Assessing Cognition Remotely: Expanding the Reach of Cognitive Testing for Older Adults at Risk for Dementia in a Randomized Controlled Trial

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ABSTRACT

Little is known about whether cognitive assessments can be completed remotely by older adults at risk for dementia, and there is no consensus on which tool is best. The SYNchronising Exercises, Remedies in GaIt and Cognition at Home (SYNERGIC@Home) study evaluated the feasibility of a home-based, double-blind, randomized-controlled trial to improve gait and cognition in individuals at risk for dementia. This paper reports a secondary analytic outcome of the cognitive tests used. The three aims were: 1) to examine whether the Montreal Cognitive Assessment (MoCA 8.1 Audiovisual), Cognitive- Functional Composite2 (CFC2), and Telephone Cognitive Screen (T-CogS) could be administered remotely; 2) to compare each tool; 3) to evaluate changes in cognition following the intervention. Sixty participants were randomized to one of four physical/cognitive exercise intervention arms, with 52 participants completing the intervention. Cognitive tests were done in the homes of participants via Zoom for Healthcare™. All 52 participants completed the assessments. The interquartile range (IQR) for the MoCA was 4, the CFC2 was 8, and the T-CogS was 1. At baseline, 11.5% scored perfectly on the MoCA, 0% scored perfectly on the CFC2, and 62% scored perfectly on the T-CogS. Scores on the MoCA (p=.076), CFC2 (p=.053), and T-CogS (p=.281) were not statistically significantly different from baseline to post-intervention. This study demonstrates that these cognitive tests can be administered remotely, with the MoCA and the CFC2 being the most sensitive to variability in scores.

Key words: cognitive testing, remote administration cognitive tests, dementia prevention, MoCA, T-CogS, CFC2

INTRODUCTION

As of 2024, almost 750,000 Canadians are living with Alzheimer's disease and related dementias (ADRD), which is expected to reach almost 1,000,000 in the next six years.[1] Up to 40% of all ADRD cases could be delayed by addressing modifiable risk factors through preventative interventions, including those incorporating physical and cognitive exercises.[2] For both cognitively intact older adults and those with mild cognitive impairment (MCI), combined physical and cognitive exercise may have a synergistic effect.[3,4]

Evaluating the effectiveness of an intervention on cognition relies on the accuracy of the cognitive assessments used. A critical characteristic of a tool that measures cognition is the tool's ability to detect changes in cognitive performance, known as its sensitivity to change. Cognitive instruments can have ceiling or floor effects (depending on whether high or low scores reflect better performance).[5] A test that works well with patients with dementia might not be responsive to change in healthy or at-risk individuals.[6,7]

The SYNchronising Exercises, Remedies in GaIt and Cognition at Home (SYNERGIC@Home) (NCT04997681) study evaluated the feasibility of a home-based, double-blind, randomized-controlled trial to improve gait and cognition in individuals at risk for dementia.[8] This study targeted older adults at risk for dementia and was done in participants' homes through secure videoconferencing. Three of the cognitive assessments used in SYNERGIC@Home included the Montreal Cognitive Assessment (MoCA) (Version 8.1 Audiovisual),[9] the Cognitive Functional Composite2 (CFC2),[10] and the Telephone Cognitive Screen (T-CogS).[11] This study reports a secondary exploratory analysis of these cognitive measures completed at baseline, and following a 16-week physical exercise and cognitive training intervention.

Most cognitive tests are administered face-to-face and have been validated in that setting. There is currently no consensus on which cognitive measures are best to use remotely.[5] Some measures of cognition have been validated for remote use, including the Montreal Cognitive Assessment (MoCA).[9] The Mini-Mental State Examination (MMSE) has also been validated for remote use via videoconferencing, demonstrating good interrater reliability.[12] The T-CogS has been validated

for use over the telephone, but not for videoconferencing. The Cognitive Functional Composite (CFC) has been shown to possess good reliability when comparing face-to-face versus videoconferencing administration.[13]

The first aim of this work was to evaluate if the MoCA, CFC2, and T-CogS could be administered remotely via secure videoconferencing. The second was to compare the cognitive tests by score at baseline, score ranges, interquartile range (IQR), and ceiling/floor effects. The third was to determine if there was any change in the cognitive scores between baseline and immediately following the 16-week intervention.

METHODS

Study Design

SYNERGIC@Home was offered in both French and English, targeting older adults at risk for dementia.[8] Participants were randomized to one of four intervention arms that included a combination of physical exercise and cognitive training. The study protocol was approved by the Research Ethics Boards of Horizon Health Network, Vitalité Health Network, Université de Moncton, and University of New Brunswick.

Participants

Older adults (60-90 years or age) who met the inclusion/exclusion criteria for the SYNERGIC@Home trial and provided consent were included in the study.[8] All participants had a diagnosis of subjective cognitive impairment (SCI), MCI, or were cognitively intact with two or more risk factors for dementia. The risk factors included: poor sleep, poor diet, first degree relative with dementia, physical inactivity, hypertension, dyslipidemia, obesity, diabetes, and/or cardiovascular disease. Participants all resided in New Brunswick, Canada.

Administration of Cognitive Assessments

All cognitive assessments (MoCA, CFC2, T-CogS) were administered via Zoom for Healthcare™ (https://www.zoom.com/en/industry/healthcare/) by a trained research coordinator (RC) who was certified by a neuropsychologist. In most cases, the same RC did both the baseline and post-intervention testing. The study partner/family member was not present for the cognitive testing done by the participant. Cognitive tests were completed prior to the 16-week intervention (baseline) and immediately post-intervention.

Montreal Cognitive Assessment Version 8.1 Audiovisual

The MoCA (Version 8.1 Audiovisual) is a 30-point test. All items on the test were explained and answered verbally through dialogue between the RC and the participant. Scores range from 0 to 30, with higher scores indicating less impairment.[14]

Cognitive-Functional Composite2

The CFC2[10] is a composite score of several cognitive tests as well as a measure of daily function. It is comprised of several of the Alzheimer's Disease Assessment Schedule-Cognitive (ADAS-Cog)[15] subscales including the Immediate Word Recall, Delayed Word Recall, Orientation, and the Clinical Dementia Rating Sum of Boxes (CDR-SB) cognitive portion.[16] The CFC2 also contains the Functional Activities Questionnaire (FAQ).[17] Scores from each test are summed to give a composite score ranging from 0–56, with lower scores reflecting less impairment.

Telephone Cognitive Screen

The T-CogS[11] is a 26-point test that assesses cognition remotely over the telephone in individuals at-risk for dementia. The T-CogS was adapted from the Mini-Mental State Examination (MMSE)[18] and is used to estimate MMSE scores that would usually be done in person. In this study, the T-CogS was done via videoconferencing with the other cognitive tests and was not done over the telephone. Scores on the T-CogS range from 0–26 with higher scores reflecting less impairment.

Analysis

To evaluate whether cognitive assessments could be delivered remotely, the number of participants completing the assessments was determined, as well as the number of protocol deviations related to the cognitive assessments.

Each cognitive test was examined by using baseline scores, score ranges, IQR (a measure of the spread and variability of the scores), and the ceiling/floor effect (determined by measuring the percentage of participants who obtained a perfect score at baseline). To help ensure equal comparison between tests, all scores for each cognitive test were scaled from 0–1, with 1 being those with the least amount of cognitive impairment and 0 being the most.

A 2-way repeated measures ANOVA was used to examine change scores for each measure between baseline and post-intervention. Statistical analyses were completed using SPSS version 28.0.1.1 (IBM SPSS Statistics, Armonk, NY).

RESULTS

Sixty participants were randomized to one of the four intervention arms. Eight withdrew prior to completion of the intervention. Seven withdrew due to time commitments and one due to an adverse event that was unrelated to the study. Fifty-two participants completed the interventions as well as the cognitive assessments. The average age of participants (N=52) was 68.8 years (SD=5.74), 78.8% were female, 76.9% anglophone, and 44.2% resided in rural communities. Most (76.9%) had a diagnosis of cognitively intact with two or more risk factors for dementia (Table 1).

Cognitive assessments were successfully delivered remotely to all 52 participants. No participant withdrew from the study due to difficulties with the remote delivery of these assessments. There were no reported protocol deviations related to the remote delivery of the cognitive assessments.

The mean scores at baseline were 25.9 (SD=3.25) for the MoCA, 11.9 (SD=6.57) for the CFC2, and 25.4 (SD=0.87) for the T-CogS. The range of scores was 16–30 for the MoCA, 1.5–32.5 for the CFC2, and 23–26 for the T-CogS. Only 11.5%

TABLE 1.
Baseline participant characteristics (N=52)

Demographics	*Number (%)*
Age, mean (SD)	68.8 (5.74 yrs)
Sex	
Female	41 (78.8)
Male	11 (21.2)
Language	
English	40 (76.9)
French	12 (23.1)
Location of Residence	
Rural	23 (44.2)
Suburban	16 (30.8)
Urban	13 (25.0)
Education Level	
High School/Community College	20 (38.5)
University Undergraduate Degree	18 (34.6)
University Graduate Degree	14 (26.9)
Cognitive Diagnosis	
Cognitively Intact with 2 or more risk factors	40 (76.9)
Subjective Cognitive Impairment	8 (15.4)
Mild Cognitive Impairment	4 (7.7)
Cognition	
Montreal Cognitive Assessment (MoCA 8.1 Audiovisual)	25.9 (3.25)
Cognitive Functional Composite2 (CFC2)	11.9 (6.57)
ADAS Cognitive Immediate Word Recall	8.4 (4.41)
ADAS Cognitive Delayed Word Recall	2.8 (2.07)
ADAS Cognitive Orientation	0 (0.19)
Clinical Dementia Rating Sum of Boxes	0.1 (0.16)
Functional Activities Questionnaire	0.3 (1.06)
Telephone Cognitive Screen (T-CogS)	25.4 (0.87)

of the participants scored perfectly (30/30) on the MoCA, 0% scored perfectly (0/56) on the CFC2, and 62.0% scored perfectly (26/26) on the T-CogS. The IQR for the MoCA was 4.0, the CFC2 was 8.0, and the T-CogS was 1.0 (Figures 1A, 1B, 1C).

The change in the mean scores between baseline and post-intervention were 0.67 for the MoCA, -1.14 for the CFC2, and 0.15 for the T-CogS. The 2-way repeated measures ANOVA revealed that the scores on the MoCA (p=.076), the CFC2 (p=.053), and the T-CogS (p=.281) were not statistically significantly different post-intervention compared to baseline.

DISCUSSION

The findings suggest that the MoCA, CFC2, and T-CogS can be successfully completed remotely via videoconferencing in older adults at risk for dementia. The T-CogS has a ceiling effect, and the MoCA and the CFC2 demonstrated more variability in the range of baseline scores in this population. Using the MoCA (IQR=4) for comparison, the IQR of 8 for the CFC2 was twice as sensitive in detecting variability in the baseline cognitive scores. The T-CogS was one-quarter as sensitive as the MoCA. There were no significant changes from baseline to post-intervention for any of the cognitive tests.

This study had several limitations. The study was entirely remote; therefore, there was no ability to compare the cognitive tests administered in-person versus remotely. In addition, SYNGERGIC@Home did not allow for any test/retest reliability measures to be completed in the small sample size. While the MoCA is validated for remote use through

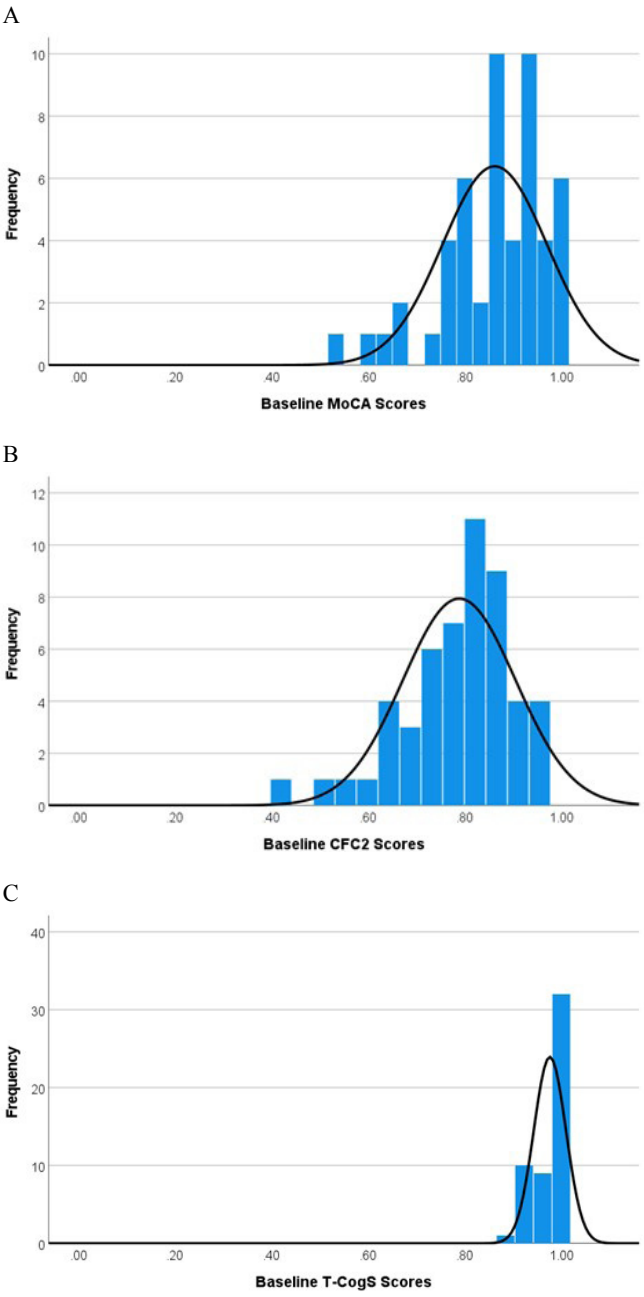

FIGURE 1. Baseline scores of cognitive tests; A: MoCA scores baseline; B: CFC2 scores baseline; C: T-CogS scores at baseline

videoconferencing, the CFC2 and T-CogS are not, potentially impacting the comparability of the three tests delivered in a remote setting. Finally, 16 weeks between cognitive tests is likely too short to expect to see a change in cognition in this population. Similar interventions in other studies, targeting those with MCI, did show some cognitive improvement after longer interventions.[3,19]

This study has demonstrated that remote cognitive testing can be done successfully. More research is required to determine which cognitive instruments are best for remote use in older adults at risk for dementia. While the MoCA and the CFC2 seem to be better tests to detect variability in cognition remotely, the CFC2 is not available for widespread use in a clinical setting, thus limiting its usefulness in clinical practice.

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CONFLICT OF INTEREST DISCLOSURES

We have read and understood the *Canadian Geriatrics Journal*'s policy on disclosing conflicts of interest and declare that Dr. Pamela Jarrett receives funding from ResearchNB with a Clinical Research Scholarship. The other authors declare no conflicts of interest.

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