAFTURS: Craft Story Paraphrase (0-25), MEMUNITS: Logical Memory Delayed recall**



# CDR>0.5 vs. CDR=0.5



**MEMUNITS vs. CRAFTDVR**

**BOSTON vs. MINTTOTS**

# Normal vs. MCI, All Visits (n= 627)

	AUC		AUC	ROC test p-value
MMSE	0.78	MOCATOTS	0.82	0.08
LOGIMEM	0.80	CRAFTVRS	0.77	0.14
		CRAFTURS	0.77	0.16
MEMUNITS	0.84	CRAFTDVR	0.81	0.07
		CRAFTDRE	0.80	<b>0.05</b>
DIGIF	0.66	DIGFORWC	0.65	0.66
DIGIFLEN	0.65	DIGFORWS	0.65	0.43
DIGIB	0.68	DIGBACKC	0.69	0.16
DIGIBLEN	0.67	DIGBACKS	0.68	0.58
BOSTON	0.73	MINTTOTS	0.72	0.42

# Dementia vs. MCI, All Visits (n= 365)

	AUC		AUC	ROC test p-value
MMSE	0.90	MOCATOTS	0.89	0.33
LOGIMEM	0.83	CRAFTVRS	0.82	0.44
		CRAFTURS	0.81	0.14
MEMUNITS	0.82	CRAFTDVR	0.82	0.75
		CRAFTDRE	0.82	0.95
DIGIF	0.68	DIGFORWC	0.68	0.91
DIGIFLEN	0.68	DIGFORWS	0.67	0.43
DIGIB	0.74	DIGBACKC	0.73	0.64
DIGIBLEN	0.74	DIGBACKS	0.72	0.25
BOSTON	0.75	MINTTOTS	0.74	0.45

# Dementia vs. Amnestic MCI, All Visits (n= 322)

	AUC		AUC	ROC test p-value
MMSE	0.91	MOCATOTS	0.90	0.38
LOGIMEM	0.84	CRAFTVRS	0.82	0.26
		CRAFTURS	0.80	<b>0.05</b>
MEMUNITS	0.82	CRAFTDVR	0.81	0.57
		CRAFTDRE	0.82	0.99
DIGIF	0.70	DIGFORWC	0.69	0.79
DIGIFLEN	0.70	DIGFORWS	0.68	0.47
DIGIB	0.76	DIGBACKC	0.75	0.62
DIGIBLEN	0.76	DIGBACKS	0.74	0.35
BOSTON	0.75	MINTTOTS	0.73	0.32

# Amnestic MCI vs. Normal, All Visits (n= 608)

	AUC		AUC	ROC test p-value
MMSE	0.79	MOCATOTS	0.83	0.06
LOGIMEM	0.81	CRAFTVRS	0.80	0.42
		CRAFTURS	0.79	0.30
MEMUNITS	0.86	CRAFTDVR	0.83	0.18
		CRAFTDRE	0.82	<b>0.05</b>
DIGIF	0.66	DIGFORWC	0.66	0.54
DIGIFLEN	0.65	DIGFORWS	0.66	0.56
DIGIB	0.68	DIGBACKC	0.69	0.25
DIGIBLEN	0.67	DIGBACKS	0.67	0.56
BOSTON	0.74	MINTTOTS	0.73	0.43

Restricted to Initial Visit

# Normal vs. MCI, Initial Visit (n= 71)

	AUC		AUC	ROC test p-value
MMSE	0.81	MOCATOTS	0.85	0.51
LOGIMEM	0.86	CRAFTVRS	0.78	0.09
		CRAFTURS	0.80	0.20
MEMUNITS	0.91	CRAFTDVR	0.89	0.48
		CRAFTDRE	0.84	0.17
DIGIF	0.72	DIGFORWC	0.70	0.70
DIGIFLEN	0.70	DIGFORWS	0.71	0.58
DIGIB	0.73	DIGBACKC	0.71	0.65
DIGIBLEN	0.76	DIGBACKS	0.70	0.21
BOSTON	0.75	MINTTOTS	0.77	0.64

# Dementia vs. MCI, Initial Visit (n= 58)

	AUC		AUC	ROC test p-value
MMSE	0.91	MOCATOTS	0.84	0.05
LOGIMEM	0.80	CRAFTVRS	0.82	0.75
		CRAFTURS	0.80	0.96
MEMUNITS	0.84	CRAFTDVR	0.79	0.31
		CRAFTDRE	0.83	0.98
DIGIF	0.61	DIGFORWC	0.65	0.36
DIGIFLEN	0.68	DIGFORWS	0.64	0.51
DIGIB	0.69	DIGBACKC	0.74	0.36
DIGIBLEN	0.69	DIGBACKS	0.78	0.12
BOSTON	0.75	MINTTOTS	0.72	0.67



# Dementia vs. Amnestic MCI, Initial Visit (n= 46)

	AUC		AUC	ROC test p-value
MMSE	0.92	MOCATOTS	0.87	0.21
LOGIMEM	0.82	CRAFTVRS	0.82	0.97
		CRAFTURS	0.81	0.84
MEMUNITS	0.81	CRAFTDVR	0.76	0.34
		CRAFTDRE	0.81	0.90
DIGIF	0.66	DIGFORWC	0.66	0.92
DIGIFLEN	0.73	DIGFORWS	0.66	0.35
DIGIB	0.71	DIGBACKC	0.77	0.36
DIGIBLEN	0.71	DIGBACKS	0.82	0.08
BOSTON	0.75	MINTTOTS	0.74	0.83

# Amnestic MCI vs. Normal, Initial Visit (n= 66)

	AUC		AUC	ROC test p-value
MMSE	0.85	MOCATOTS	0.88	0.65
LOGIMEM	0.85	CRAFTVRS	0.82	0.42
		CRAFTURS	0.84	0.72
MEMUNITS	0.92	CRAFTDVR	0.91	0.55
		CRAFTDRE	0.86	0.23
DIGIF	0.73	DIGFORWC	0.74	0.85
DIGIFLEN	0.73	DIGFORWS	0.74	0.69
DIGIB	0.77	DIGBACKC	0.74	0.48
DIGIBLEN	0.79	DIGBACKS	0.73	0.32
BOSTON	0.79	MINTTOTS	0.77	0.51

# CDR=0.5 vs. CDR=0, Initial Visit (n= 89)

	AUC		AUC	ROC test p-value
MMSE	0.89	MOCATOTS	0.88	0.77
LOGIMEM	0.91	CRAFTVRS	0.84	<b>0.05</b>
		CRAFTURS	0.85	0.12
MEMUNITS	0.93	CRAFTDVR	0.91	0.27
		CRAFTDRE	0.89	0.25
DIGIF	0.75	DIGFORWC	0.74	0.94
DIGIFLEN	0.75	DIGFORWS	0.75	0.99
DIGIB	0.76	DIGBACKC	0.75	0.61
DIGIBLEN	0.78	DIGBACKS	0.73	0.05
BOSTON	0.78	MINTTOTS	0.79	0.64

# CDR>0.5 vs. CDR=0.5, Initial Visit (n= 60)

	AUC		AUC	ROC test p-value
MMSE	0.89	MOCATOTS	0.87	0.53
LOGIMEM	0.87	CRAFTVRS	0.81	0.19
		CRAFTURS	0.84	0.43
MEMUNITS	0.81	CRAFTDVR	0.74	0.12
		CRAFTDRE	0.79	0.49
DIGIF	0.67	DIGFORWC	0.67	0.93
DIGIFLEN	0.68	DIGFORWS	0.68	0.97
DIGIB	0.78	DIGBACKC	0.79	0.81
DIGIBLEN	0.73	DIGBACKS	0.82	0.19
BOSTON	0.84	MINTTOTS	0.85	0.86

# Optimal Cutpoint

# Optimal Cutpoints

(based on Youden index)

<b>CDR=0 vs CDR = 0.5 (743)</b>	<b>MMSE</b>	<b>MoCA</b>
<b>Overall</b>	27	24
<b>Age &lt; 85 Men Lower Education (64)</b>	27	23
<b>Age &lt; 85 Men Higher Education (195)</b>	27	24
<b>Age &lt; 85 Women Lower Education (147)</b>	27	23
<b>Age &lt; 85 Women Higher Education (216)</b>	28	24
<b>Age &gt;=85 Men Lower Education (13)</b>	24	21
<b>Age &gt;= 85 Men Higher Education (45)</b>	27	23
<b>Age &gt;= 85 Women Lower Education (28)</b>	28	22
<b>Age &gt;= 85 Women Higher Education (35)</b>	27	23

# Optimal Cutpoints (sample size)

<b>CDR = 0.5 VS CDR <math>\geq</math> 1 (417)</b>	<b>MMSE</b>	<b>MoCA</b>
<b>Overall</b>	21	17
<b>Age &lt; 85 Men Lower Education (49)</b>	21	16
<b>Age &lt; 85 Men Higher Education (142)</b>	24	20
<b>Age &lt; 85 Women Lower Education (75)</b>	22	15
<b>Age &lt; 85 Women Higher Education (71)</b>	20	17
<b>Age <math>\geq</math>85 Men Lower Education (11)</b>	21	16
<b>Age <math>\geq</math> 85 Men Higher Education (33)</b>	25	18
<b>Age <math>\geq</math> 85 Women Lower Education (18)</b>	23	11
<b>Age <math>\geq</math> 85 Women Higher Education (18)</b>	24	14

# Optimal Cutpoints (sample size)

<b>Normal vs Amnestic MCI (609)</b>	<b>MMSE</b>	<b>MoCA</b>
<b>Overall</b>	27	24
<b>Age &lt; 85 Men Lower Education (46)</b>	27	25
<b>Age &lt; 85 Men Higher Education (143)</b>	27	24
<b>Age &lt; 85 Women Lower Education (124)</b>	27	23
<b>Age &lt; 85 Women Higher Education (190)</b>	29	24
<b>Age &gt;=85 Men Lower Education (9)</b>	26	21
<b>Age &gt;= 85 Men Higher Education (38)</b>	26	25
<b>Age &gt;= 85 Women Lower Education (26)</b>	28	20
<b>Age &gt;= 85 Women Higher Education (33)</b>	27	23



# Optimal Cutpoints (sample size)

<b>AD vs Amnestic MCI (328)</b>	<b>MMSE</b>	<b>MoCA</b>
<b>Overall</b>	24	18
<b>Age &lt; 85 Men Lower Education (37)</b>	23	16
<b>Age &lt; 85 Men Higher Education (103)</b>	24	20
<b>Age &lt; 85 Women Lower Education (68)</b>	24	14
<b>Age &lt; 85 Women Higher Education (56)</b>	25	15
<b>Age &gt;=85 Men Lower Education (9)</b>	21	18
<b>Age &gt;= 85 Men Higher Education (24)</b>	24	17
<b>Age &gt;= 85 Women Lower Education (15)</b>	23	11
<b>Age &gt;= 85 Women Higher Education (16)</b>	24	21

# Conclusions

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- New tests vs old tests – **about similar levels of ability** in discriminating among CDR=0, 0.5 and  $\geq 1$ .
- New digit backward score – slightly better in detecting CDR=0.5 (vs CDR=0). Possibly due to a longer digits (scores up to 14 as opposed to 12) used in the new test. (10 subjects scored 13!)
- CRAFT Delayed Recall Verbatim scores (0-44)
  - reduced ability in discriminating CDR=0.5 (vs CDR $\geq 1$ ). Possibly due to scoring confusions.
- MOCA and MMSE—very different optimal cutpoints.

# Next Step

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- Refine/Develop models and approaches to create equivalent scales and apply to longitudinal analyses (stimulate statistical and non-statistical communities!!)

*Special thanks go to all the 24 centers which contributed the cross walk data, accumulating over 900 records.*

*Committee members who assisted the implementation process.*

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