

Equating the ADAS-Cog and MMSE to Cogstate Brief Battery scores

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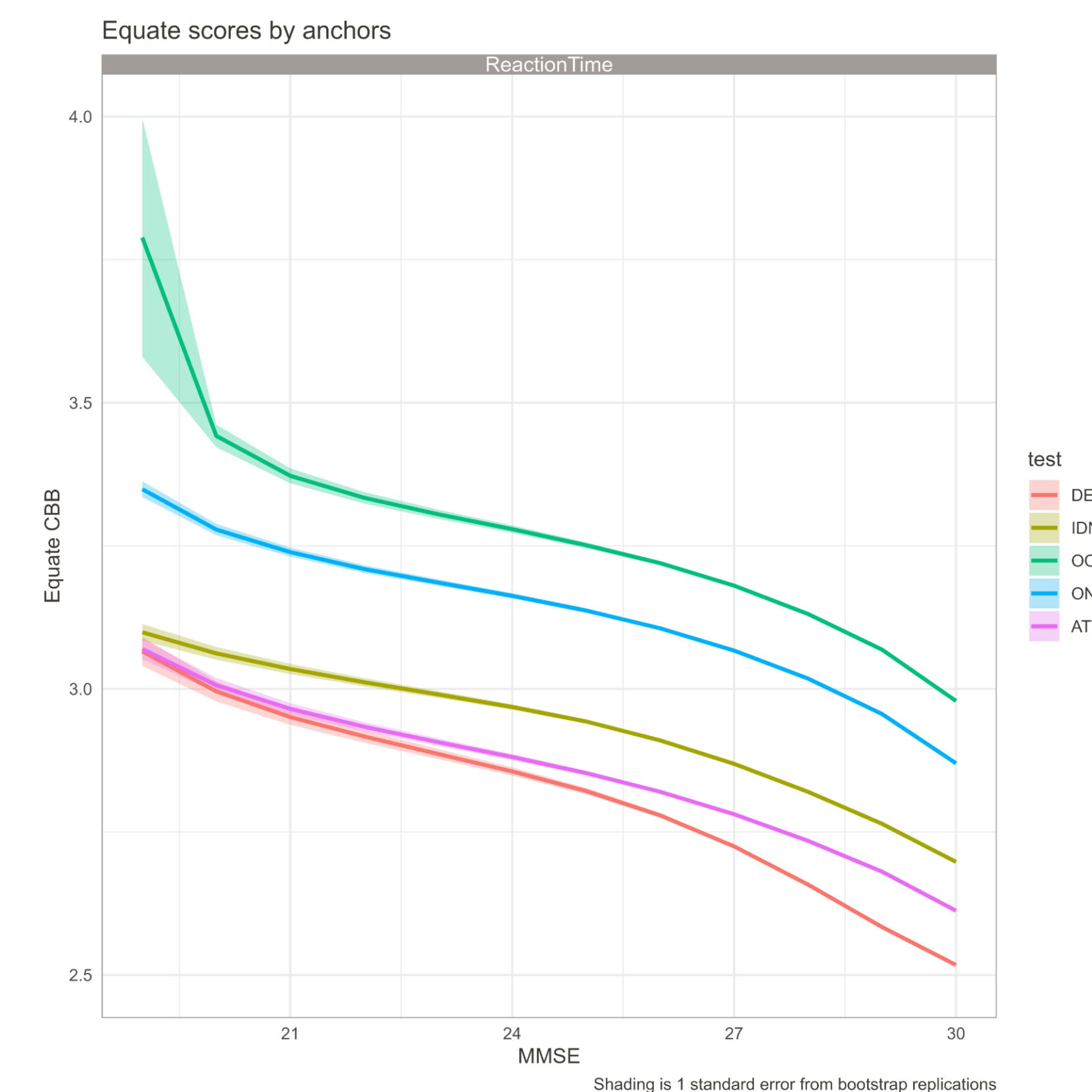
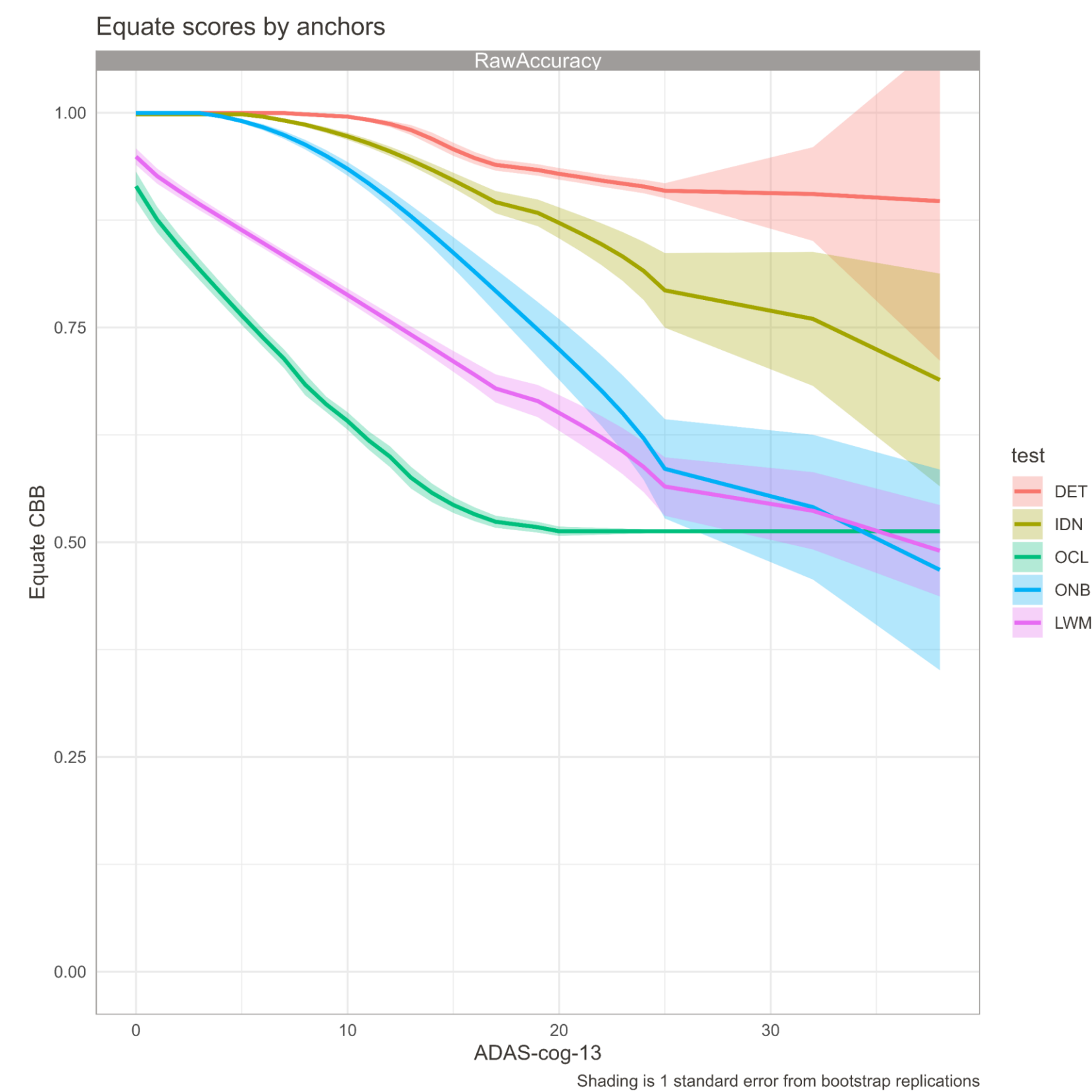


Introduction

- The ADAS-Cog and MMSE are standard COAs for measuring cognition in Alzheimer's disease (AD) clinical trials
- The Cogstate Brief Battery (CBB) is a digital cognitive test developed to accurately, precisely and reliably detect cognitive change in serial cognitive testing
- ADAS-Cog and MMSE scores were equated with CBB scores to validate the latter and use a common scale to translate scores between traditional and modern COAs

Methods

- Data were aggregated for baseline visits from three large AD studies
- Participants included healthy/cognitively normal (HC), MCI, pre-clinical AD, and mild AD
- An equipercentile linking routine for single-group designs, using bootstrap-resampled standard error (SE; variability of estimated CBB scores for each COA score) and bias (mean differences of resampled results from full model) metrics, was employed to fit score distributions
- Equated CBB scores were derived for each anchor (individual total score) for the ADAS-Cog13 and MMSE
- Reaction time (RT; log₁₀ ms) and accuracy (proportion correct) for each of the CBB tests and two composite accuracy (LWM) and reaction time (ATT) scores were fit to ADAS-Cog and MMSE totals



ADAS-cog-13										
	RawAccuracy					ReactionTime				
	DET	IDN	OCL	ONB	LWM	DET	IDN	OCL	ONB	ATT
32	0.91	0.76	0.51	0.54	0.60	3.00	3.06	3.46	3.24	2.98
25	0.91	0.79	0.51	0.59	0.64	2.96	3.02	3.40	3.22	2.95
24	0.91	0.82	0.51	0.62	0.65	2.92	2.98	3.38	3.20	2.93
23	0.92	0.83	0.54	0.65	0.67	2.90	2.96	3.34	3.18	2.91
22	0.92	0.85	0.54	0.68	0.68	2.88	2.94	3.32	3.16	2.89
21	0.93	0.86	0.56	0.70	0.69	2.86	2.92	3.30	3.14	2.88
20	0.93	0.87	0.56	0.72	0.71	2.84	2.92	3.30	3.14	2.86
19	0.93	0.88	0.59	0.75	0.72	2.82	2.90	3.28	3.12	2.85
17	0.94	0.90	0.61	0.79	0.73	2.80	2.88	3.26	3.10	2.83
16	0.95	0.91	0.62	0.82	0.75	2.78	2.88	3.24	3.08	2.82
15	0.96	0.92	0.64	0.84	0.76	2.76	2.86	3.22	3.06	2.80
14	0.97	0.93	0.66	0.86	0.78	2.74	2.84	3.20	3.04	2.78
13	0.98	0.94	0.67	0.88	0.79	2.72	2.84	3.18	3.04	2.77
12	0.99	0.96	0.70	0.90	0.80	2.68	2.82	3.16	3.02	2.75
11	0.99	0.96	0.71	0.92	0.82	2.66	2.80	3.14	3.00	2.73
10	1.00	0.97	0.73	0.93	0.83	2.64	2.78	3.12	2.98	2.72
9	1.00	0.98	0.75	0.95	0.85	2.62	2.78	3.10	2.96	2.70
8	1.00	0.99	0.77	0.96	0.86	2.60	2.76	3.08	2.94	2.68
7	1.00	0.99	0.79	0.97	0.87	2.56	2.74	3.06	2.92	2.66
6	1.00	1.00	0.81	0.98	0.89	2.54	2.72	3.04	2.90	2.65
5	1.00	1.00	0.84	0.99	0.90	2.54	2.72	3.00	2.88	2.63
4	1.00	1.00	0.86	1.00	0.92	2.52	2.70	2.98	2.84	2.61
3	1.00	1.00	0.89	1.00	0.93	2.50	2.68	2.96	2.82	2.59
2	1.00	1.00	0.92	1.00	0.94	2.50	2.66	2.94	2.80	2.57
1	1.00	1.00	0.95	1.00	0.96	2.50	2.64	2.90	2.78	2.55
0	1.00	1.00	0.99	1.00	0.98	2.50	2.62	2.86	2.74	2.53

MMSE										
	RawAccuracy					ReactionTime				
	DET	IDN	OCL	ONB	LWM	DET	IDN	OCL	ONB	ATT
19	0.01	0.03	0.14	0.41	0.36	3.10	3.78	3.34	3.07	
20	0.54	0.52	0.51	0.33	0.47	3.00	3.06	3.44	3.28	3.01
21	0.63	0.61	0.51	0.44	0.52	2.96	3.04	3.38	3.24	2.97
22	0.70	0.68	0.51	0.52	0.57	2.92	3.02	3.34	3.20	2.93
23	0.78	0.73	0.51	0.59	0.61	2.88	3.00	3.30	3.18	2.91
24	0.85	0.77	0.51	0.65	0.65	2.86	2.96	3.28	3.16	2.88
25	0.90	0.82	0.54	0.72	0.69	2.82	2.94	3.26	3.14	2.85
26	0.93	0.87	0.59	0.79	0.73	2.78	2.92	3.22	3.10	2.82
27	0.96	0.91	0.64	0.86	0.77	2.72	2.86	3.18	3.06	2.78
28	0.98	0.95	0.70	0.92	0.81	2.66	2.82	3.14	3.02	2.73
29	0.99	0.98	0.76	0.96	0.85	2.58	2.76	3.06	2.96	2.68
30	0.99	1.00	0.84	0.99	0.91	2.52	2.70	2.98	2.88	2.61

Results

- Data for 8,878 participants were analyzed (HC = 4,021; PC = 773; MCI = 420; AD = 414; Unclassified/Mixed = 3,250)
- Scores ranged from 0-39 (ADAS-Cog13), 0-27 (ADAS-Cog11), and 9-30 (MMSE)
- Estimates of CBB scores by COA scores showed expected associations between assessments
- CBB composites for Accuracy and RT at MMSE >= 26 were estimated at approximately 0.7-0.9 and 2.8-2.6 respectively
- SE in ADAS-Cog and MMSE totals from CBB scores were larger for scores which reflect worse performance and were from smaller samples (accuracy: > 0.10; RT > 1.0)
- MMSE RT SE estimates were significantly smaller (all < 0.2) than ADAS-Cog estimates
- Results of both ADAS-Cog versions were virtually identical

Discussion

- Results can be reliably converted when performance is clinically better
- Lack of samples in lower performance ranges presents an issue for reliable conversion
- Demonstrating how traditional COAs compare to digital assessments can aid clinical interpretation and the understanding of limitations in each assessment
- Using score equating tables may help establish a robust method for exploring associations and differences between assessments and scores

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