

Equivalency of Self-Administered App (LILA) and Telehealth Administration of the International Shopping List Test



Cogstate

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Background

- Self-administered digital cognitive assessments offer the opportunity for cost efficient and scalable screening for cognitive impairment associated with Alzheimer's Disease.
- Episodic memory decline is a cognitive hallmark of AD¹, and provides a key domain for detecting and monitoring early cognitive changes associated with the disease^{2,3}
- The International Shopping List Test (ISLT) is a validated test of episodic memory⁴, shown to differentiate between clinical disease stages⁵, and to be sensitive to amyloid- β associated cognitive decline in MCI and cognitively unimpaired individuals⁶
- LILA is an app that adapts the ISLT for self-administration via smartphone, that has been shown to be feasible and have good acceptability for older adults

The aim of this study was to evaluate the equivalency of the ISLT when self-administered via app (LILA) compared with a clinician-administered telehealth version.

Method

Recruitment was completed via social media advertisements.

Inclusion criteria:

- Aged 35-79 years
- Located in the United States
- Reported English as their first language
- Access to a smartphone to complete the LILA app assessment
- Access to a device with internet access to complete the telehealth assessment

Sample

The pilot sample included n = 46 participants.

- Mean (SD) age of 53.6 (12.8) years
- 63% identified as female

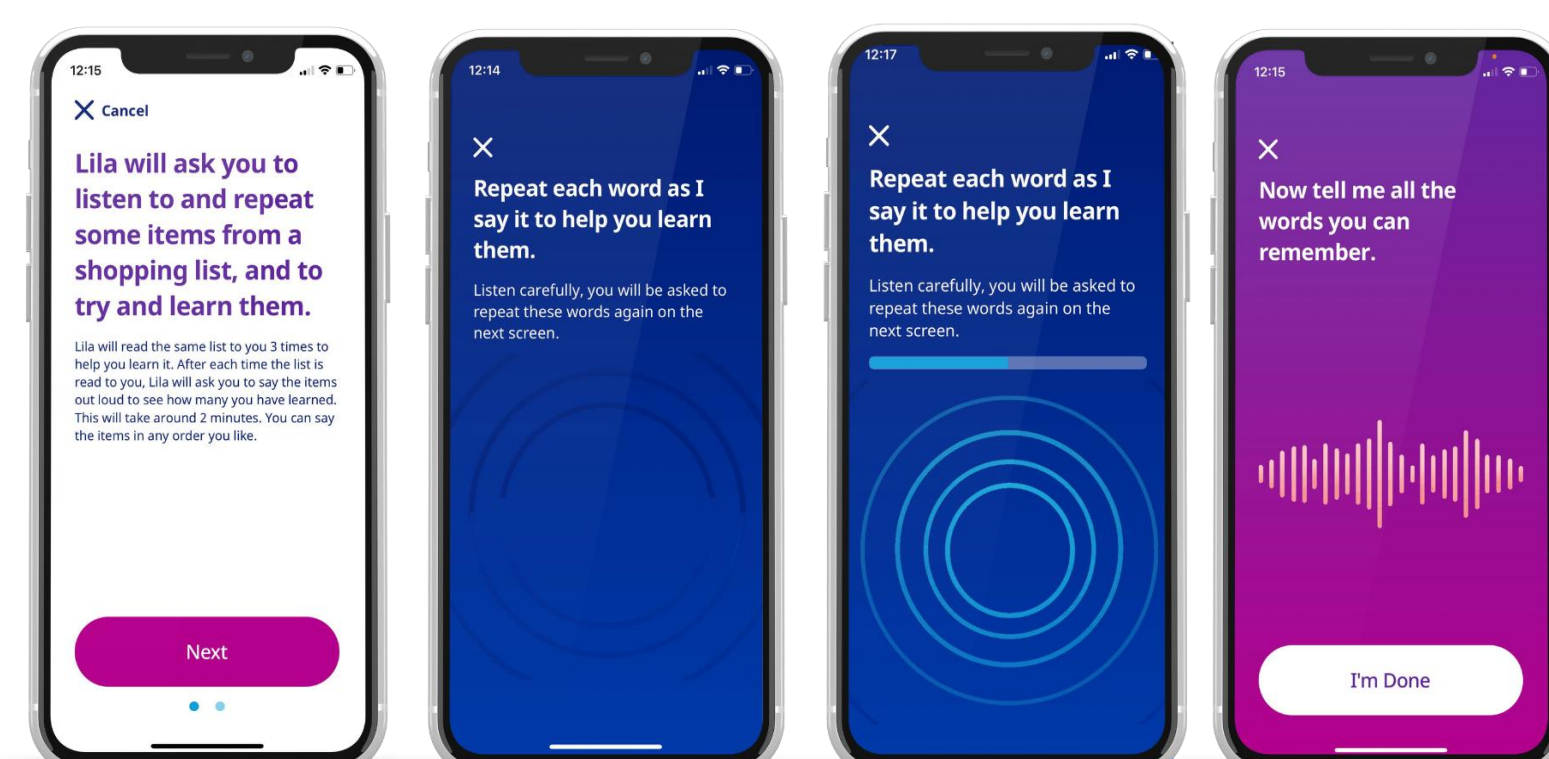
Procedure

Participants were randomized to either complete LILA or the telehealth assessment first and then completed the remaining assessment 1-week later.



For the telehealth assessment, a trained study staff member administered and scored the ISLT.

For the LILA assessment, participants installed the LILA app on their personal smartphone device and completed the assessment independently. Natural Language Processing analyzed and scored responses, generating a score for the total number of words correctly recalled by the participant for each round of the test.



Assessment

The assessment comprised of the ISLT, which is a verbal list learning test for a 12-item shopping list that includes:

- 3-learning rounds
- 10-minute delay
- 1-delayed recall round

Outcome scores include total words correctly recalled across the three learning rounds (immediate recall) and total words correctly recalled after the 10-minute delay (delayed recall)

Analyses

- Completion rates for each assessment method
- Mean and SD total correct score for each round of the test for each method
- Correlation between assessment methods for immediate and delayed recall scores
- Comparison of immediate and delayed recall scores between methods:
 - Paired t-tests for a null hypothesis significance test (NHST)
 - Equivalence test via two one-sided tests (TOST) set for equivalency within ± 0.5 SD

Results

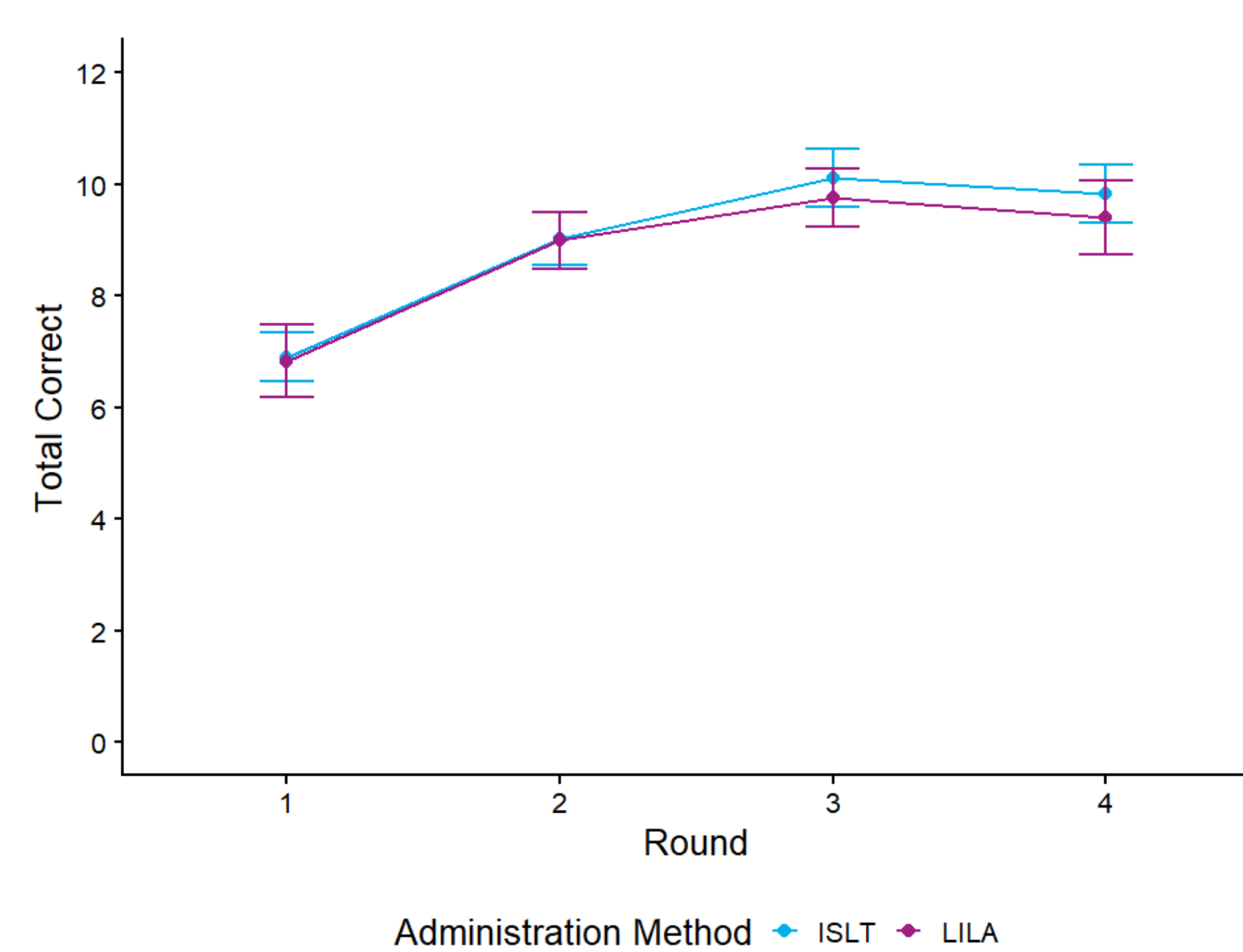
Completion Rates

- The completion rate was 100% (n = 46) for telehealth and 91.3% (n = 42) for LILA.

Descriptive Statistics by Test Round

- Figure 1 shows the mean and SD for the total correct score for both administration methods by test round
- Both methods show the expected learning curve across rounds 1-3 (immediate recall) and decay at round 4 (delayed recall).

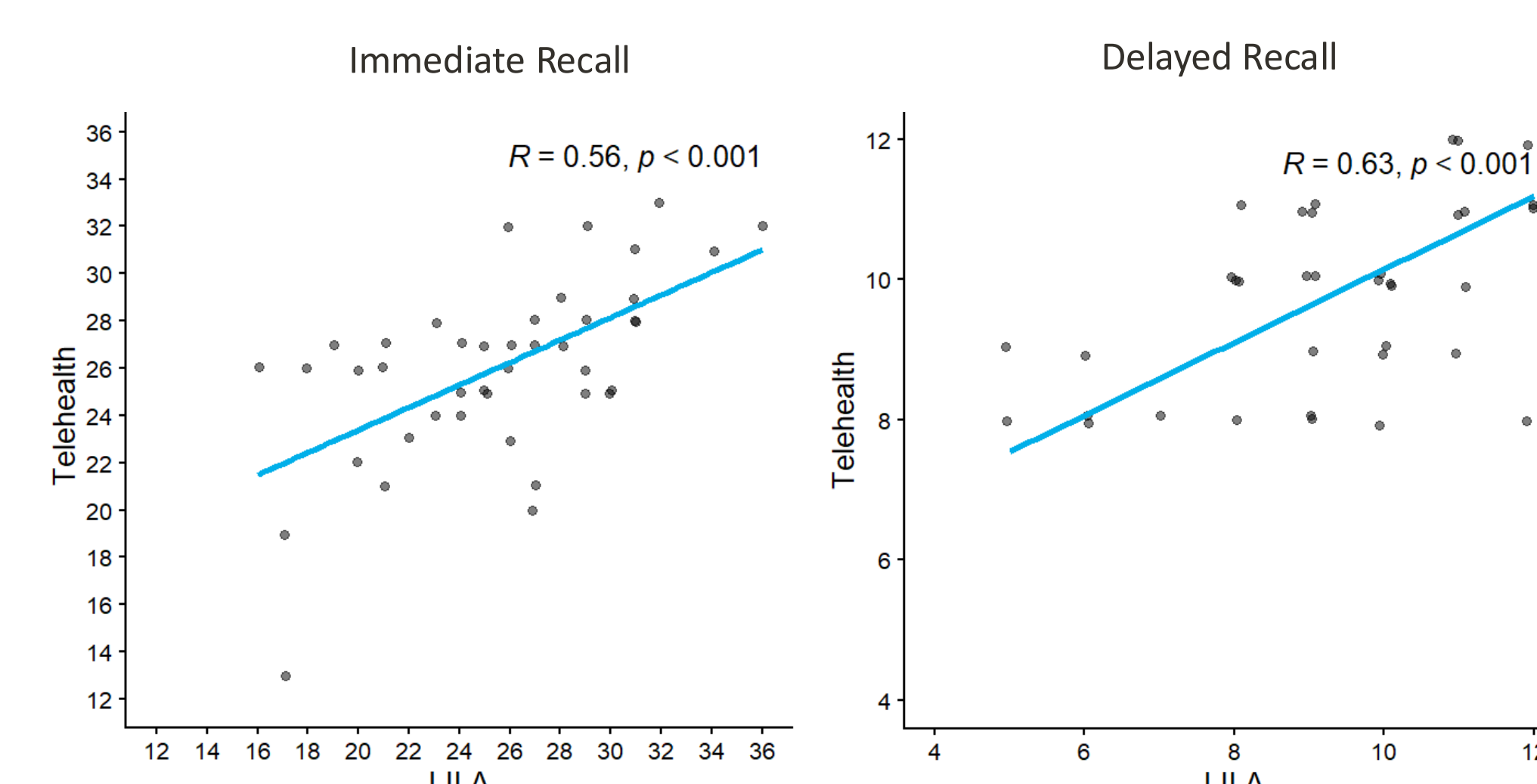
Figure 1. Mean Total Correct Score by Round for LILA and Telehealth



Correlation between LILA and Telehealth

- Figure 2 shows the scatterplot of total correct scores for immediate and delayed recall from LILA and telehealth assessments
- For both immediate and delayed recall there was a significant moderate positive correlation between total correct scores from the two administration methods

Figure 2. Scatterplot of Total Correct Score for LILA and Telehealth



Paired t-test NHST

- Table 1 shows the results from the paired t-test NHST for both immediate and delayed recall
- There was no significant difference between the mean total correct scores for immediate or delayed recall between LILA and telehealth.

Table 1. NHST Results for Difference between LILA and Telehealth

Test Phase	t	df	p	Hedges' g [95% CI]
Immediate Recall	0.74	41	.47	0.10 [-0.17, 0.37]
Delayed Recall	1.72	41	.09	0.21 [0.04, 0.47]

TOST Equivalence Test

- Table 2 shows the results from the TOST for both immediate and delayed recall
- The TOST confirmed that LILA and telehealth administration can be considered equivalent within a margin of ± 0.5 SD for both immediate and delayed recall (mean difference = 0.45 words and 0.43 words, respectively).

Table 2. TOST Results for Equivalency of LILA and Telehealth

Test Phase	t	df	p	Hedges' g [95% CI]
Immediate Recall	-2.79	41	.004	0.11 [-0.14, 0.36]
Delayed Recall	-2.11	41	.02	0.26 [0.01, 0.51]

Conclusion

- There is good concordance between LILA and telehealth:
 - Test **completion rates were high** across both methods
 - Similar learning and decay** for recall of words observed across test rounds
 - Moderate positive correlations** for both immediate and delayed recall scores for each method
 - Only trivial to small differences in immediate and delayed recall scores between methods (e.g., **<0.5 words difference between LILA and telehealth score on average**)

LILA offers a valid self-administered version of the ISLT, that shows equivalent results to those from the clinician-administered version, and offers the opportunity for greater flexibility and efficiency in cognitive screening for AD

- Future studies are needed to further evaluate the utility of LILA for individuals with cognitive impairment, for longitudinal monitoring of cognition, and amongst non-English speaking populations.

References

- Weintraub, S., Wicklund, A. H., & Salmon, D. P. (2012). The neuropsychological profile of Alzheimer disease. *Cold Spring Harbor Perspectives in Medicine*, 2(4), Article Article a006171. <https://doi.org/10.1101/cshperspect.a006171>
- Bäckman, L., Jones, S., Berger, A.-K., Laukka, E. J., & Small, B. J. (2005). Cognitive impairment in preclinical Alzheimer's disease: A meta-analysis. *Neuropsychology*, 19(4), 520-531. <https://doi.org/10.1037/0894-4105.19.4.520>
- Baker, J.E., Lim, Y.Y., Pietrzak, R.H., Hassenstab, J., Snyder, P.J., Masters, C.L., Maruff, P. (2017). Cognitive impairment and decline in cognitively normal older adults with high amyloid- β : A meta-analysis. *Alzheimer's & Dementia: DADM*, 6, 108-121. <https://doi.org/10.1016/j.dadm.2016.09.002>
- Lim YY, Prang KH, Cysique L, Pietrzak RH, Snyder PJ, Maruff P. (2009). A method for cross-cultural adaptation of a verbal memory assessment. *Behav Res Methods*. 41(4), 1190-200. <https://doi.org/10.3758/BRM.41.4.1190>
- Lim YY, Harrington K, Ames D, Ellis KA, Lachovitzki R, Snyder PJ, Maruff P. Short term stability of verbal memory impairment in mild cognitive impairment and Alzheimer's disease measured using the International Shopping List Test. *J Clin Exp Neuropsychol*. 2012;34(8):853-63. <https://doi.org/10.1080/13803395.2012.689815>
- Baker, J.E., Lim, Y.Y., Jaeger, J., Ames, D., Lautenschlager, N.T., Robertson, J., Pietrzak, R.H., Snyder, P.J., Villegane, V.L., Rowe, C.C., Master, C.L., Maruff, P. (2018). Episodic Memory and Learning Dysfunction Over an 18-Month Period in Preclinical and Prodromal Alzheimer's Disease. *Journal of Alzheimer's Disease*. 65 (3). <https://doi.org/10.3233/JAD-180344>
- Lim YY, Cummins H, Bransby L, Stellman G, Fredrickson A, Edgar CJ, Maruff P. Acceptability and validity of a smartphone-administered word list learning test, LILA, in cognitively unimpaired adults. *Alzheimers Dement*. 2025 Jan 3:20 (Suppl 3): e091888. <https://doi.org/10.1002/alz.091888>.

Disclosures

KD Harrington, JM Barbone, J Segura, S Archer, L Miller, R Ray, N Farouk, KM Sink and P Ventola are full-time employees of Cogstate Ltd.

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