

NIH Toolbox Cognition Battery Normative Standards across Administration Platforms

Sensitivity and Validity in HIV infection

Kaitlin B. Casaletto, PhD
Assistant Professor
University of California, San Francisco

Thank you!!!

Coauthors:

Anya Umlauf, M.S.

Ian Abramson, PhD

Donald Franklin, BA

Bob Heaton, PhD

History of the NIH Toolbox-Cognitive Battery: Platform Development

2006-2012: NIH Toolbox Development and Normative Study (desktop-based)

2012: Finalized Toolbox (web-based) released to research community

2015: Revised Cognitive Battery normative standards released (based on desktop version)

2016: iPad-based Toolbox released

OUR QUESTION:

Can the normative standards be applied across administration platforms?

To Norm, or not to Norm?

Quantify *change* (i.e., “impairment”) cross-sectionally

Clinic

Individual level

Research

No or non-demographically matched control group

Remove effects of demographics (reduce variance, covariates)

Development of Normative Standards

Published in final edited form as:

J Int Neuropsychol Soc. 2015 May ; 21(5): 378–391. doi:10.1017/S1355617715000351.

Demographically Corrected Normative Standards for the English Version of the NIH Toolbox Cognition Battery

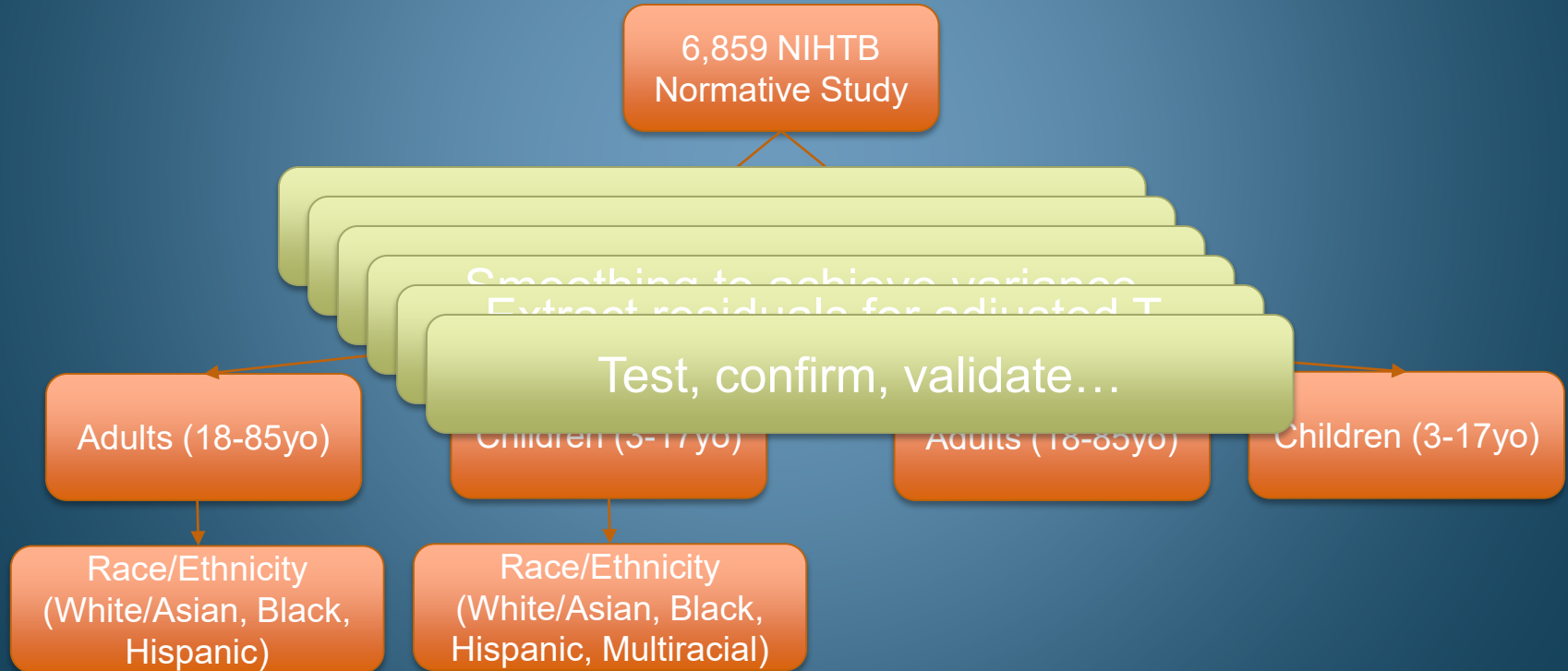
Kaitlin B. Casaletto¹, Anya Umlauf², Jennifer Beaumont³, Richard Gershon³, Jerry Slotkin³, Natacha Akshoomoff², and Robert K. Heaton²

Published in final edited form as:

J Int Neuropsychol Soc. 2016 March ; 22(3): 364–374. doi:10.1017/S135561771500137X.

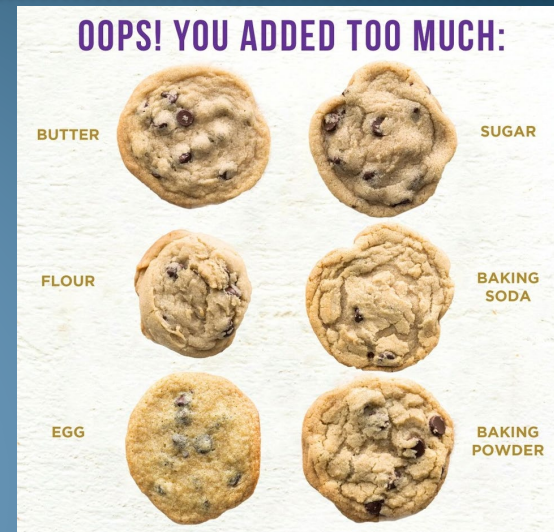
Demographically Corrected Normative Standards for the Spanish Language Version of the NIH Toolbox Cognition Battery

Kaitlin B. Casaletto¹, Anya Umlauf², Maria Marquine², Jennifer L. Beaumont³, Daniel Mungas⁴, Richard Gershon³, Jerry Slotkin³, Natacha Akshoomoff², and Robert K. Heaton²



Importance of Test Invariance for Normative Standards

Change to what goes into a test,
change what comes out of that test!



“Never change standardized test stimuli.” –V. Malcarne, PhD

If a new score \neq old score, norms won't work

Example: DCCS T-score = $50 + 10 * \{[(\text{DCCS scaled score}) - (12.92 - 9.84 * (\text{age}/100) + 1.45 * (\text{edu}/10) + 0.30 * \text{male})] / [1.78 - 0.63 * (\text{age}/100) + 0.16 * (\text{edu}/10) + 0.32 * \text{male}]\} / 1.28$

Aims

- 1. Determine comparability of NIH Toolbox-CB in detecting HIV-associated neurocognitive disorders (HAND) across platforms**
- 2. Validate the NIH Toolbox-CB in a known neurocognitive disease, HIV-associated neurocognitive disorders (HAND)**

Why HIV-associated neurocognitive disorders (HAND)?

~30-50% of HIV+ individuals

Mild-to-moderate fronto-striatal pattern

Weaknesses: *processing speed, executive functions, memory retrieval*

Strengths: *language processing*

Heterogeneous

Limited floor/ceiling effects

Pragmatics... HNRP

Participants:

$n=83$ iPad and $n=530$ web-based NIHTB-CB assessments

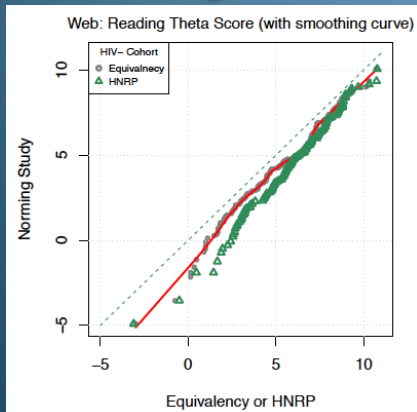
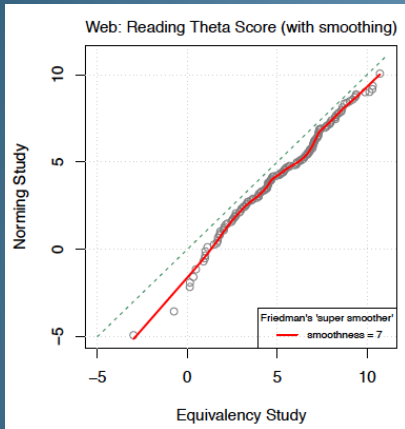
	iPad			Web		
	HIV+	HIV-	Cohen's <i>d</i>	HIV+	HIV-	Cohen's <i>d</i>
<i>N</i>	57	26		404	126	
Age, y	52.3 (13.7)	52.3 (13.3)	0.001	50.6 (12.3)	48.5 (15.5)	0.16
Edu, y	14.0 (2.6)	14.7 (2.9)	0.26	13.9 (2.5)	14.2 (2.4)	0.12
Sex, % M (n)	86% (49)	69.2% (18)	0.43	88.6% (358)	61.1% (77)	0.75
Race			0.02			0.12
White	61.4% (35)	69.2% (18)		61.1% (247)	55.6% (70)	
Black	21.2% (12)	30.8% (8)		21.5% (87)	26.2% (33)	
Hispanic	17.5%)	0%		17.3% (70)	18.3% (23)	
WRAT-4 Reading	102.1 (10.9)	104 (13.5)	0.16	101.0 (14.0)	105.0 (13.7)	0.29*
"Gold-standard" Impaired, %	43.9% (25)	26.9% (7)	0.35	47.5% (192)	14.3% (18)	0.71

Note: * $p < 0.05$; "gold-standard" = HNRP comprehensive neuropsychological battery

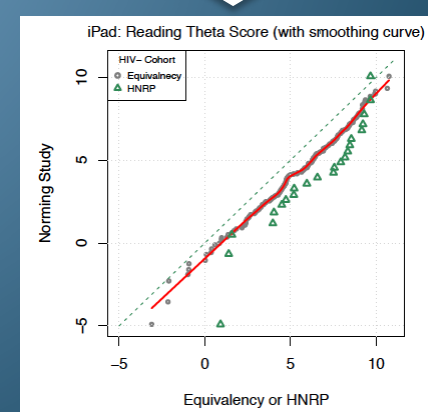
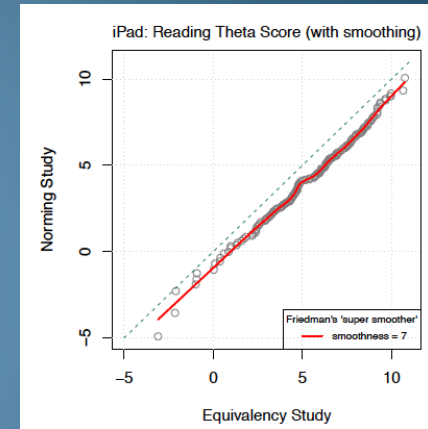
Equivalency smoothing helps...

Equivalency study: new individuals "matched" to those in Norming Study and administered both web and iPad

Web conversion



iPad conversion



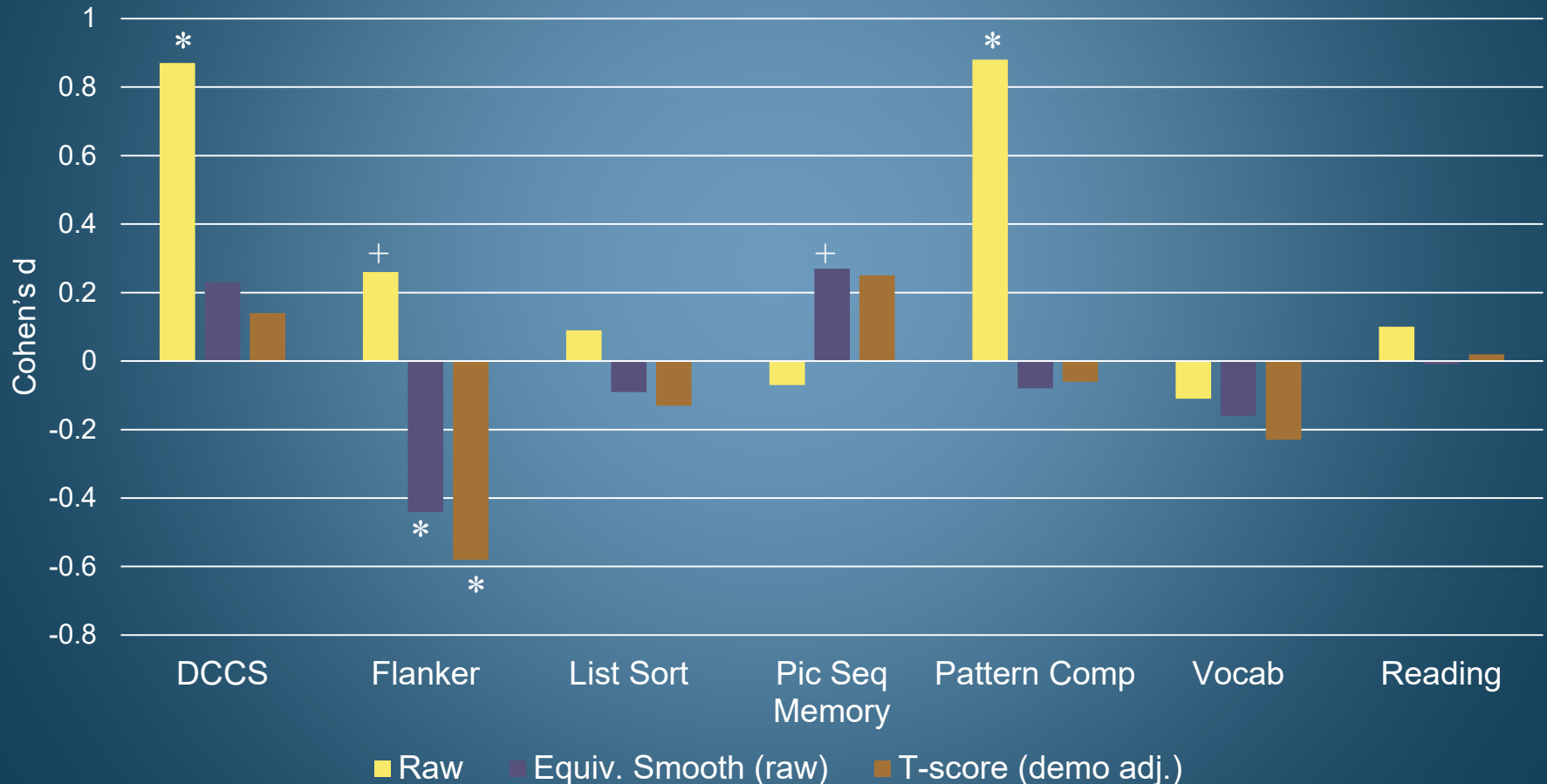
1. Conversion formula extracted

2. Conversion formula applied to HNRP

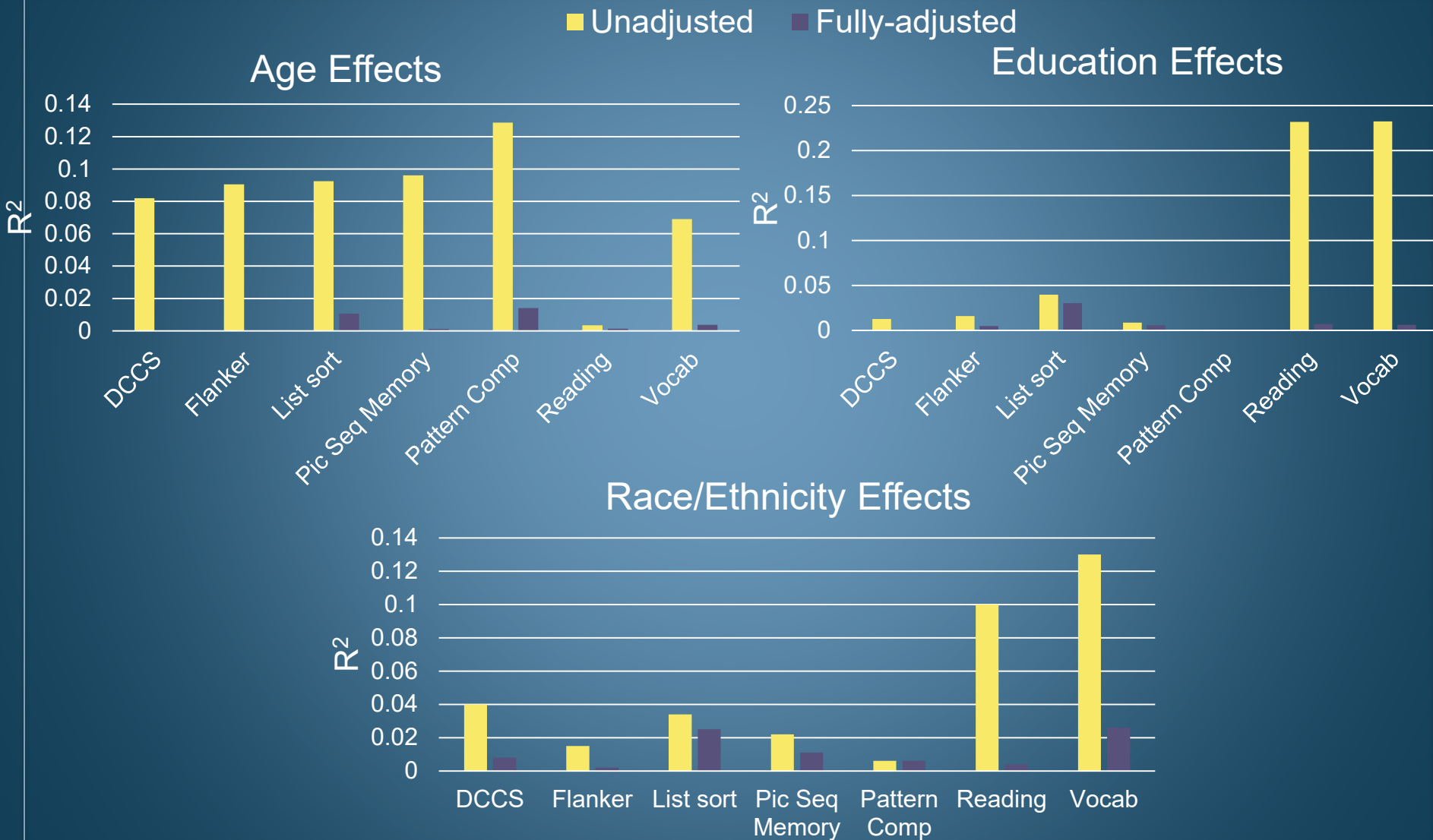
Equivalency smoothing usually helps...

N=158 iPad vs. Web matched on age (± 5 yrs), edu (± 2 yrs), sex, race/ethnicity, HIV serostatus

Cohen's d: iPad > Web



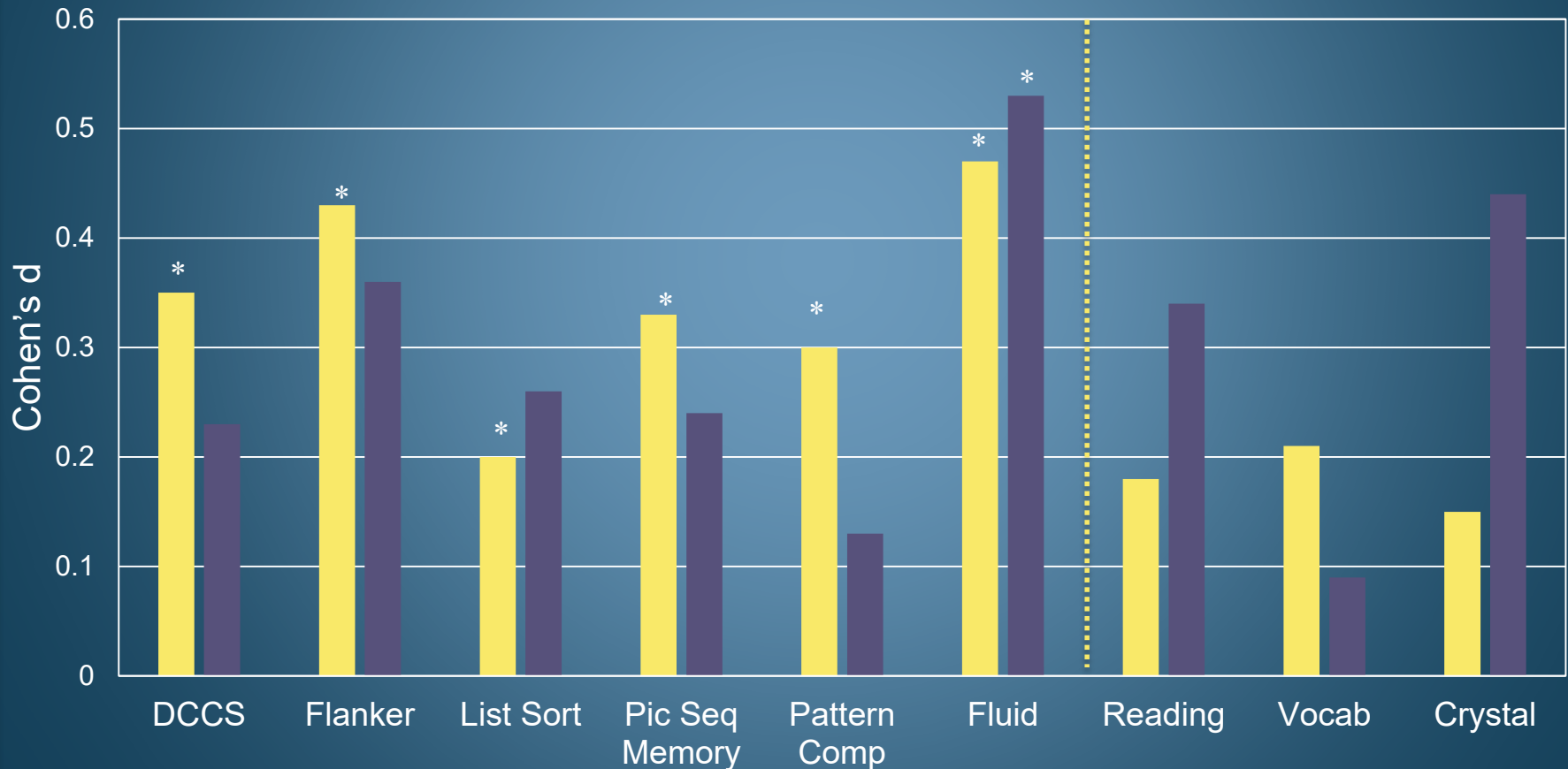
Normative standards control for demographics



Norm-adjusted NIHTB-CB Fluid Scores are sensitive to HIV-infection, across platforms

Cohen's d: HIV+ < HIV-

■ Web-based (n=530) ■ iPad-based (n=83)



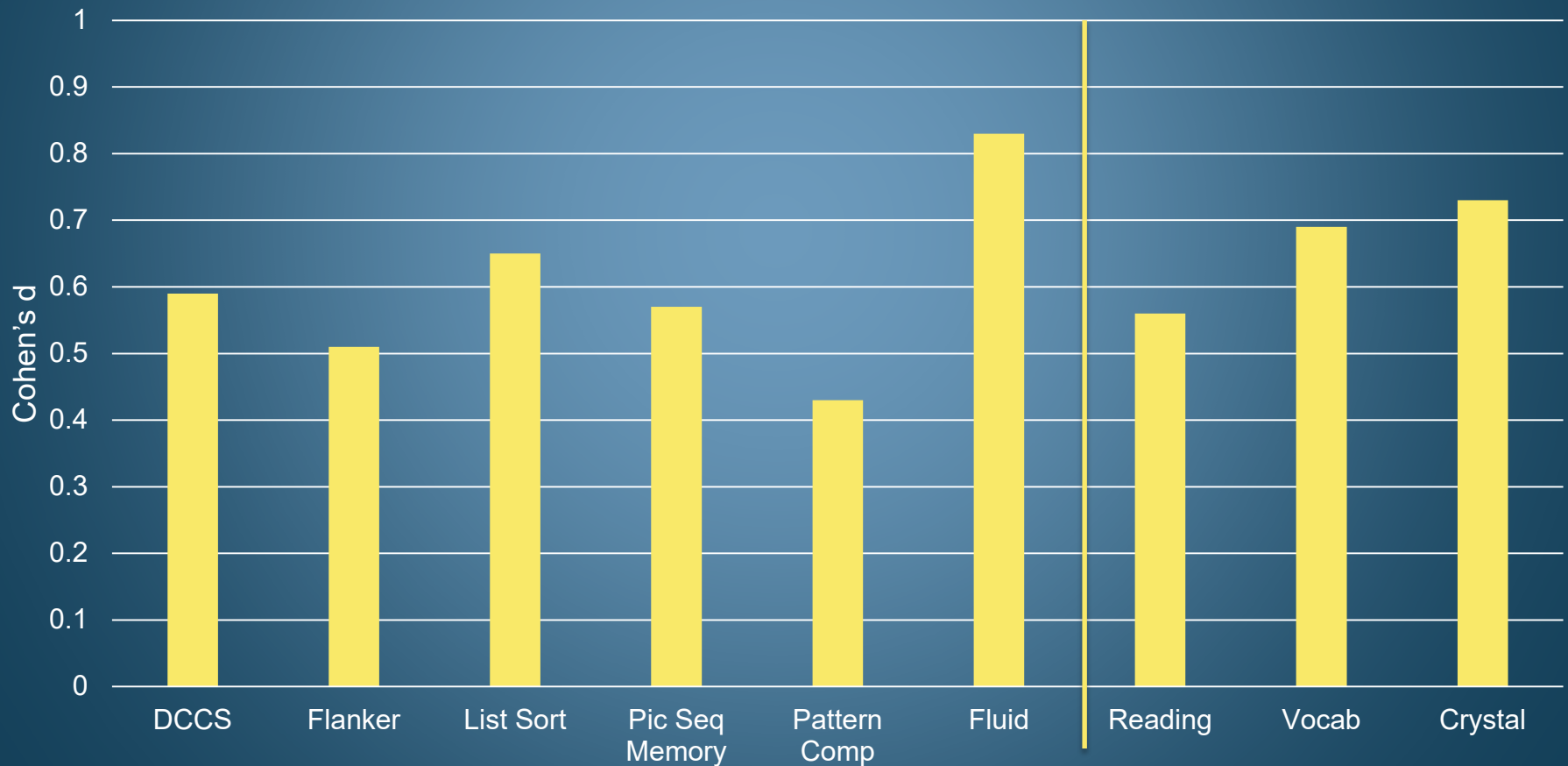
*p<0.05

NIHTB-CB is sensitive to “gold standard” HAND

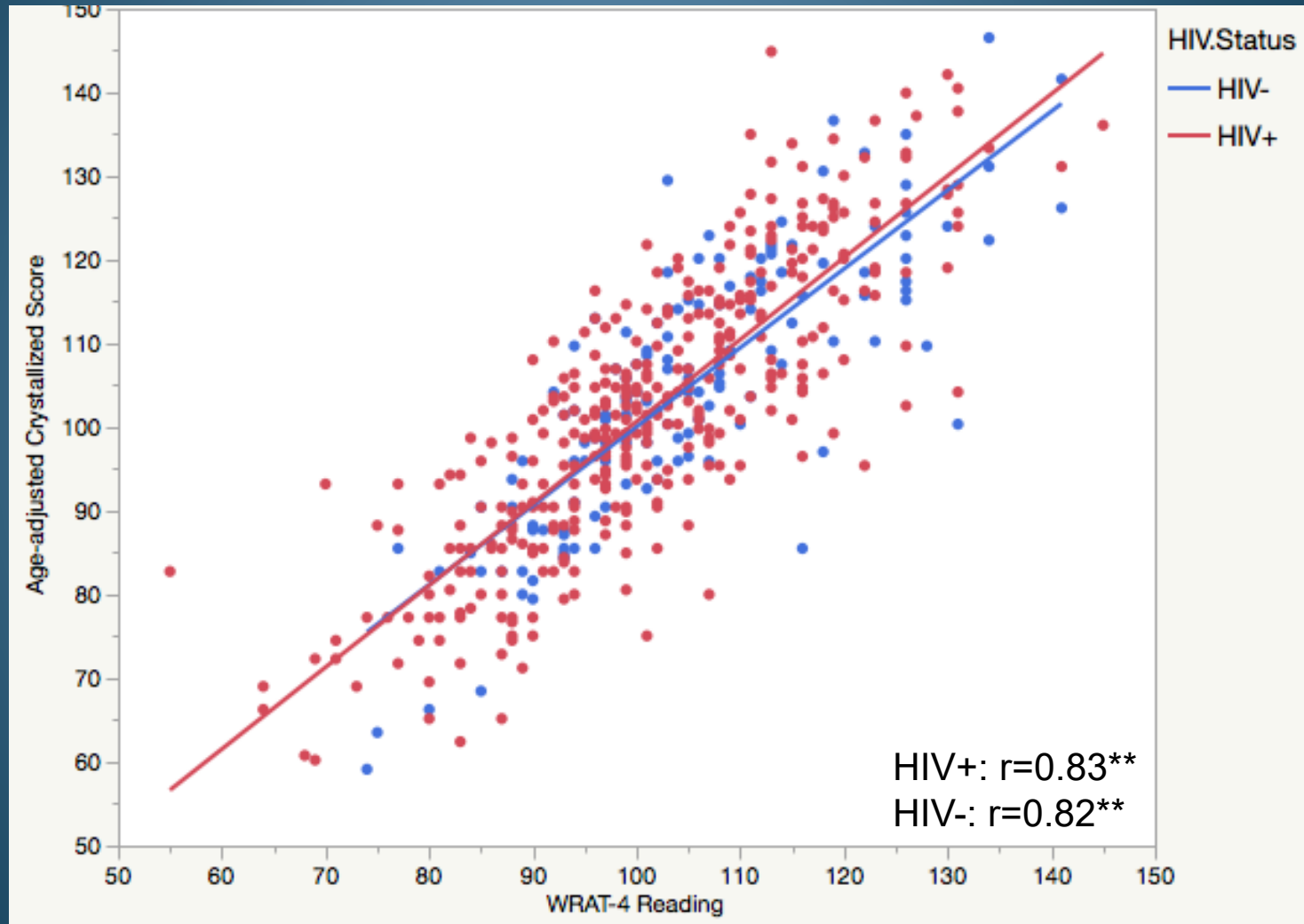
Web and iPad, combined

*all bars
p's < 0.05

All HIV+: no HAND > HAND



WRAT-4 and NIHTB-CB Crystallized scores



NIHTB-CB is sensitive to HAND

Normative standards can be statistically adjusted...

...not ideal...

work in progress

NIHTB-CB Fluid scores can detect HIV+ difference

Show effect with gold standard, comprehensive battery

NIHTB-CB Crystallized scores track with gold standard (WRAT4)

Consider Crystallized based cut-offs to define Fluid “impairment”

Lessons learned

- 1. Tests need to be normed with the platforms/programs that will be used going forward!**
- 2. Programs or Tests should never be changed after norming**
- 3. If/when technology substantially advances/changes, re-norming may be necessary**

Questions?