

Self-Administered Assessment Integrating Digital Questionnaires, Cognitive Tests and Speech Analysis – A Feasibility Study

Filippa O. Lindskov¹, Cecilia El-Sayed Petersen¹, Ann Nielsen¹, Kristian S. Frederiksen^{1,2}, Gunhild Waldemar^{1,2}, T. Rune Nielsen^{1,3}

1: Danish Dementia Research Centre, Department of Neurology, Rigshospitalet, Copenhagen, Denmark. 2: Department of Clinical Medicine, University of Copenhagen, Copenhagen, Denmark. 3: Department of Psychology, University of Copenhagen, Copenhagen, Denmark.

BACKGROUND AND AIM

In Denmark, 100,000 people live with dementia, projected to rise to 146,000 by 2040. With an aging population and fewer health care professionals, the diagnostic pathway is under pressure. Furthermore, 57% of patients are diagnosed at moderate to severe stages. There is a need for accessible, cost-effective tools for early detection in primary care. Emerging technologies like AI, speech analysis, and remote testing offer potential solutions, but it is unclear whether individuals with mild cognitive impairment can complete self-administered tests.

This study assessed the feasibility of self-administered questionnaires, neurocognitive tests, and speech analysis in cognitively impaired patients (MMSE ≥ 24).

PARTICIPANTS AND PROCEDURES

15 patients from the Copenhagen Memory Clinic completed three different tasks on an iPad. Baseline characteristics are shown in Table 1.

- **cCOG.** A web-based cognitive test tool for detecting neurocognitive disorders completed by navigating through 6 tasks using buttons and a keyboard: 12-word recall and delayed recall with pictures, a reaction time test, fragmented letters and modified Trail-Making-Test A and B. Duration 20-40 minutes.
- **SB-C:** A speech based biomarker for neurocognitive disorders completed by navigating through 4 tasks using buttons. Replies were spoken aloud and recorded for later analysis. Tasks included 15-word recall, semantic verbal fluency and a free speech task of positive and negative experiences. Duration 10-15 minutes.
- **Four different questionnaires:** 1; demographic variables and health information, 2; the Cognitive Functioning Instrument (CFI), 3; symptoms of Frontotemporal Dementia and Dementia with Lewy Bodies (qSYM), and 4; the Geriatric Depression Scale-15 (GDS).

Feasibility measures: Technological proficiency was assessed before testing; time use, assistance, and breaks were observed during testing; usability and acceptance were evaluated afterwards.

Criteria for feasibility were an average test completion time below one hour, and an overall completion rate of 80% or more.

Table 1: PARTICIPANTS CHARACTERISTICS

N	15
Age, Mean	73.4 (62-83)
Sex (m/f)	8 / 7
Education	
Less than 10 years	3
10-12 years	6
More than 12 years	6
Syndrome Diagnosis	
MCI	10
Mild Dementia	5
Aetiology	
Alzheimer's Disease	3
Frontotemporal Dementia	1
Mixed + Cerebrovascular	3
Dementia w/Lewy Bodies	2
Unknown/Other	6
MMSE-score	
Mean (Range)	27.7 (25-30)
Online Proficiency	
Internet at home (Y/N)	14 / 1
Frequency of tablet/smartphone use	
Daily	10
Weekly	1
Rarely/Never	4
Online confidence	
I can do it myself	8
I do it, but I feel insecure	2
I get help (sometimes)	4
I cannot do it myself	1

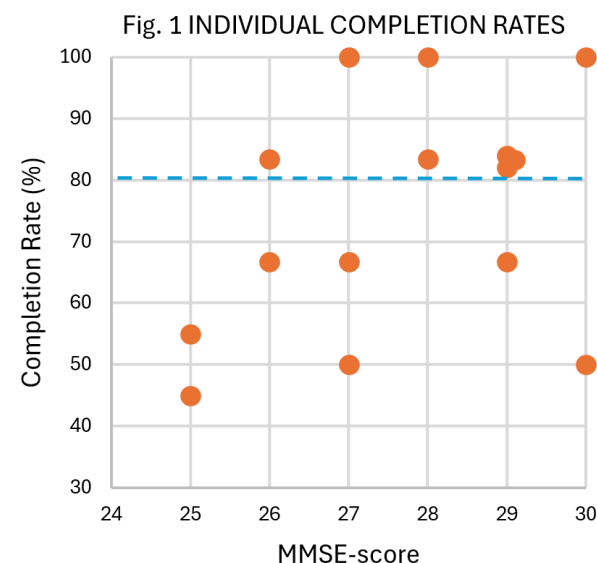


Figure 1. Cumulated self-administered completion rates for each participant (CRI). Three participants all had an MMSE of 29 and a CR of 83.3%, these have been separated for visual clarity. 8/15 participants completed the task with a CRI above 80%, not correlated to MMSE-score ($R^2=0.15$).

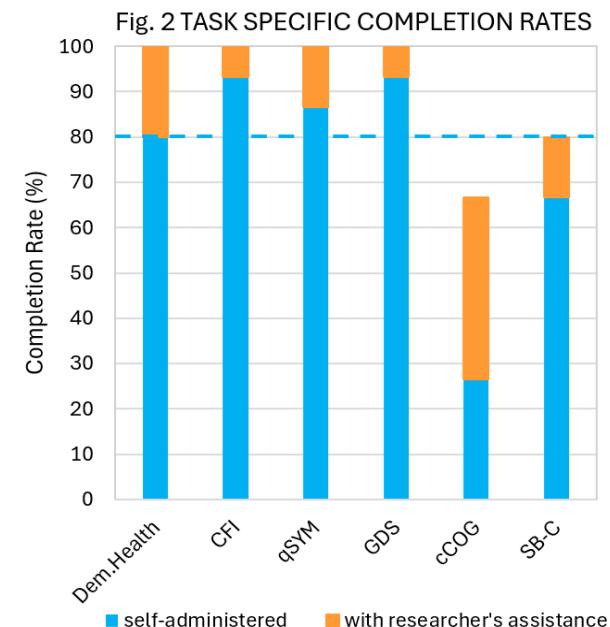


Figure 2. Completion rates for each constituent task (CRI), comparing self-administered testing (including the support of a relative) to CRT with a health professional researchers assistance. Dem.Health: Demographic variables and health information. CFI: Cognitive Functioning Instrument. qSYM: Questionnaire on symptoms of DLB and FTD. GDS: Geriatric Depression Scale. cCOG: web-based cognitive test tool for detecting neurocognitive disorders. SB-C: Speech Based biomarker for Cognition.

RESULTS

All but one completed the tasks in less than an hour. Individual and task specific completion rates are shown in figures 1 and 2.

Reasons for non-completion were fatigue, technical challenges and low self-efficacy. Technical challenges mainly arose at the start of each task, largely due to inability to activate the touch screen, size of text and buttons and misinterpretation of instructions. MMSE-score prior to testing did not significantly correlate with completion rates.

CONCLUSION

Self-administered digital questionnaires seem to be feasible as a means of collecting data in cognitively impaired persons. The speech based analysis SB-C fulfilled the criteria with support from a clinician, whereas the neurocognitive test cCOG was more challenging. Due to fatigue during testing, the best completion rates were achieved when cognitive tests were performed prior to questionnaires.

PERSPECTIVES FOR FUTURE USE

Self-administered testing should consider duration of test, availability of support from a relative, mindful design choices and short instructions to guide the testee. Future research should focus on identifying patient subgroups most suitable for self-administered testing.

