

A Computerized Cognitive Assessment Battery Optimized for At-Home Testing

BACKGROUND.

The administration of cognitive tests in patients' homes facilitates access by underserved communities and can increase testing capacity and efficiency. However, the validity of at-home computerized cognitive tests is often questioned because of limitations in examiner monitoring, distractions, environmental noise, and potential cheating. Here, we compare performance of the computerized California Cognitive Assessment Battery (CCAB) when administered at-home or in the laboratory using otherwise identical procedures.

METHOD.

The California Cognitive Assessment Battery (CCAB) includes 17 verbal and 15 non-verbal tests that have been optimized and normed for at-home assessment on tablet computers (Figure 1). To reduce the influence of distractions and noise, CCAB verbal stimuli are adjusted for hearing loss and delivered at high intensities through noise-attenuating circumaural headphones. Verbal responses are digitally recorded using a noise-cancelling head-mounted microphone. Most importantly, CCAB test administration is proctored through a control interface that warns of potential error conditions (e.g., performance failures, excessive noise, etc.), displays test performance in real time, facilitates patient observations, and incorporates video chat and test-control capabilities to readminister tests should problems arise.

During the COVID pandemic 310 (mean age 70.1 years) participants successfully completed three 90-minute enrollment test sessions in their homes. Omnibus z-scores were obtained by averaging z-scores from 70 individual test measures, as well as cognitive domain scores averaged over tests of episodic memory, processing speed, executive function, and working memory. At 6 months, 277 participants were retested, 46% of them in the laboratory. At 18 months, 200 participants were retested, 57% in the laboratory.

RESULTS.

Table 1 shows Omnibus z-score correlations at enrollment, 6-, and 18- months as a function of retest location: at-home/in-lab tests showed similar correlations as at-home/at-home tests. Table 2 shows mean z-scores for at-home and in-lab assessments at 6- and 18-months, estimated with a model that included Omnibus z-scores at enrollment. No significant differences were observed as a function of test site at 6-months ($t(273) = -0.56$, *NS*) or 18-months ($t(172) = 0.44$, *NS*), nor were significant differences seen for cognitive domain scores.

CONCLUSIONS.

CCAB test results are similar whether assessments are administered at-home or in a laboratory.

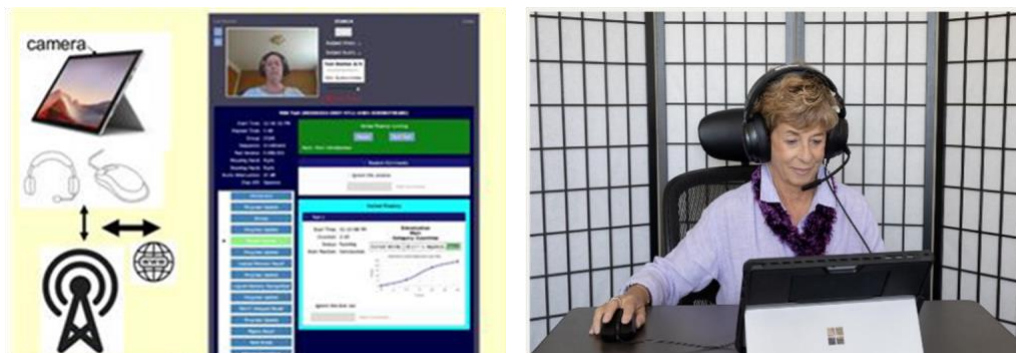


Figure 1. The CCAB was administered on a standard PC tablet computer with cellular connectivity (left) in participants' homes (right) or in a laboratory test booth. Automated CCAB tests were proctored by an examiner who monitored test performance in real time (middle) and corrected rare problems using video chat and remote test control to assure valid results.

Test site	6-Mo	18-Mo
Lab	0.95	0.93
Home	0.93	0.92

Table 1. Correlations of omnibus z-scores from at-home enrollment testing with follow-up

retest z-scores from lab or home test sites.

Test site	6-Mo	18-Mo
Lab	-0.04 (0.91)	0.03 (0.94)
Home	0.03 (1.07)	-0.03 (1.07)
<i>t-test</i>	<i>-0.56</i>	<i>0.44</i>

Table 2. Mean omnibus z-scores from follow-up tests at lab and home retest sites. Site differences were insignificant for omnibus z-scores and scores in individual cognitive domains (not shown).