Cognitive Function and Frailty

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- Relationship between cognition and frailty

- Cognitive trajectories

- Defining cognitive impairment and dementia

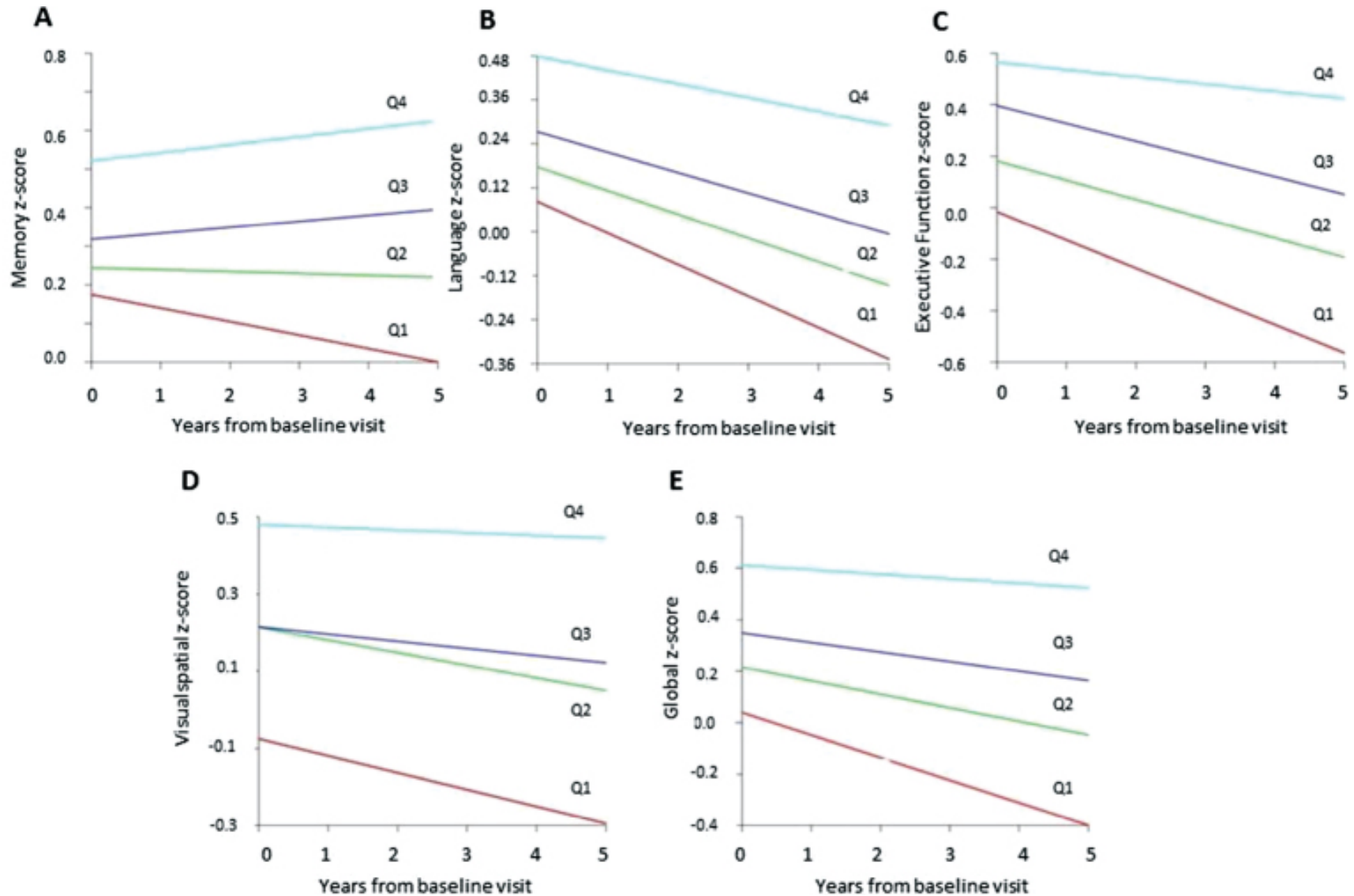- Tools for measuring cognition in your work

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Frailty → **Cognitive impairment**

Association holds both in cross section and longitudinally

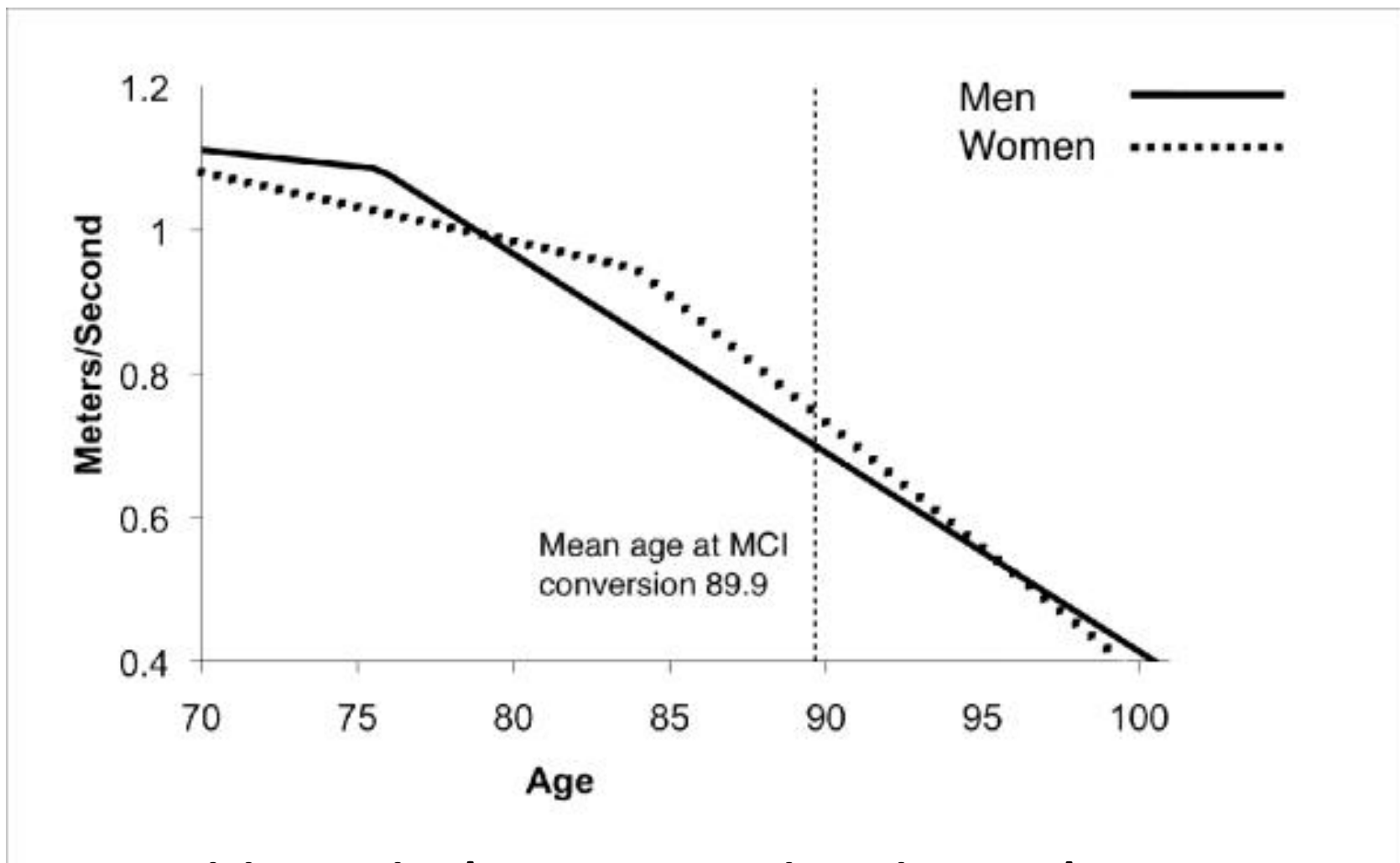Roberston, DA. Aging Research Reviews 2013
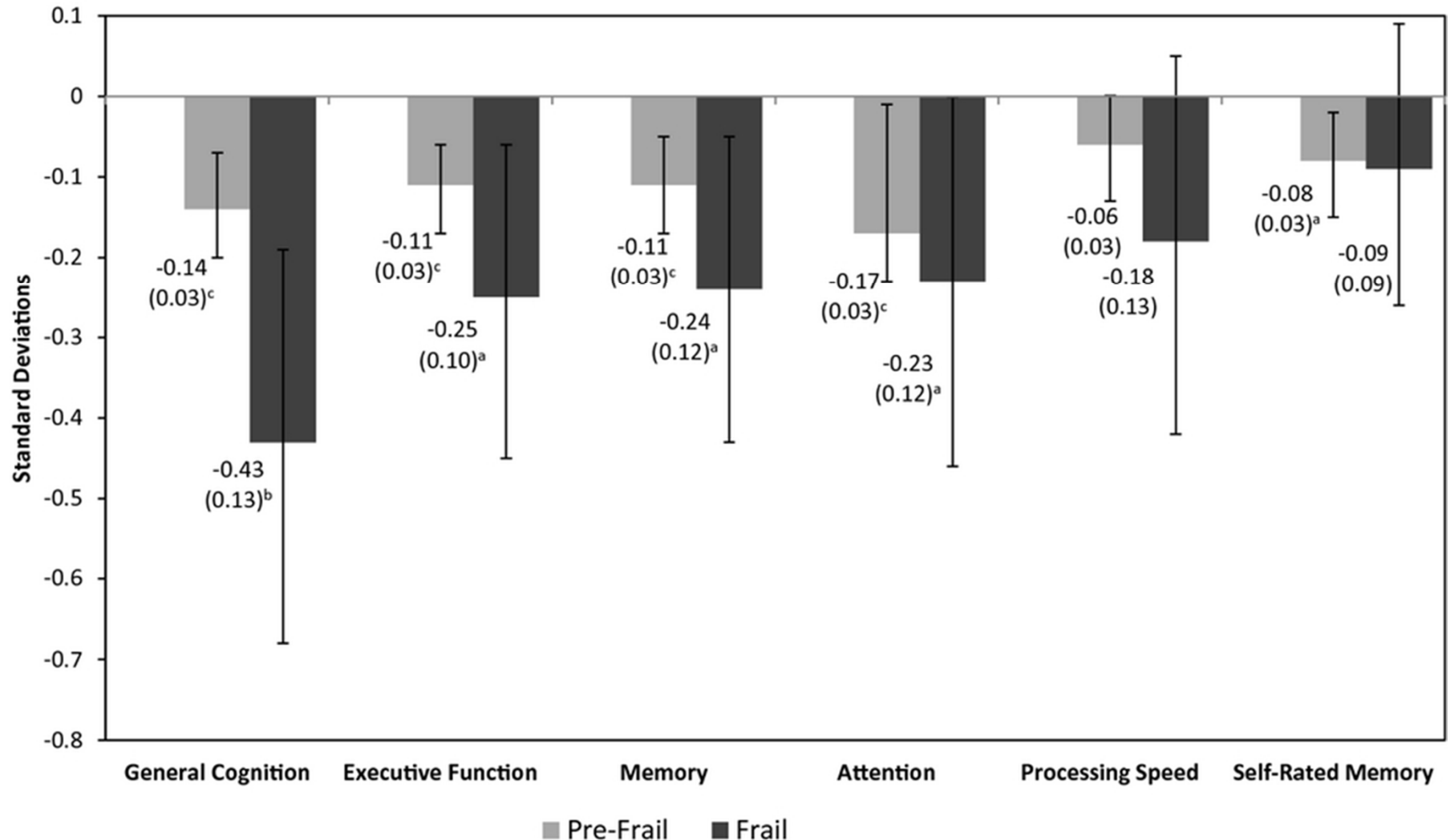
The Irish Longitudinal Study of Aging (TILDA) – strongest predictors of cognition were gait speed and muscle strength

Slow Gait Speed Predicts Cognitive Decline, but baseline cognition did not predict decline in gait

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Mayo Clinic Study of Aging

Mielke et al. J Gerontol A. 2013

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204 participants in the Oregon Brain Aging Study

Buracchio, et al. Arch Neurol. 2010

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Frailty → **Cognitive impairment**

Roberston, DA. Aging Research Reviews 2013

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- 942 non-frail older Mexican Americans, having MMSE <21 at baseline resulted in greater odds of becoming frail (OR 1.09 (1.00-1.19) per year) c/w people with MMSE ≥21 Raji et al. J Gerontol A 2010
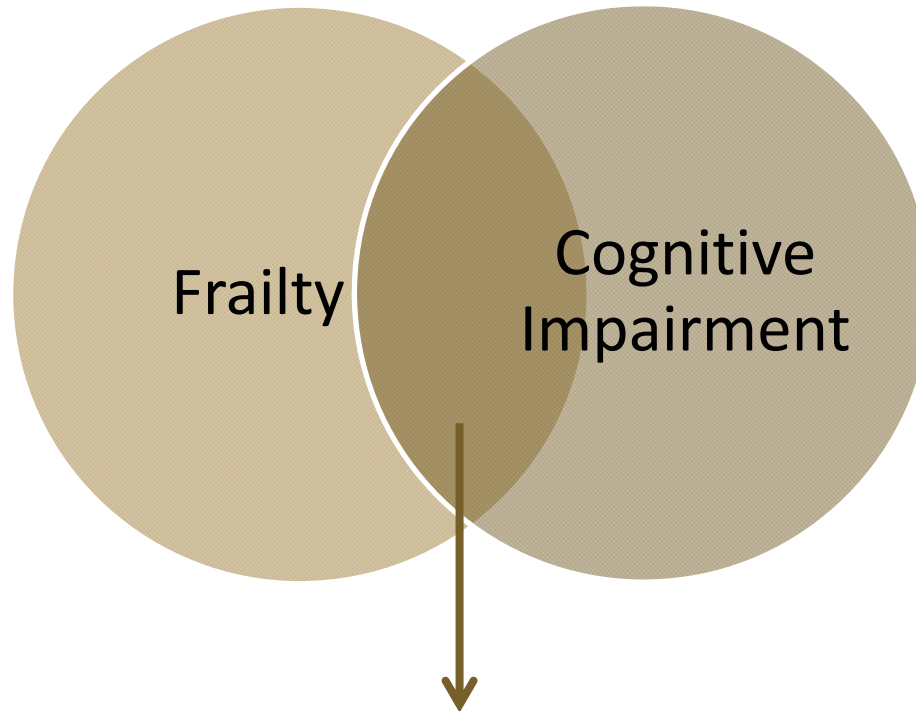
Gait Speed Decline by Quartiles of 3MS*

Legend:
- Q1=<88
- Q2=88-92
- Q3=93-96
- Q4=>96

X-axis: Baseline, 1 Year, 2 Years, 3 Years
Y-axis: Mean Gait Speed (m/s)
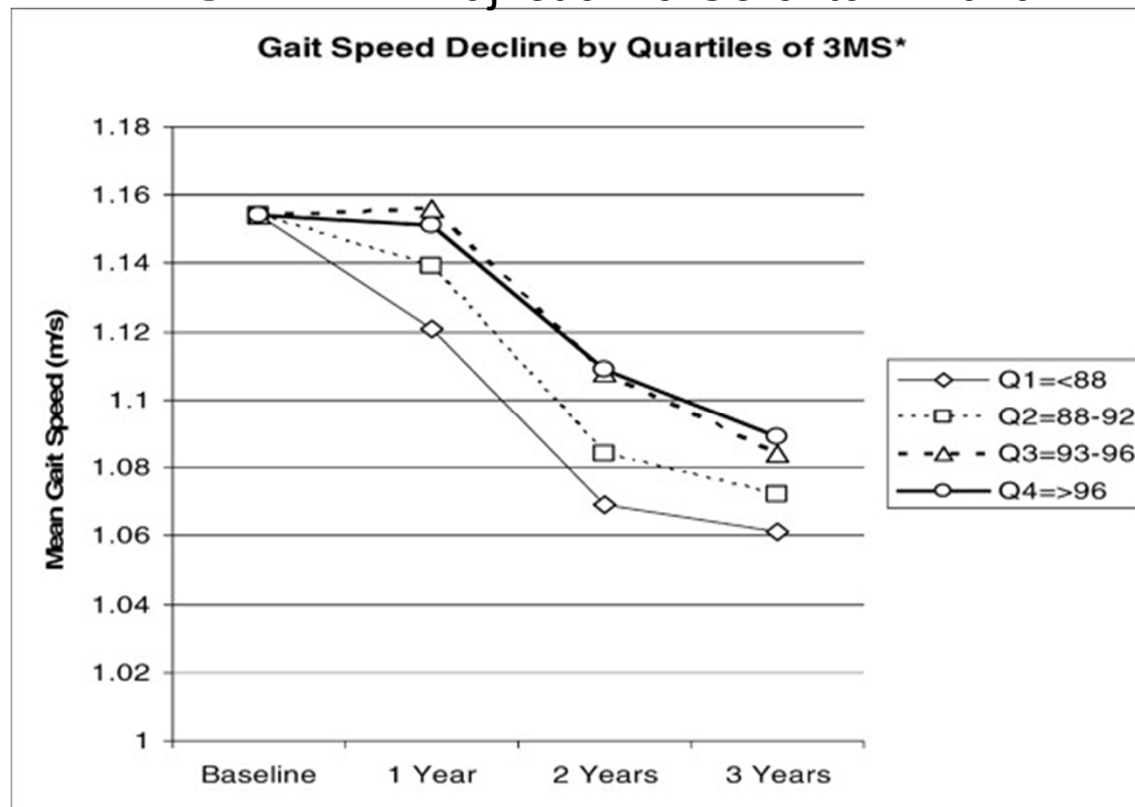
*HABC data adjusted for baseline gait speed, age, race, sex, clinic

Atkinson HH, et al. J Gerontology A. 2007
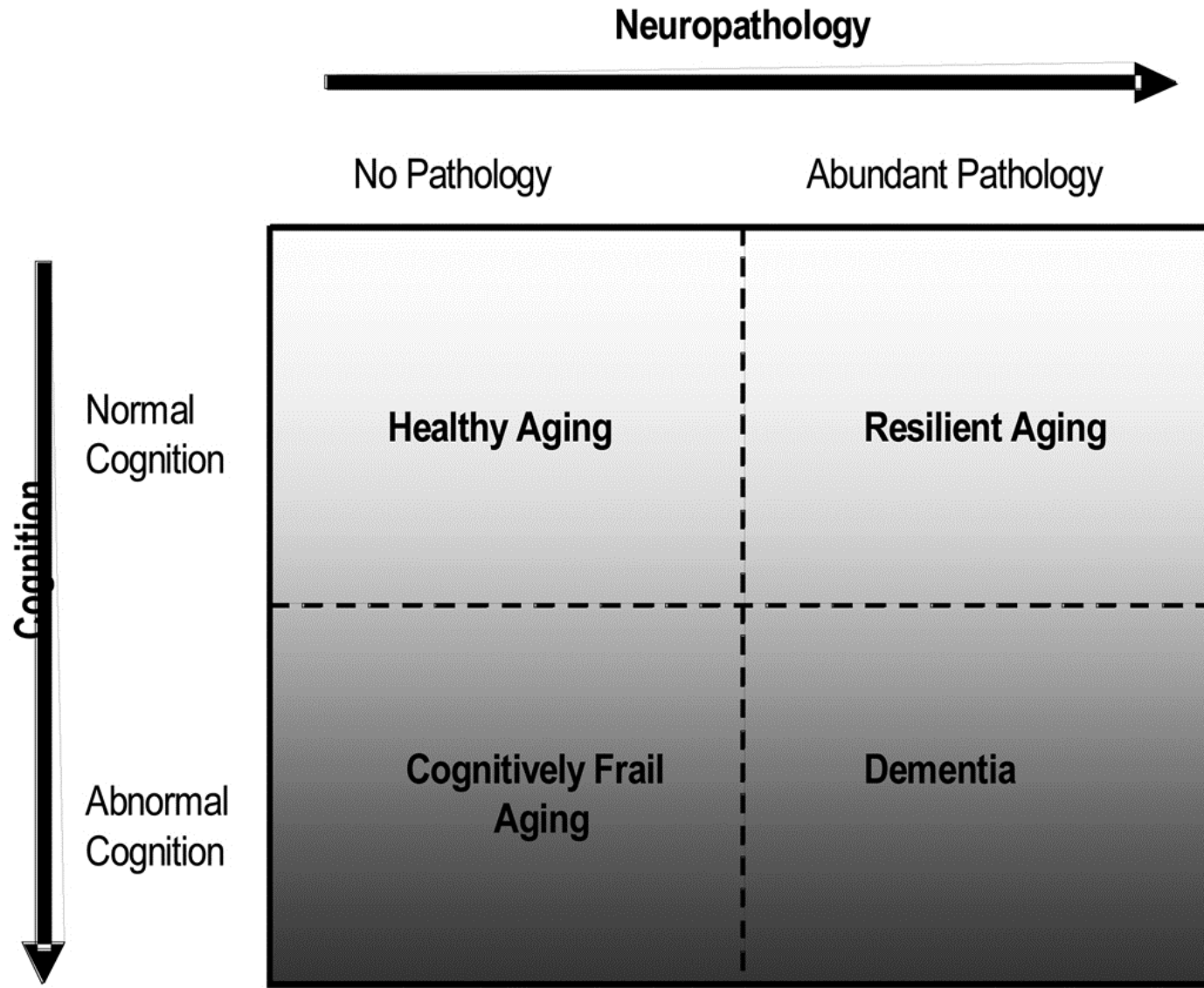
Frailty

Cognitive
Impairment

Likely to be common pathophysiologic pathways
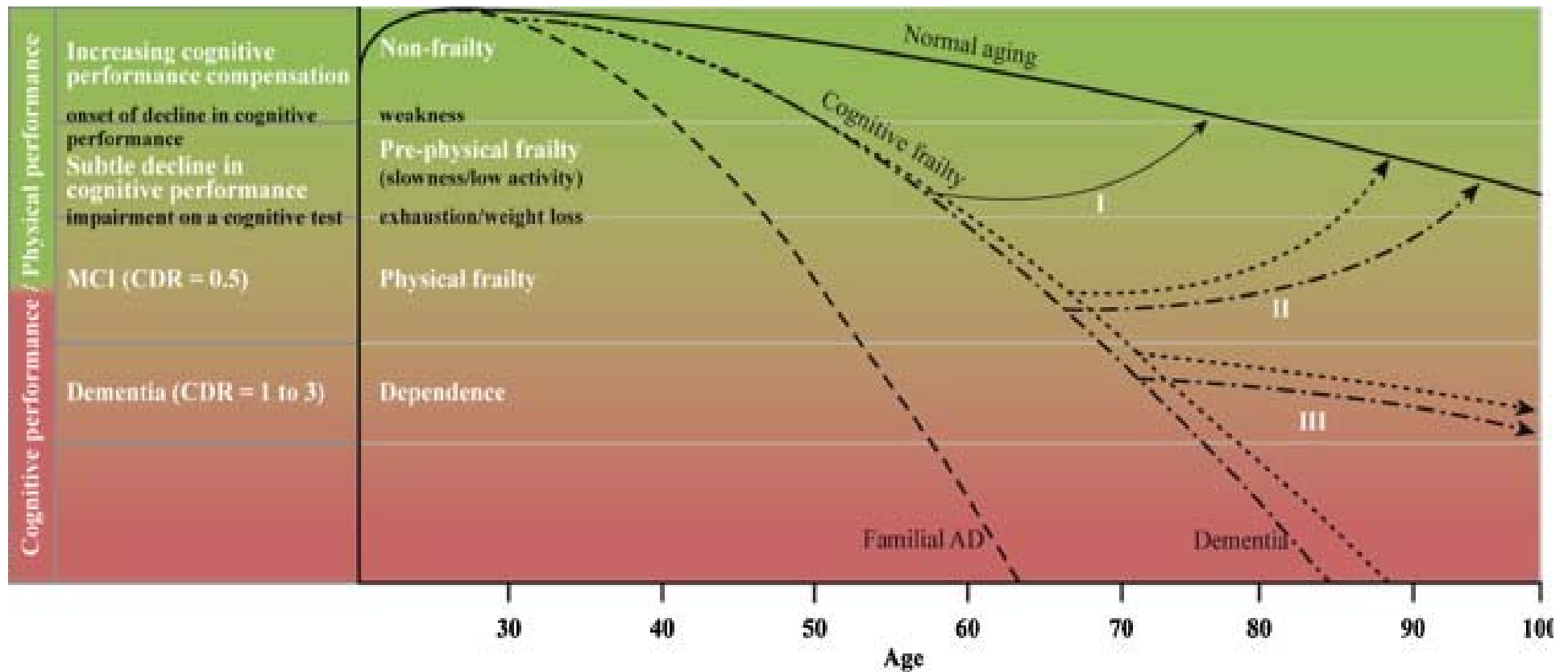• Alzheimer's disease pathology
• CVD Risk factors
• Chronic inflammation
• Lifestyle factors (physical inactivity)
• Depression

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- Normal cognitive aging?

- Mild Cognitive impairment/ Pre-dementia?

- Cognitive vulnerability/ decreased reserve?

Cognitive resilience vs frailty

Negash et al. Curr Alz Res 2011

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- International Consensus Group

  - **Goal was to identify a condition of cognitive impairment caused by <u>physical conditions</u>**

- Proposed definition:

  - Presence of both physical frailty and cognitive impairment (CDR 0.5)

  - Exclusion of concurrent Alzheimer's dementia or other dementias

Kelaiditi, et al. J Nutrition, Health, and Aging. 2013

Cognitive trajectories

Ruan et al. Ageing Research Reviews 2015

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MCI (mild cognitive impairment)

- Cognitive impairment in 1 or more domains

- Does NOT Interfere with work or usual activities

- Decline from previous baseline

- Not explained by delirium or major psychiatric d/o

Dementia

- Cognitive impairment in **2** or more domains

- **Interferes** with work or usual activities

- Decline from previous baseline

- Not explained by delirium or major psychiatric d/o

NIA/AA Criteria; Albert 2011; McKhann 2011

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Documentation of cognitive impairment in Primary Care is poor

- <50% of patients with dementia have the dx in chart

- <25% of patients with MCI have cognitive impairment noted in chart

- Use of Electronic Medical Records or health services data may not be adequate for your research – shocking!!

Olafsdottir, et al. Dement Geriatr Cogn Disord 2000;
Valcour, et al. Arch Int Med 2000

- Global cognitive function

  - Mini-cog

  - MMSE, 3MSE, MoCA

- Domain specific cognitive functions

  - Memory

  - Executive function

  - Language

  - Processing speed

  - Visuospatial function

  - Concentration and working memory

- Very brief screening tool (3 minutes)

- 3 item recall and a clock draw

- Valid in culturally and educationally diverse groups

Boorson, et al. Int J Geri Psychiatry. 2000
Boorson, et al. JAGS. 2003
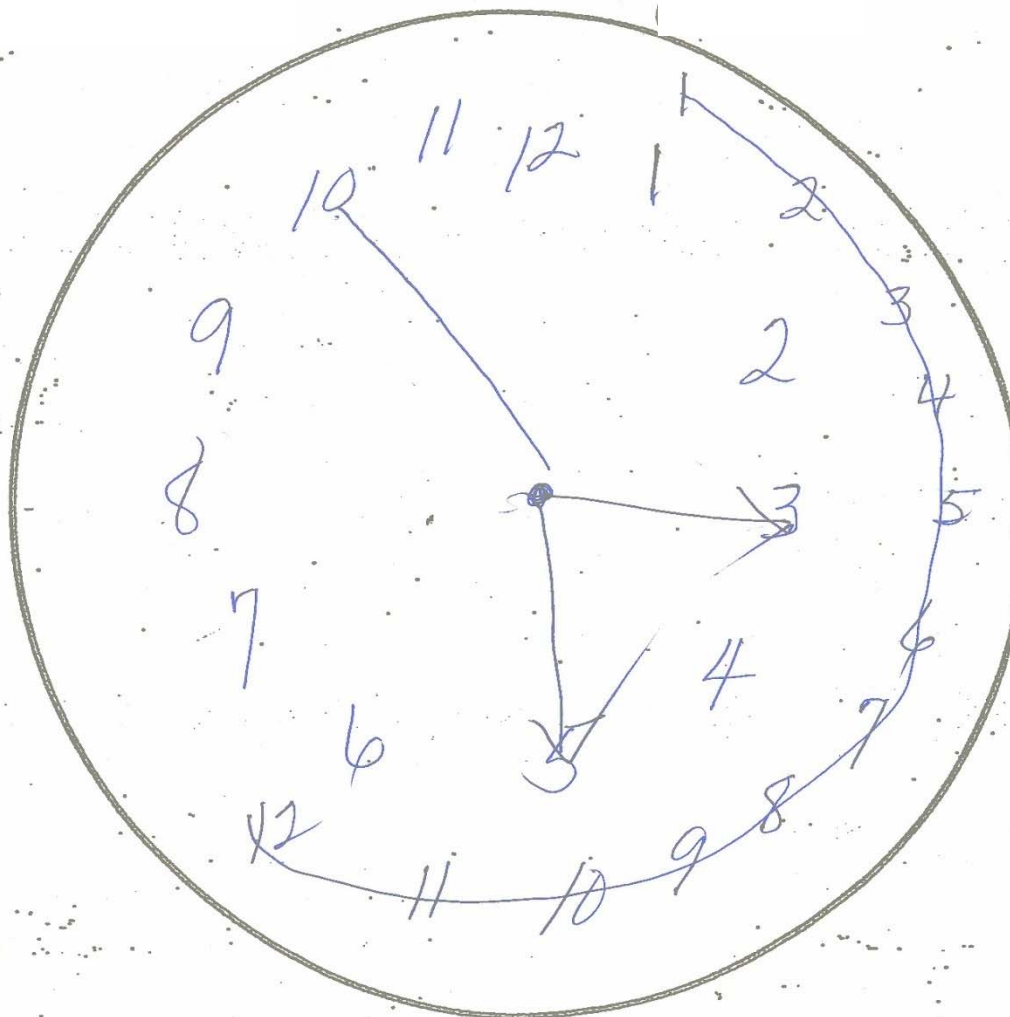
- Mini Mental State Examination (MMSE) published in 1975 by Folstein and Folstein

- Over the decades became the primary screening tool in practice for cognitive impairment

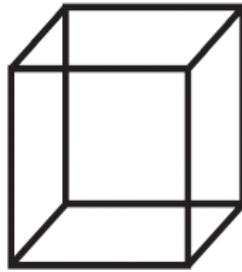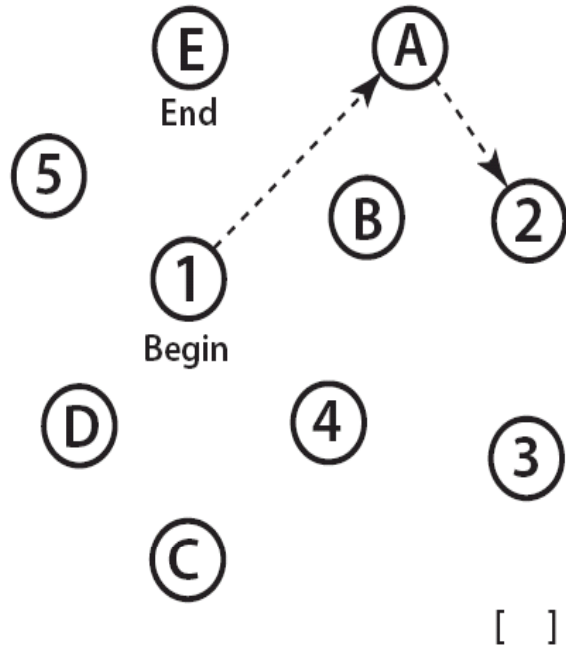- Now copyright protected and should be purchased from Psychological Assessment Resources, Inc ($1.36 each)

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Montreal Cognitive Assessment (MoCA)

MONTREAL COGNITIVE ASSESSMENT (MOCA)
Version 7.1 Original Version

NAME :
Education :
Sex :
Date of birth :
DATE :

VISUOSPATIAL / EXECUTIVE

Copy cube

Draw CLOCK (Ten past eleven) (3 points)

POINTS

[ ] [ ] [ ] [ ] [ ]
Contour Numbers Hands
__/5

NAMING

[ ]   [ ]   [ ]   __/3

MEMORY Read list of words, subject must repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 5 minutes.

	FACE	VELVET	CHURCH	DAISY	RED	
1st trial						No points
2nd trial						

ATTENTION Read list of digits (1 digit/ sec.).
Subject has to repeat them in the forward order [ ] 2 1 8 5 4
Subject has to repeat them in the backward order [ ] 7 4 2   __/2

Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors
[ ] F B A C M N A A J K L B A F A K D E A A A J A M O F A A B   __/1

Serial 7 subtraction starting at 100 [ ] 93 [ ] 86 [ ] 79 [ ] 72 [ ] 65   __/3
4 or 5 correct subtractions: **3 pts**, 2 or 3 correct: **2 pts**, 1 correct: **1 pt**, 0 correct: **0 pt**

LANGUAGE Repeat : I only know that John is the one to help today. [ ]
The cat always hid under the couch when dogs were in the room. [ ]   __/2

Fluency / Name maximum number of words in one minute that begin with the letter F [ ] _____ (N ≥ 11 words)   __/1

ABSTRACTION Similarity between e.g. banana - orange = fruit [ ] train – bicycle [ ] watch - ruler   __/2

DELAYED RECALL

Has to recall words WITH NO CUE	FACE [ ]	VELVET [ ]	CHURCH [ ]	DAISY [ ]	RED [ ]	Points for UNCUED recall only
Optional Category cue						
Multiple choice cue						

__/5

ORIENTATION [ ] Date [ ] Month [ ] Year [ ] Day [ ] Place [ ] City   __/6

© Z. Nasreddine MD   www.mocatest.org   Normal ≥ 26 / 30   TOTAL __/30
Administered by: _____   Add 1 point if ≤ 12 yr edu

Forms and Instructions available for free at:
www.mocatest.org

Nasreddine JAGS 2005

VISUOSPATIAL / EXECUTIVE

Copy cube

Draw CLOCK (Ten past eleven)
(3 points)

POINTS

E
End
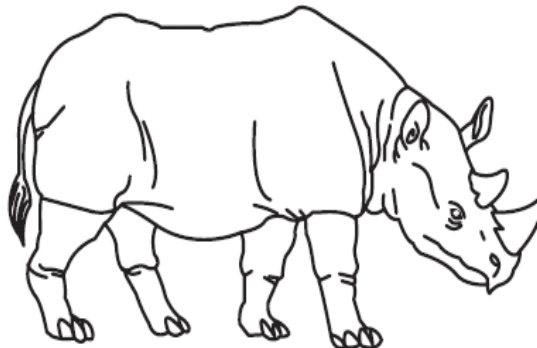
A

5

B

2

1
Begin

D

4

3

C

[ ]

[ ]

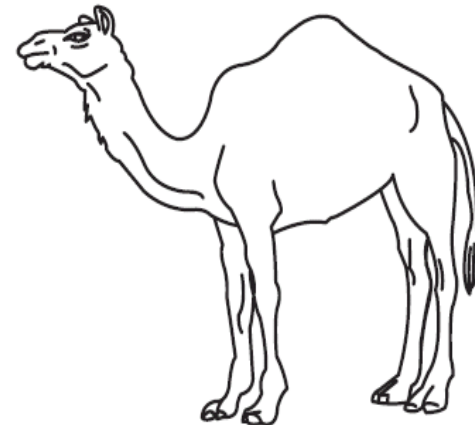[ ] Contour   [ ] Numbers   [ ] Hands

___/5

NAMING

[ ]

[ ]

[ ]

___/3

MEMORY	Read list of words, subject must repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 5 minutes.		FACE	VELVET	CHURCH	DAISY	RED	No points
		1st trial						
		2nd trial						

ATTENTION	Read list of digits (1 digit / sec.).	Subject has to repeat them in the forward order	[ ] 2 1 8 5 4	__/2
		Subject has to repeat them in the backward order	[ ] 7 4 2	

Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors

[ ]   F B A C M N A A J K L B A F A K D E A A A J A M O F A A B   __/1

Serial 7 subtraction starting at 100   [ ] 93   [ ] 86   [ ] 79   [ ] 72   [ ] 65   __/3

4 or 5 correct subtractions: **3 pts**, 2 or 3 correct: **2 pts**, 1 correct: **1 pt**, 0 correct: **0 pt**

LANGUAGE	Repeat : I only know that John is the one to help today. [ ]	__/2
	The cat always hid under the couch when dogs were in the room. [ ]	

Fluency / Name maximum number of words in one minute that begin with the letter F   [ ] _____ (N ≥ 11 words)   __/1

ABSTRACTION	Similarity between e.g. banana - orange = fruit [ ] train – bicycle [ ] watch - ruler	__/2

DELAYED RECALL	Has to recall words WITH NO CUE	FACE [ ]	VELVET [ ]	CHURCH [ ]	DAISY [ ]	RED [ ]	Points for UNCUED recall only	__/5
Optional	Category cue							
	Multiple choice cue							

ORIENTATION	[ ] Date [ ] Month [ ] Year [ ] Day [ ] Place [ ] City	__/6

© Z.Nasreddine MD   Version 7.1   **www.mocatest.org**   Normal ≥ 26 / 30   TOTAL   __/30

≥ 23?

Administered by: _____   Add 1 point if ≤ 12 yr edu

MoCA is more sensitive than MMSE

118 older adults; mean age 79; educ 14 years

Instrument	Sensitivity (95% CI)	Specificity (95% CI)
MMSE (≤ 24)		
MCI	0.17 (0.05-0.37)	0.96 (0.87-0.99)
MCI/AD	0.36 (0.22-0.52)	0.96 (0.87-0.99)
MoCA (≤ 26)		
MCI	1.00 (0.87-1.00)	0.35 (0.24-0.47)
MCI/AD	0.97 (0.87-0.99)	0.35 (0.24-0.47)
MoCA (≤ 23)		
MCI	0.96 (0.79-0.99)	0.95 (0.87-0.99)

Luis, et al Int J Geriatric Psych 2009

- What do the MoCA scores mean?

    - What is really normal for a given age, education, and race?

- What is the best "cut-off" for screening for impairment?

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- Using the <u>S</u>ystolic blood <u>PR</u>essure <u>IN</u>tervention <u>T</u>rial (SPRINT)

- To present normative data and cut-points for identifying impaired individuals in a large, diverse sample of older adults

  - 8724 participants age 50+ with HTN, but no DM, stroke, dementia, or significant depression

    - Mean age 68 (9.4) yrs
    - 36% female
    - 59% White, 30% Black, and 11% Hispanic
    - 75% had >12 years of education

- Mean (SD) MoCA= 23 (4.1)
- 15% were considered possibly impaired by Logical Memory or Digit Symbol Coding

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- 70% had "positive screen" (<26) on MoCA
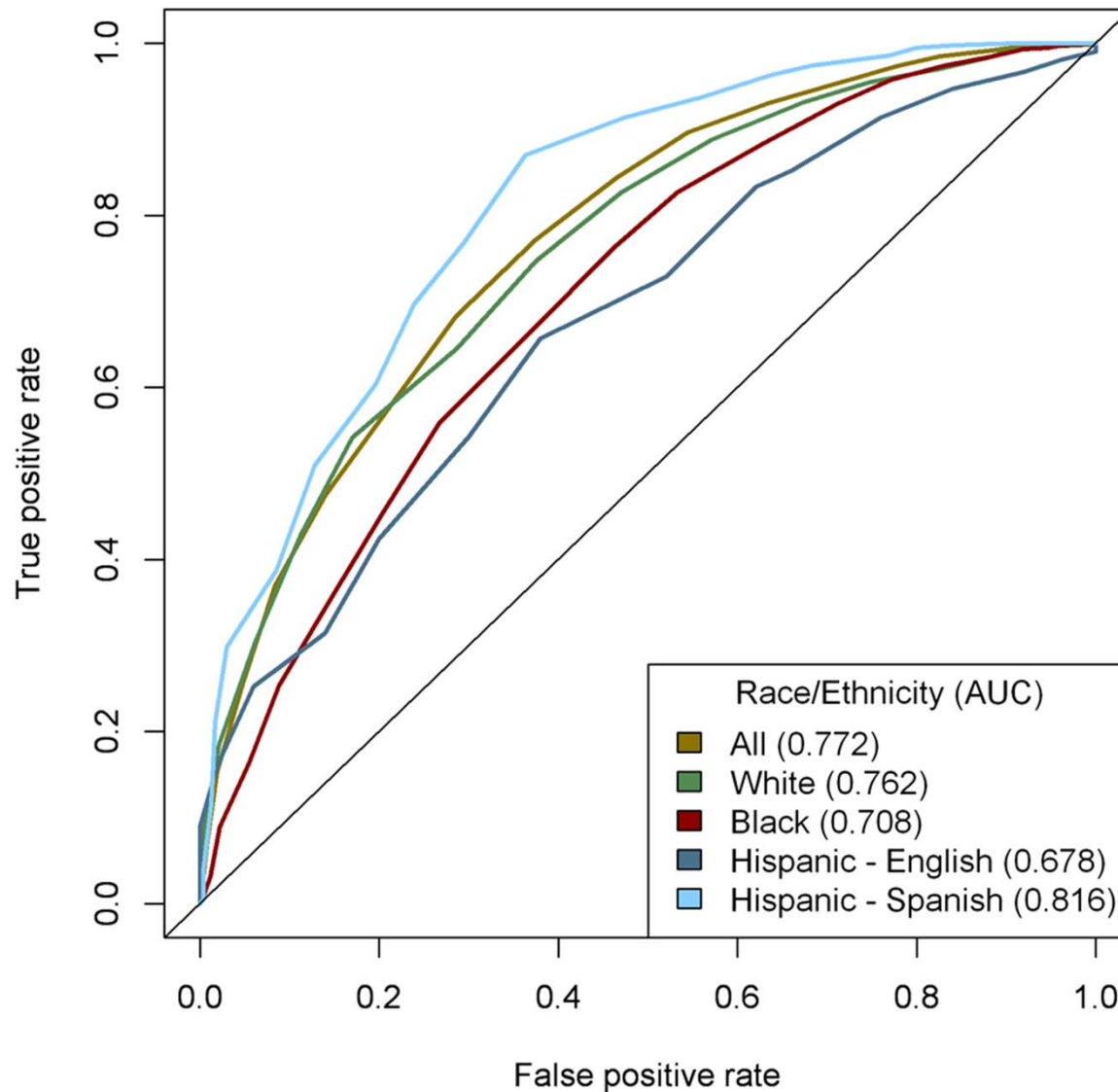- 81% of Blacks and Hispanics scored <26

MoCA Norms for 12 yrs Education
90th, 50th, 10th percentile

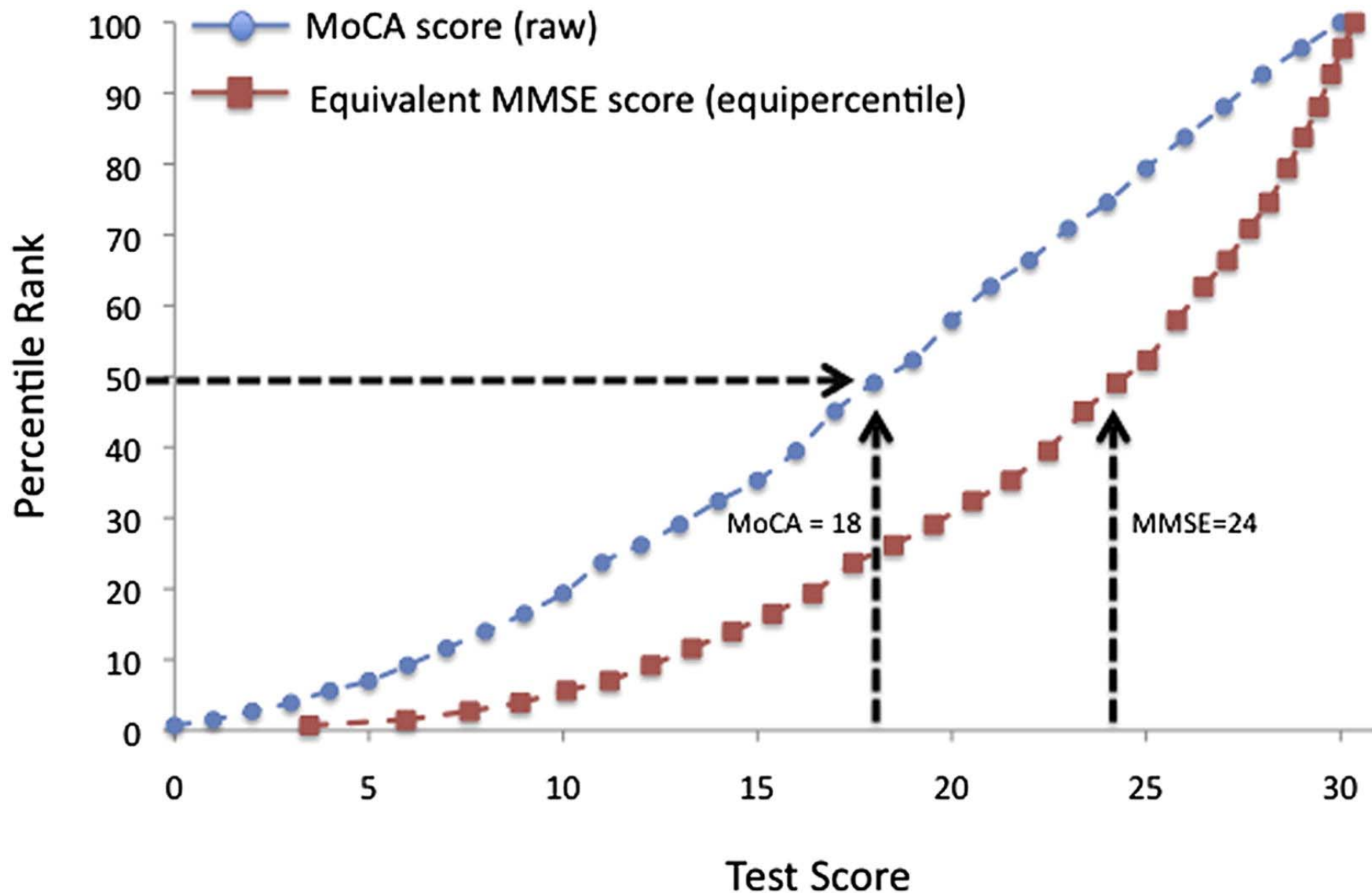Sink, et al. Presented at American Geriatrics Society Annual Meeting, 5/2014
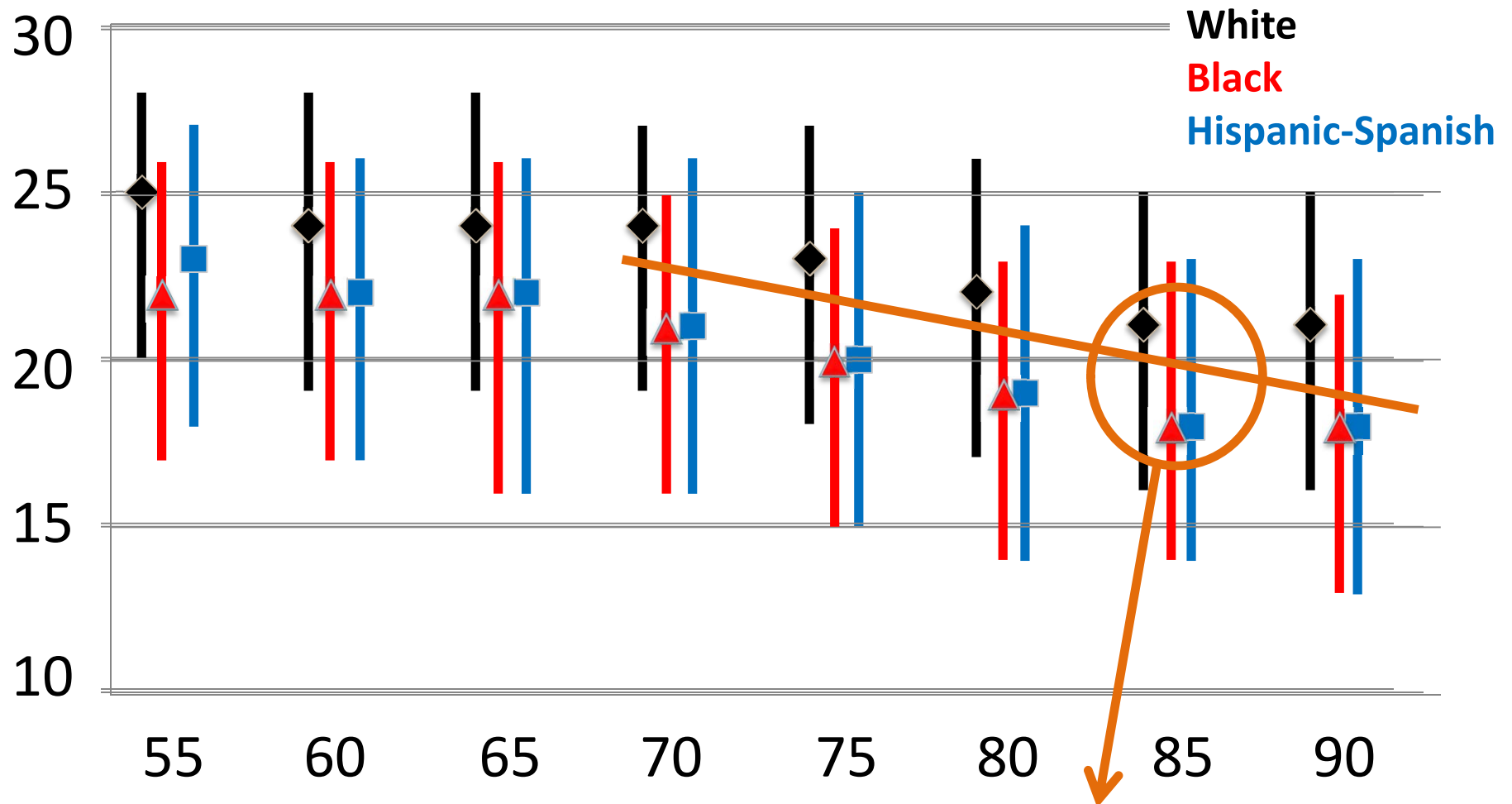
ROC Curve for Impaired based on Screening battery*

Best Cut-off = 23

Sensitivity 71%

Specificity 68%

* Suspected impairment defined as participants with scores >1.5 SD below normative mean on either the Logical Memory Delayed Recall or the Digit Symbol Coding test, or baseline use of Alzheimer's medications

Race/Ethnicity (AUC)
- All (0.772)
- White (0.762)
- Black (0.708)
- Hispanic - English (0.678)
- Hispanic - Spanish (0.816)

Sink, et al. Presented at American Geriatrics Society Annual Meeting, 5/2014

MoCA scores are about 6 points lower than MMSE scores

Roalf, et al, Alzheimer's and Dementia 2012

MMSE to MoCA conversion

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MoCA	MMSE
28-30	30
20-21	26
18	24
13	20
9	15
4	10
1	6

Roalf et al. Alz & Dementia. 2012

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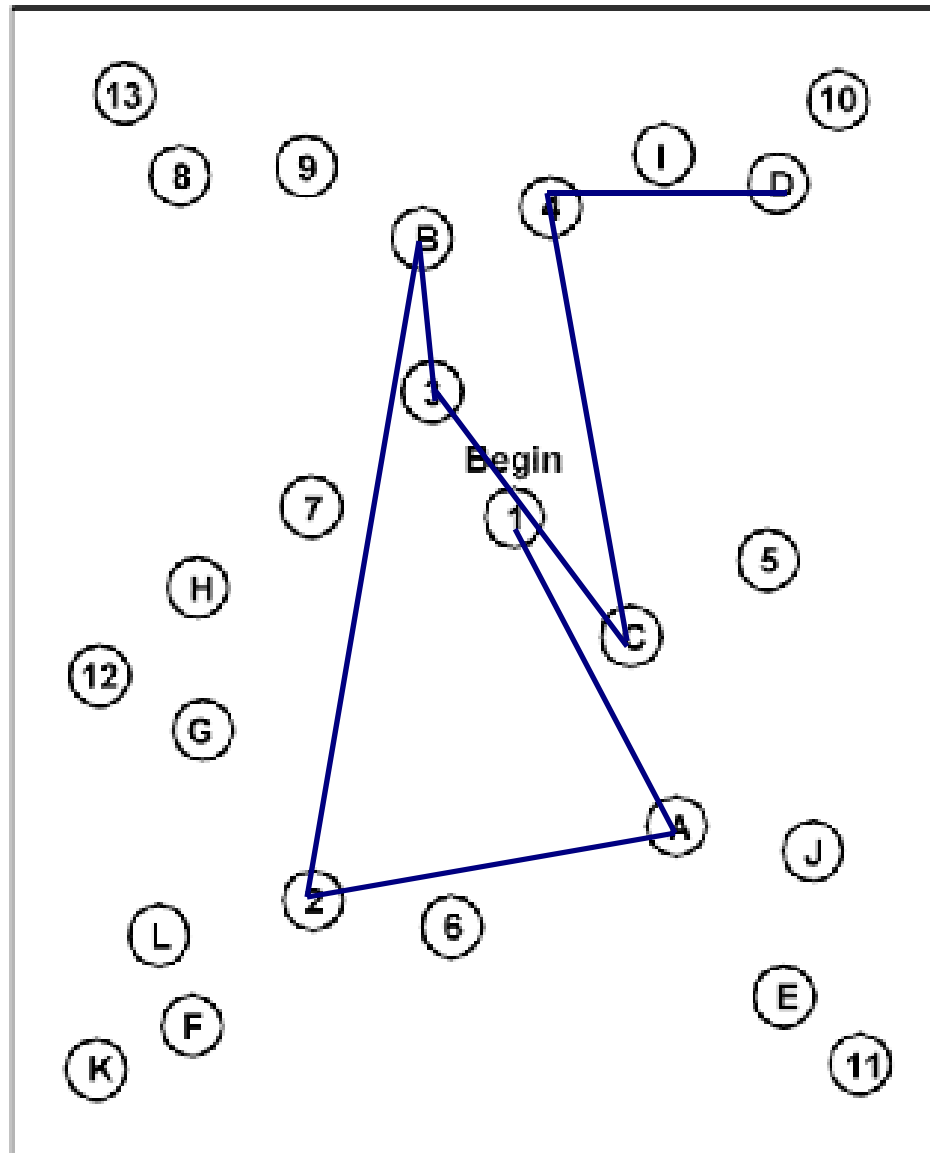School of Medicine

- If you want a screening test that is sensitive for MCI, MoCA definitely better than MMSE

    - Optimal cut-off still to be determined

    - MoCA highly sensitive to age/education/race effects

- If you want to track change over time in relatively high functioning cohort/population, MoCA probably better than MMSE

- If you have a more impaired population, MMSE easier (faster) to administer and has less of a floor effect

- To screen out cognitively impaired participants from trials/studies, either is fine; adjust the cut-off as needed (cost may be a factor)

- Global cognitive function

  - Mini-cog

  - MMSE, 3MSE, MoCA

- Domain specific cognitive functions

  - Memory

  - Executive function

  - Language

  - Processing speed

  - Concentration and working memory
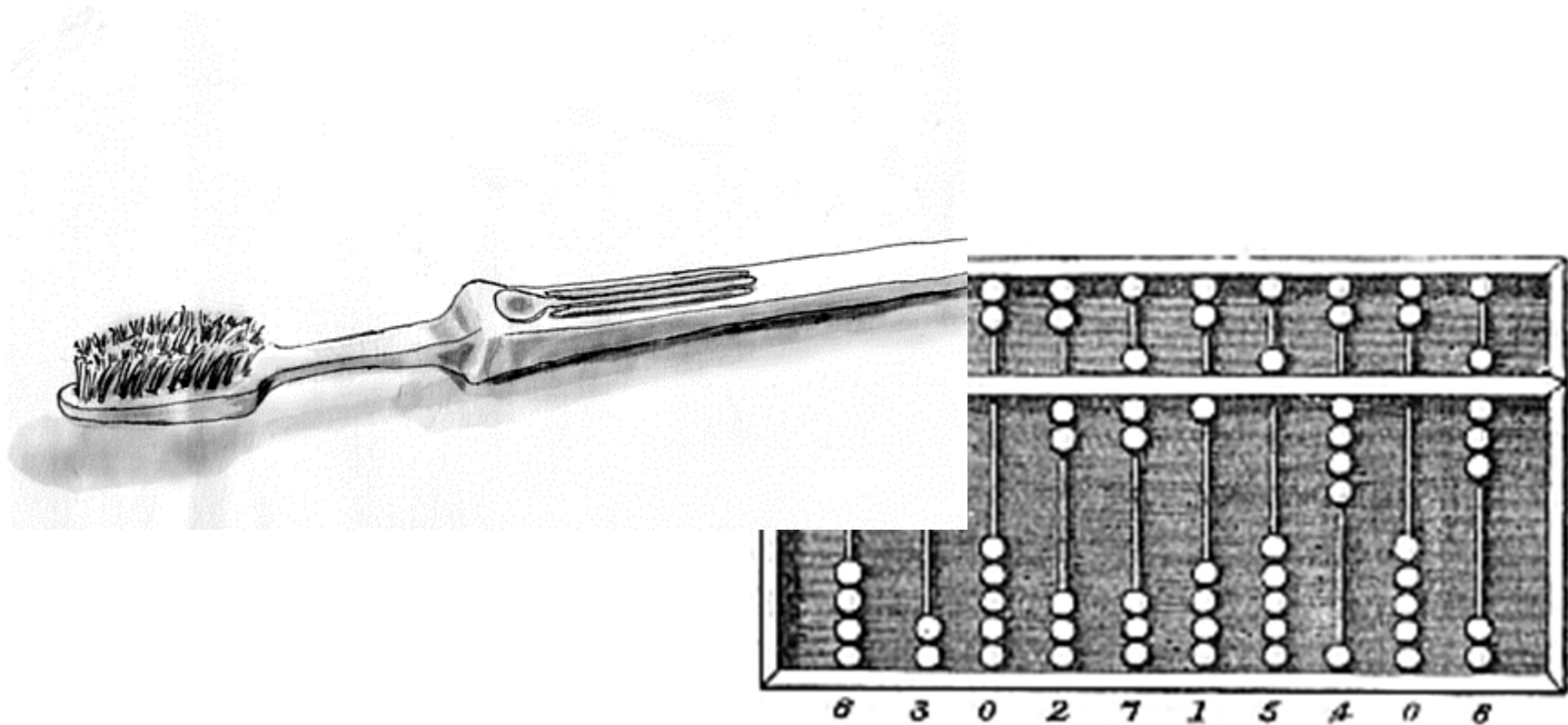
  - Visuospatial function

- Word lists
    - Rey Auditory Verbal Learning Test (RAVLT)
    - Hopkins Verbal Learning Test (HVLT)
    - California Verbal Learning Test (CVLT)
- Paragraph Recall
    - Logical Memory Story
    - East Boston Memory Test

- Multidimensional higher order processing

  - Cognitive flexibility (set shifting)

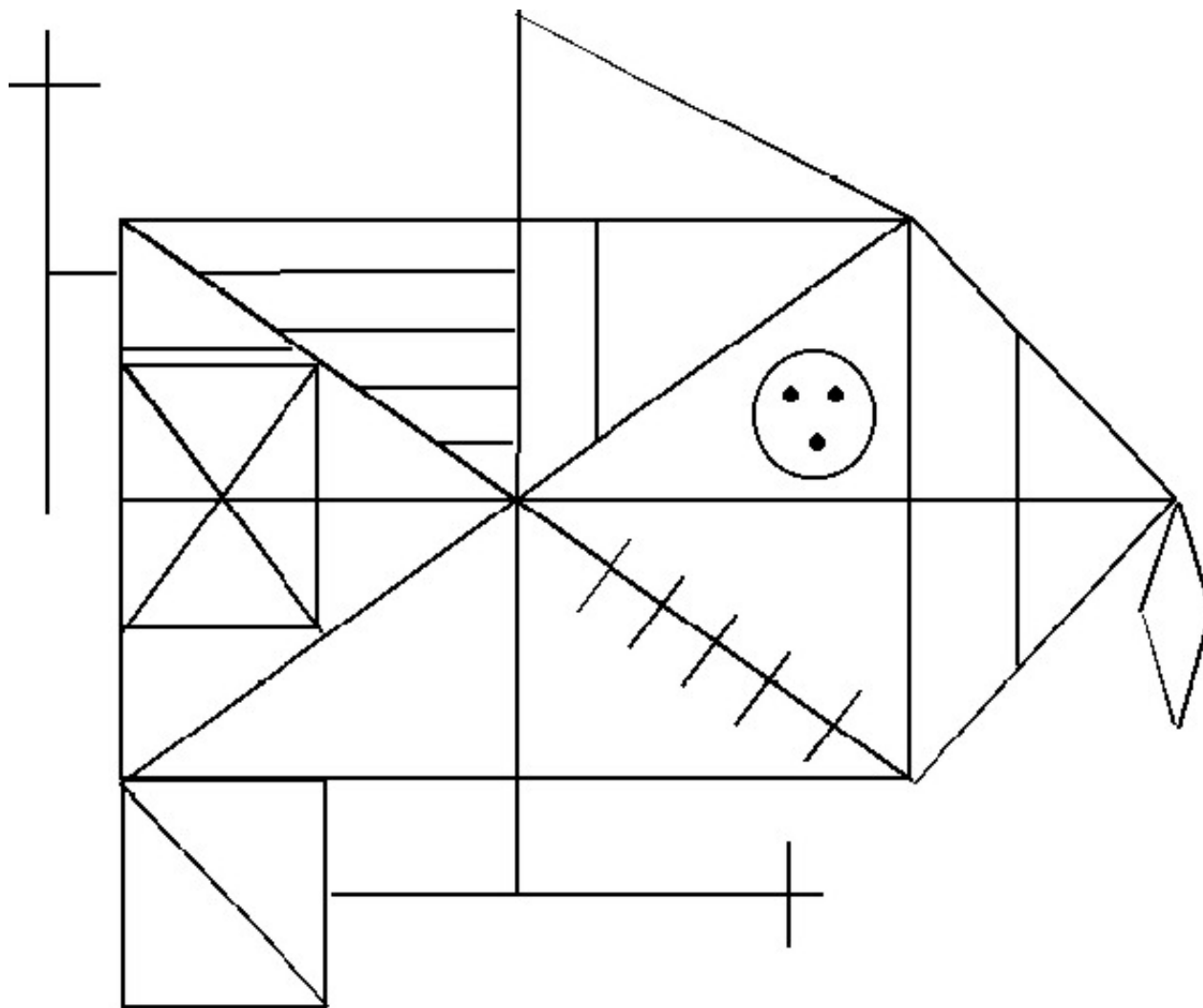 - Planning/organizing

  - Selective attention

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- Reading, writing, repetition, naming
- Boston Naming Test: 15-60 items

- Digit Span forward and backward

- Digit Symbol Coding aka Digit Symbol Substitution Test (DSST)

- Cognitive impairment and frailty are associated
  - More work is needed to better understand the relationships and potential underlying mechanisms
- Concept of "cognitive frailty" is emerging
- It is important to measure cognition, even if briefly, as relying on medical records or claims data will likely not be adequate for most studies
  - This can be done with global measures or domain specific measures depending on what is most appropriate for a given study