

Web-based computerised cognitive testing using CANTAB: comparison to in-person assessment.

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Methodological Question

Remote pre-screening of potential participants has the potential to improve the efficiency of clinical trials by obtaining patient reported or objective cognitive data before site visits. Remote testing presents some unique challenges, notably variable computer hardware and operating system, and lack of direct behavioural observation by a rater. These data present a direct comparison of results obtained in person or remotely, to establish the validity of remote testing methods.

Background

Remote pre-screening of potential participants has the potential to improve the efficiency of clinical trials by obtaining patient reported or objective cognitive data before site visits. Remote testing presents some unique challenges, notably variable computer hardware and operating system, and lack of direct behavioural observation by a rater. Here we present the results of two studies aimed at validating at home web-based testing against in-person assessment addressing these challenges.

Methods

Study one is a between-subjects study assessing the comparability of web-based and in-person testing. Six hundred participants were recruited for web-based testing. These were compared to a matched sample of 94 participants assessed in person. Participants completed tests of episodic memory (Paired Associates Learning - PAL) and Spatial Working Memory (SWM) from the CANTAB. From participants in the web-based condition, we collected reaction times, hardware and software platform, and browser behaviour. The latter was used to quantify participant engagement.

The second study is a within-subjects counterbalanced cross-over study. Forty-seven participants recruited via social media and local advertising in and around Cambridge (UK) and completed the CANTAB PAL and SWM tests on average one week apart. Tests were administered either on the iPad in a clinical unit, or via web-based testing in the home environment on a laptop/desktop computer. Participants were randomly allocated to two groups: in-person or web-based first, and all were tested twice, so all participants underwent testing in both settings. A multivariate analysis of variance (MANOVA) analysis was carried out to investigate whether there were statistically significant

differences between the testing platforms (in-person vs web-based). The key outcome measures for each test were used as dependent variables and the platform as a fixed factor. Covariates in this model were Age, Gender and Level of Education.

Results

In the first experiment, there was no significant difference in distribution of scores between supervised and web-based testing. Within the web-based testing, there was no difference between hardware platforms or browser. A number of participants in the web-based condition showed trial-by-trial response times which were more variable and slower than seen in supervised testing. This was correlated with worse task performance and younger age. Browser monitoring revealed whether participants tabbed to a different browser window during the task. This behaviour was associated with poorer performance, more variable reaction time, and younger age. In our second experiment, we again found no significant effect of testing location (in-clinic or web-based: $F(21,66) = 0.67, p > .05$) overall, or any significant difference for the key outcome measures of the tests.

Conclusions:

The two studies presented here aimed to assess the equivalence of CANTAB testing conducted in-person or remotely in a home setting. The first, between subjects study showed an equivalent distribution of scores in the two conditions, and revealed metrics of inattention which could indicate participant attention and compliance. Our second experiment provided a direct test of the equivalence of in-person and web-based testing methodologies, by employing a within subjects cross-over design. These findings support the validity of home-based computerised assessment.