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REVIEW ARTICLE

Remote cognitive and behavioral assessment: Report of the Alzheimer Society of Canada Task Force on dementia care best practices for COVID-19

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Abstract

Introduction: Despite the urgent need for remote neurobehavioral assessment of individuals with cognitive impairment, guidance is lacking. Our goal is to provide a multidimensional framework for remotely assessing cognitive, functional, behavioral, and physical aspects of people with cognitive impairment, along with ethical and technical considerations.

Methods: Literature review on remote cognitive assessment and multidisciplinary expert opinion from behavioral neurologists, neuropsychiatrists, neuropsychologists, and geriatricians was integrated under the auspices of the Alzheimer Society of Canada Task Force on Dementia Care Best Practices for COVID-19. Telephone and video approaches to assessments were considered.

Results: Remote assessment is shown to be acceptable to patients and caregivers. Informed consent, informant history, and attention to privacy and autonomy are paramount. A range of screening and domain-specific instruments are available for telephone or video assessment of cognition, function, and behavior. Some neuropsychological tests administered by videoconferencing show good agreement with in-person assessment but still lack validation and norms. Aspects of the remote dementia-focused neurological examination can be performed reliably.

Discussion: Despite challenges, current literature and practice support implementation of telemedicine assessments for patients with cognitive impairment. Convergence of data across the clinical interview, reliable and brief remote cognitive tests, and remote neurological exam increase confidence in clinical interpretation and diagnosis.

KEYWORDS

Alzheimer's disease, assessment, cognitive impairment, dementia, telehealth, telemedicine

1 | BACKGROUND

There is a vital need for a framework to guide the remote cognitive and behavioral assessment of individuals with cognitive impairment. Cognitive impairment is an epidemic: Nearly one in three individuals over age 70 years lives with either mild cognitive impairment (MCI) or dementia.[1] Almost 50 million people live with dementia worldwide,[2] and this number is predicted to increase 161% by 2050.[3] This "dementia tsunami" has led to an urgent need for access to diagnostic assessment and care to minimize the burden on older adults, caregivers, healthcare systems, and society. The lack of access to specialty care may have the consequences of delayed or missed diagnoses, suboptimal symptom management, missed opportunities for lifestyle and other behavioral interventions, and increased risks to caregivers. Remote assessment and care may provide opportunities to mitigate some of these challenges.

With the onset of the coronavirus disease (COVID-19) pandemic, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), remote assessment of individuals with cognitive impairment is no longer a need only for those in rural communities or with travel and mobility limitations. The absence of proven SARS-CoV-2 vaccines and effective treatments led to public health strategies relying on preventative measures such as hand washing, mask wearing, and physical distancing, all of which substantially limit access to in-person clinical care and are particularly difficult to implement for frail individuals with cognitive impairment.[4] Underlying dementia, compared to other medical comorbidities, confers the greatest risk for contracting COVID-19 in adults over 65 years, while advanced age and cognitive impairment dramatically increase morbidity and mortality from COVID-19.[5] Thus remote assessment of cognition has immediately become an imperative for those attempting to provide care for this population. Rather than simply representing a cost-efficient alternative, remote assessment is an important means of protecting patients and their families from the unnecessary risk of exposure in hospitals.

The Centers for Medicare & Medicaid Services defines "telemedicine" as the "two-way, real time interactive communication between the patient and the physician or practitioner at [a] distant site." Current approaches to telemedicine include telephone calls or videoconferencing. Remote dementia care is accepted by families[6] and reduces emergency room visits.[7] Furthermore, remote assessment reduces the burden placed on caregivers to bring the patient to the clinic. To provide guidance for clinicians who are conducting remote cognitive assessment, the Alzheimer Society of Canada convened the Task Force on Dementia Care Best Practices for COVID-19 with multidisciplinary expertise from behavioral neurology, neuropsychiatry, neuropsychology, geriatrics, and persons with lived experience. These best practices provide guidance for the multi-dimensional assessment of cognition, behavior, and function in cognitively impaired individuals.

In what follows we discuss ethical and technical considerations and then provide an overall framework for remote neurobehavioral assessment, including telephone and video-administration formats. We review specific assessment methods to obtain information on cognition, behavior, and function. In Supplementary Materials we provide guidance on administering a dementia-focused remote neurological examination.

2 | SEARCH STRATEGY

We searched Medline (PubMed) without language restriction from 2000 up to June 2020, with the following search terms; "(telehealth OR telemedicine OR telecognitive OR telephone OR videoconferencing OR video OR telepsychiatry OR telecare) AND (dementia OR neuropsychological OR cognitive assessment OR cognitive testing OR cognitive screening OR cognitive status OR cognitive impairment OR neurologic exam)." Other information sources included Google Scholar, Web of Science, society and physician organization websites, and disease support groups' sites. Authors' reference lists were also used to identify relevant literature. An expert multidisciplinary work group composed of behavioral neurologists, neuropsychologists, and neuropsychiatrists compiled, interpreted, and synthesized the literature review and also provided practical guidance based on their expertise.

3 | ETHICAL CONSIDERATIONS

The same clinical and ethical standards that apply to in-person encounters also apply to the remote environment. The biomedical ethics principles of autonomy, non-maleficence, beneficence, and justice must also guide remote care delivery. Several frameworks are available to guide the implementation of such principles in technology development and implementation. As one example, "ethical adoption," defined as the "deep integration of ethical principles into the design, development, deployment, ongoing usage, and management of technology," offers practical recommendations for technology developers and researchers.[8] To meet the highest standards of ethical care delivery, the interests and welfare of the patient should come first (i.e., fidelity) and the clinician should be transparent in disclosing the rationale for and limitations of remote care delivery. Until guidelines for implied consent with remote health care are developed, verbal informed consent, detailing the limits of confidentiality, and two-factor verification of the patient's identity (i.e., name and date of birth) should precede a visit. Practitioners should be aware of methods for handling imminent risk to self or others when providing remote health care. Finally, it is recommended to minimize obtrusiveness by offering patients an alternative modality of care, such as telephone instead of videoconference.

Telemedicine has the potential benefits of enabling access to specialists among patients with reduced mobility and/or geographical constraints, and improved patient convenience and comfort. Potential pitfalls include a threat to patient privacy and confidentiality, limitations in clinical data acquisition, risks to quality and continuity of care, and the potentially negative impact of remote care on patient-clinician relationships. Although older adults are increasingly adept at using technology, age-related perceptual, language, and cognitive barriers must be considered.[8] In addition, it is important to consider how sociocultural and economic factors influence access to remote care and the interpretation of remote cognitive assessments.[8] Clinician and patient comfort and proficiency with technology, awareness of telehealth limitations, and judgement of when to shift to an in-person encounter are necessary to fulfill competency of care in telehealth.[9]

Telemedicine should humanize both the provider and patient. In general, patients are satisfied with remote care.[6] In an analytic literature survey on remote physician-patient communication, non-verbal behavior and lack of touch were the only categories reported as unsatisfactory for patients.[10] During a telemedicine encounter, clinician empathy can be effectively communicated by maintaining eye contact, facial expression, empathetic gestures (e.g., head nods), voice, and attentiveness.[11] This is critical because clinician empathy is associated with positive health outcomes.[12] To achieve continuity of care, the clinician should be accessible for future guidance, create a medical record of the telemedicine encounter, and communicate the management plan with the patient, care partner, and referring clinician.[9] For initial assessments involving a differential diagnosis and management plan, a written clinic visit summary provided to the patient may be helpful.

Disclosure of a diagnosis using telemedicine can be especially challenging. A study on telephone disclosure of apolipoprotein E (APOE) genotype results and elevated Alzheimer's disease (AD) risk via telephone found that it is generally safe.[13] Support for patients and caregivers following a difficult diagnosis can be facilitated by providing educational materials and community resources.[14] For example, there are excellent resources and programs offered via the Alzheimer Society (e.g., First Link), the Alzheimer's Association (e.g., Family Caregivers), and Alzheimer's Disease International (e.g., Advice and Support).

RESEARCH IN CONTEXT

1. Systematic Review: The COVID-19 pandemic necessitates a framework for remote cognitive and behavioral assessment. A literature review was performed and an expert task force of behavioral neurologists, neuropsychiatrists, geriatricians, and neuropsychologists was convened under the auspices of the Alzheimer Society of Canada to create guidance on remote assessment of cognitively impaired individuals.
2. Interpretation: We outline guidance on the remote cognitive, affective, behavioral, functional and physical assessment of cognitively impaired individuals along with ethical and logistical considerations.
3. Future Directions: Further development and validation of tools are needed that are unbiased by language, sensorimotor limitations, education, or culture. Telemedicine will play a larger role in assessment of cognitively impaired individuals during the pandemic and beyond.

4 | LOGISTICAL RECOMMENDATIONS FOR SETTING UP AND ADMINISTERING TELEMEDICINE SERVICES

To protect patient privacy and confidentiality, it is imperative to use encrypted, password-protected videoconferencing software that meets Health Insurance Portability and Accountability Act (HIPAA) requirements.[9] The platform should be universally compatible across devices (e.g., tablets, smartphones, and computers) and user-friendly with minimal preparatory steps for the patient. Encrypted platforms exist that are for-profit (e.g., Zoom Healthcare, Reacts, Cisco Webex Meetings, Medesync, Microsoft Teams, Doxy.me, Vidyo) or open-source and in the public domain (e.g., Jitsi). Patient and clinician internet connectivity can be checked with an internet speed test to ensure that there is adequate bandwidth (e.g., 384 Kbps in both downlink and uplink directions)[15] to reduce potential frustration from connectivity issues and to enhance detection of involuntary movements such as tremor. Confirmation that the patient has sufficient audiovisual input and access to glasses and hearing aids is essential, as perceptual difficulties and slower internet speeds have been linked to lower test scores in videoconferenced environments.[15]

History from an informant is essential to a thorough and reliable cognitive assessment, given the role of anosognosia. Consistent with the recent Fifth Canadian Consensus Conference on Diagnosis and Treatment of Dementia (CCCDTD5) recommendations, cognitive assessments include information on cognition, function, and behavior, and fundamentally both patient or care partner are required as sources of information.[16] With the patient's consent, history can be obtained by phone from an informant located in a separate, private space or during a separate appointment. Family members at a third remote site can be included in counseling and history taking.

In setting up the encounter, clinician and patient rooms should be quiet and private, with no backlighting or orientation prompts such as calendars. Screenshare options allow presentation of high-resolution visual stimuli (i.e., PDF copies of testing materials) during the remote cognitive assessment. Patient's written responses (e.g., cube copy) can be held up to the camera and documented via screen capture. The patient's face should be positioned close to the webcam so as to help create a sense of natural eye contact. It is important to have a back-up plan if technical difficulties (e.g., continue via telephone) or the need for in-person assessment arise.[17] If audio fails in the setting of preserved video, a combined approach of using the telephone for audio and the tablet, smartphone, or computer for video may be considered. If this is done, the sound on the videoconference device must be muted on both sides to avoid an echo. It is critical to obtain a telephone number prior to the telemedicine encounter as a back-up method of communication in the case of technical failures.[18] The American Psychological Association provides a helpful checklist for setup of telemedicine encounters.

5 | FRAMEWORK FOR REMOTE NEUROBEHAVIORAL STATUS EXAMINATION

The same principles apply for telehealth as they do for in-person testing[19]: Instruments should be easy to administer and acceptable to both the patient and family members. Ideally, instruments should be valid and reliable, measure change over time, and not be biased by language, sensorimotor limitations, education, or culture.[20]

A report by the American Academy of Neurology Behavioral Neurology Section Workgroup in 2015 described the neurobehavioral status exam (NBSE).[21] The NBSE is a battery of domain-specific cognitive tests that assess attention, executive function, language, memory, visuospatial functioning, and social cognition to be used in combination with a general neurologic examination, with the goals of facilitating diagnosis and guiding management. The cornerstone of the NBSE is a careful history including the chronology, character, and progression of cognitive, affective, behavioral and constitutional symptoms, functional status, and relevant medical history. Consequently, clinical diagnosis should be guided by the pattern of clinical findings rather than hinging on isolated tests. Incisive clinical judgment is required to ensure that diagnosis is based on *converging* evidence from the history, cognitive testing, affective, functional, and behavioral assessments, and the general neurological examination. Relatedly, adopting a 'dashboard framework' to manage complex cognitive, behavioral, and neuropsychiatric symptoms can help track the goals of care (see Supplementary Materials for approach to the dementia-focused remote neurological examination).

6 | REMOTE COGNITIVE ASSESSMENTS

Despite data suggesting equivalency of neuropsychological tests administered in-person versus by telehealth, validation studies are still lacking.[22] To demonstrate equivalency and validity, studies with non-inferiority designs, measurement invariance designs, or differential item functioning designs are needed to allow for accurate use of normative data as the basis for interpretation of test scores.[19] Challenges with remote administration of cognitive testing include dealing with patients' sensorimotor limitations, distractions, and aids (e.g., calendars and notes) in their environment, or assistance from family members, all of which can render tests invalid. Video, as opposed to telephone, administration of cognitive testing can mitigate some of the issues. In a systematic review and meta-analysis of videoconference administered neuropsychological testing, studies of participants with a mean age of 65 to 75 that utilized a high-speed network connection demonstrated consistent performance across videoconference and on-site conditions.[23] Specifically, verbally mediated tasks including digit span, verbal fluency, and list learning were not affected by videoconference administration. However, Boston Naming Test (BNT) scores were slightly lower on videoconference compared to onsite testing.[23] Moreover, studies with older participants and slower internet connections had more variable findings, as did tests that required motor responses. Thus patient age and quality of internet connection are factors to consider in choosing between telephone or videoconference testing.[23] The broader general concern with a telehealth approach, however, is a reduction in specificity of the cognitive assessment instruments, compared to face-to-face testing. Most current work in the field of videoconferenced neuropsychological testing has focused on feasibility of administration. Although studies to date suggest that videoconference administration of some neuropsychological assessments is feasible and acceptable,[23] accurate interpretation of the test scores is another matter. The development of new norms for neuropsychological tests delivered via teleconference has been recommended.[24]

General guidance is that telehealth assessments are not necessarily substitutes for standardized neurocognitive assessments. If remote cognitive assessments are completed, they need to be embedded within a comprehensive assessment to mitigate concerns about the use of normative data derived from in-person assessments for clinical determination of impairment from cognitive tests administered in remote environments. Caution is needed when patients score close to cutoffs, as diagnostic accuracy is lower, especially for mild cognitive impairment (MCI).[25]

6.1 | Telephone administration of cognitive screening tests

Among several telephone-based cognitive assessments,[22] the best known and most validated telephone cognitive test is the Telephone Interview for Cognitive Status (TICS).[26] The TICS takes under 10 minutes to administer, and assesses orientation, attention, short-term memory, sentence repetition, immediate recall, naming to verbal description, word opposites, and praxis; the modified TICS (TICSm) also includes delayed verbal recall.[22] One disadvantage of the TICS is its culturally biased items. The TICS has demonstrated sensitivity and specificity to detect dementia and AD, and scores are highly correlated with the Mini-Mental State Exam (MMSE).[26] For detecting MCI, however, the utility of the TICS is less clear. The TICSm was found to perform well when subjects with MCI were pooled either with subjects with dementia (cutoff ≤31; sensitivity = 83.3%, specificity 78.3%) or with subjects with normal cognition (cutoff ≤28; sensitivity = 83.3%; specificity 81.6%), but performed only fairly in separating MCI from either normal cognition or dementia.[27] Subsequent studies have suggested that the TICS and TICSm are as reliable and as valid as the MMSE for screening cognitively impaired older adults, and that the TICSm has little advantage over TICS for screening dementia and even MCI.[28] Recent evidence suggests adjusting for age, sex, and education to improve the utility of the TICS in screening for MCI,[29] although more data are required.

The Montreal Cognitive Assessment (MoCA) BLIND is a shortened version of the MoCA with the visual elements removed (total 22 points, cutoff <19, for MCI sensitivity = 63%, specificity = 98%[30]), and suitable for telephone administration. An even shorter version for telephone use, including verbal fluency, recall, and orientation (total 12 points, cutoff <11) has been endorsed by the National Institute of Neurological Disorders and Stroke–Canadian Stroke Network Vascular Cognitive Impairment Harmonization Standards Working Group.[31] In post-stroke patients, these telephone MoCAs were validated for detecting MCI, and performed comparably to the TICS, but not as well as the in-person MoCA.[32] Both versions were most reliable in detecting multi-domain MCI over single-domain MCI.[32] Another alternative is the MoCA 5-minute protocol, which was developed for vascular cognitive impairment, with the goals of brevity and utility for telephone administration.[33] The MoCA 5-minute protocol includes 5-word learning (attention), animal semantic fluency (language, executive function), 6-item orientation, and delayed recall (memory). It has demonstrated validity and reliability in distinguishing between cognitively impaired (Clinical Dementia Rating [CDR] 0.5-1) and cognitively unimpaired older adults, with performance very similar to the full MoCA (Area Under the Receiver Operating Characteristic [AUROC] for MoCA 5-minute protocol, 0.78; MoCA = 0.74; $P > .05$ for difference).[33] Thus the MoCA 5-minute protocol has been suggested as a brief clinical screen that offers additional information, such as type of memory failure (i.e., encoding vs retrieval), which may assist diagnosis. Other brief global screening instruments include the Short Portable Mental Status Questionnaire, which has been validated for telephone use,[34] and the Blessed Orientation-Memory-Concentration test,[35] both of which correlate well with the MMSE.

Other approaches for telephone testing include ultra-brief screens or domain-specific testing as part of a dashboard approach (Table 1). The Months Backwards Test (MBT) takes <2 minutes to administer and assesses processing speed, focused and sustained attention, working memory, and executive function. Performance can be assessed according to accuracy and processing speed and can be scored pass/fail or on a 10-point scale.[36] The Trail Making Test (Parts A and B) has been adapted for oral use and may be suitable for telephone or videoconference administration.[37] Other brief options include timed tests of oral fluency for animal names, which assesses semantic knowledge, processing speed, as well as executive function. These are easy to administer, and are minimally biased by language of administration, education, or culture. Letter fluency testing has also been administered via telephone, with results very similar to in-person testing.[38] Auditory responsive naming tests (also known as definition naming) may offer an alternative to the more frequently used visual naming tests, and may be suitable for telephone use.[39] In these tests, modified dictionary descriptions are given as prompts to generate words. Auditory naming may be more sensitive to pathology than visual naming, and associated with executive function,[40] although, to our knowledge, no validations for telephone use have been published.

As part of the Successful Aging after Elective Surgery (SAGES) study,[38] a 30-minute composite neuropsychological battery was developed for telephone use, demonstrating excellent correlation and agreement to in-person testing scores. Instruments in this battery addressed a number of domains: episodic memory (Hopkins Verbal Learning Test); attention/short-term memory (digit span forwards and backwards); executive function/language (verbal fluency); executive function/semantic access/language (category fluency); confrontational naming/language (modified BNT with written descriptors and phonemic clues).[38]

6.2 | Videoconferenced assessments

Videoconference has shown promise for cognitive assessments and offers advantages over telephone assessments, since many assessments require visual cues. Furthermore, domains that are difficult to assess over the telephone may be assessed over videoconference such as visuospatial function/construction, praxis, social cognition/emotional processing, and facial recognition. A systematic review of telemedicine studies in AD and MCI demonstrated that there was no difference in the efficacy comparing in-person diagnosis with diagnosis made via videoconference.[61]

The MoCA has been considered as potentially useful for telehealth as it can be administered with little adaptation, and the MoCA website now offers instructions on video administration. A study in older veterans compared in-person and video-administered MoCA and demonstrated good accuracy and inter-rater reliability across administration modalities.[62] Included in the MoCA is the clock drawing test (CDT), which cannot be administered over the telephone, but can be drawn

TABLE 1 Domain-specific cognitive measures for telemedicine use

Test name	Administration time, min	Public domain	Telephone administration possible	AAN Behavioral Neurology Workgroup[21] recommended	Use in telemedicine (references)
Attention					
Oral Trail Making Test, Part A[37]	5	✓	✓		✓ [41]
Digit Span Forward[21]	3-5	✓	✓	✓	✓ [42,41,43–46]
Digit Span Backward[21]	3-5	✓	✓	✓	✓ [41,43–44]
Sequential Operations Series (eg, Months-of-the-Year-Backward)[21]	2	✓	✓	✓	✓ [47]
					[49]
Executive Function					
Oral Trail Making Test, Part B[37]	3	✓	✓		✓ [41]
Frontal Assessment Battery[21]	10	✓		✓	✓ [50]
Similarities subtest (WAIS-IV)[21]	3-5		✓	✓	✓ [51]
Language					
Boston Naming Test-15-Item Short Form[21]	3-5			✓	✓ [42,41,43,44]
Cookie Theft Picture[52,53]	3-5	✓			✓ [54]
Controlled Oral Word Association[21]	5		✓	✓	✓ [14,42,41,43,54,55]
Semantic Category Fluency[21]	5	✓	✓	✓	✓ [42,41,43–45]
Auditory naming test[39]	3-5		✓		✓[38]
Memory					
Rey Auditory Verbal Learning Test[21]	15	✓	✓	✓	✓[56,57]
Hopkins Verbal Learning Test[21]	5-10	✓	✓	✓	✓[42,41,43–45]
Rey Visual Design Learning Test[58]	5-10	✓			✓[89]
Spatial cognition					
Cube Copying Test[21]	3	✓		✓	✓ [14]
Short-forms JLO[21]	10	✓		✓	✓ [59]
Social cognition					
Ekman 60 Faces Test[60]	10				

AAN, American Academy of Neurology; ANT, Auditory Naming Test; BNT-15, Boston Naming Test-15 Item Short Form; COWAT, Controlled Oral Word Association; HVLT, Phonemic/Letter Fluency; Hopkins Verbal Learning Test; JLO, Judgment of Line Orientation; MBT, Months of the Year Backward Test; RAVLT, Rey Auditory Verbal Learning Test; RBANS, Repeatable Battery for the Assessment of Neuropsychological Status; RVDLT, Rey Visual Design Learning Test; TMT-A, Trail Making Test Part A; TMT-B, Trail Making Test Part B; WAIS-IV, Wechsler Adult Intelligence Scale, Fourth Edition.

during videoconference and displayed to the camera. There are mixed results in the utility of the CDT as a standalone videoconference test, thought to be due to the motor component of the task.[42,41]

The Rowland Universal Dementia Assessment Scale (RUDAS) is a screening instrument developed for use in a culturally and linguistically diverse population, and is less biased by language, sex, and education than the MMSE.[63] The six items include memory (four-item grocery list with ~5-minute recall), visuospatial orientation (body part identification including cross-body), praxis (alternating fist/palm bilaterally), visuo-constructional drawing (cube copying), judgment (imaginary road crossing), and language (animal fluency).[64] The RUDAS has been validated for videoconference use, where it was administered unchanged, and compared to face-to-face testing. Mean scores between videoconferenced and in-person administrations were very similar, and the videoconference RUDAS detected dementia at its cutoff of 23/30.[65]

If more detailed testing is required, the Repeatable Battery for Neuropsychological Status (RBANS) may be considered. Developed to detect neurocognitive disorders, the RBANS assesses the domains of processing speed (coding), immediate memory (encoding and immediate learning of verbal information), visuospatial/constructional (judgment of line orientation, perceiving and copying a design), attention (auditory registration, visual scanning, forward digit span), language (naming, semantic fluency, expressive), and delayed memory.[52] The RBANS has been validated for telehealth use via high-definition video system with generally high correlations between videoconferenced and face-to-face scores and low differences in mean RBANS index scores between testing conditions.[59]

6.3 | Computerized testing

Computerized cognitive testing may also address accessibility issues, but further research is needed to assess its utility in cognitive screening. Caution in implementing computerized cognitive testing is suggested, given that the psychometric quality, standardization, normative data and administration advice of computerized cognitive testing for neurocognitive disorders are lacking.[66] The American Academy of Clinical Neuropsychology and the National Academy of Neuropsychology have put forth a position paper on the use of computerized neuropsychological assessment devices.[67] Although there are existing tools in the public domain (e.g., NIH toolbox, Test My Brain) with normative data, they lack rigorous validation studies in clinical and telemedicine contexts.

7 | REMOTE ASSESSMENT OF AFFECT, BEHAVIOR, AND FUNCTION

Self-, informant-, and clinician-rated standardized scales are available to assess the important constructs affect, behavior, and function for persons with dementia (summarized in Supplementary Table S1). Depression is common in dementia and MCI and is associated with poorer outcomes.[68] Moreover, depression can contribute to cognitive impairment and may be a reversible component of the presenting cognitive complaint. Depressive symptoms can be elicited directly from the patient or from the informant. Caution with self-report of symptoms is important, as 'affective anosognosia' may decrease reliability, resulting in under-reporting of symptoms and necessitating informant reports. One of the most frequently used clinician administered tools for depression is the Geriatric Depression Scale (GDS), which can be administered over telephone or videoconference.[69] However, the GDS is limited by low sensitivity.[70] The Hamilton Depression Rating Scale may serve as a more sensitive clinician-administered alternative.[70] The Cornell Scale for Depression in Dementia (CSDD), which was developed for dementia and incorporates both an interview of the patient and the informant, also has greater sensitivity than the GDS[70] for depression detection, but takes somewhat longer to complete.[71] Brief self-reports of depressive symptoms may also be useful. The Patient Health Questionnaire-9 (PHQ-9) is very well known and simple to complete as it mirrors Diagnostic and Statistical Manual of Mental Disorders (DSM) criteria.[72] It has shown utility in memory clinics and correlation with the CSDD.[73] Similarly, anxiety is important to assess in persons with cognitive impairment and can be measured over telephone or videoconference using either clinician administered or self-report measures. A systematic review and meta-analysis of anxiety tools in dementia determined that the most sensitive tool is the Rating Anxiety in Dementia[74] (RAID—based on caregiver and patient interview), while the most specific is the abbreviated Penn State Worry Questionnaire[75] (which has both self- and collateral-rated versions, with the collateral version having greater sensitivity).

As neuropsychiatric symptoms (NPS) are core features of the dementia process,[76] and associated with poorer outcomes, global measures of NPS are warranted. Generally, informants provide information on NPS, and although tools are similar, there can be differences in how they capture symptoms and response to intervention. One of the most frequently used instruments is the Neuropsychiatric Inventory Questionnaire (NPI-Q)[77] which is brief (~5 minutes) and assesses delusions, hallucinations, agitation/aggression, dysphoria/depression, anxiety, euphoria/elation, apathy/indifference, disinhibition, irritability/lability, aberrant motor, nighttime behavior, and appetite and eating issues on a 0-3 severity scale. An alternative to the NPI-Q is the BEHAVE-AD,[78] which is a similar informant-rated scale with 25 questions assessing the behavioral categories of paranoid and delusional ideation, hallucinations, activity disturbances, aggressiveness, diurnal rhythm disturbances, affective disturbances, and anxieties and phobias. The BEHAVE-AD is rated on a 4-point severity scale and takes ~15 minutes to complete. Inclusion of a sleep questionnaire is helpful to screen for obstructive sleep apnea and rapid eye movement (REM) sleep behavior disorder. The Mayo Sleep Questionnaire[79] is in the public domain and has been validated for use in dementia.

Neuropsychiatric symptoms can present prior to development of dementia. An analysis of National Alzheimer Coordinating Center data determined that of 59% of participants developed NPS before the diagnosis of a cognitive disorder, including 30% of those who developed AD.[80] New-onset behavioral symptoms are reflected in the 2018 National Institute on Aging Alzheimer's Association (NIA-AA) AD framework as Stage 2 AD (preclinical disease) and have been operationalized through the International Society to Advance Alzheimer's Research and Treatment (ISTAART-AA) criteria for mild behavioral impairment (MBI).[81] MBI is characterized by later-life emergent and persistent NPS and represents an at-risk state for cognitive decline and dementia, and the index manifestation of dementia for some patients. The MBI Checklist (MBI-C)[82] is a validated rating scale to capture MBI in non-demented community-dwelling older adults. The MBI-C is completed by an informant (taking ~7 to 9 minutes), and uses a 0 to 3 severity scale similar to the NPI-Q. The MBI-C assesses the domains of apathy, mood/anxiety symptoms, agitation/impulse dyscontrol, social behavior, and psychotic symptoms, and has been associated with amyloid positivity in cognitively unimpaired older adults,[83,84] and with MCI and poorer neuropsychological test performance in patients with Parkinson disease.[84] Thus the MBI-C may have a role in assessing NPS in those with at most mild cognitive impairment.

Functional measures of instrumental activities of daily living (IADLs) early on, and basic activities of daily living (BADLs) later in the course of dementia are important to assess disease severity and progression, and to address safety issues. Even in those with only subjective cognitive decline, impaired IADL function is associated with increased dementia risk,[85] demonstrating the importance of assessing function. Again, informant reports may provide the best assessment of function, less influenced by anosognosia. CCCDTD5 recommendations on informant-based functional measures include the AD8, Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE), Quick Dementia Rating System, FAQ, Lawton-Brody IADL, 4-item IADL scale, and Amsterdam IADL questionnaire, any of which are suitable to capture function in memory clinic patients.[16] The Harvard Automated Phone Task (APT) is a brief, objective, self-administered assessment that is designed to measure early IADL functioning among cognitively normal and persons with MCI.[86]

It is important to note that any attempts to measure NPS and function via telehealth all require mechanisms that ensure appropriate patient consent for informant involvement in the assessment process, as well as methods to provide/administer these scales to informants that ensure confidentiality of patient and informant health information. These assessments can be completed before the telemedicine encounter or by the informant in a separate private room during the remote cognitive assessment of the patient with the clinician.

8 | LIMITATIONS

A number of issues limit telemedicine implementation. In all cases, an assessment of the videoconferencing readiness of the patient should be completed before deciding to engage in remote dementia care. There are numerous questions that must be addressed. Where will the videoconferencing occur? Is the environment sufficiently free of distractions and orientation cues that render tests invalid? Does the patient's condition make them more susceptible to distractions in a non-controlled environment? Do they have sensory impairments that contraindicate telephone or videoconferencing? Even if videoconferencing appears clinically indicated, remote training for patients and families in how to use the videoconferencing platform for remote healthcare visits may be required, and alternative methods for contacting patients in the event of technological failure are necessary. Home environments for remote assessments are by nature variable, making consistency of assessments across patients, and across visits with the same patient longitudinally, challenging. Identification of clinical meaningful change in the telemedicine environment is, therefore, difficult. So too, is the assessment of key aspects of mental status or patient behavior such as body language conveying affect and informant or patient discomfort.

Clinicians must enter into an ethical decision-making process regarding telemedicine and consider the potential harm to the patient in interpreting results from remote assessments. If risks and benefits are unclear, the best choice may be to not administer the assessment at all. When circumstances are less than ideal, clinicians must be cautious in their interpretation of any data they obtain. Although valid tools exist for remote brief cognitive assessments that have good correlations with in person-based instruments, effectiveness of their use for diagnosis in real-world clinical practice is unknown, as are their measurement properties for establishing clinically meaningful change over time. Most tools have been developed for use in epidemiological studies or clinical research, and as such are best suited to rapidly characterize the cognitive functioning of a sample rather than individual patients. Most validation studies provide little information about test accuracy at the individual level, especially in patients with complex comorbidities or from diverse groups, as race/ethnicity has been shown to interact with test modality (face-to-face vs telephone). Although some telemedicine measures have considered issues of case-level predictive accuracy, studies with large samples including under-represented groups is an important part of test development that is lacking in many of the reviewed tools. In all cases, cautious interpretation is urged as research continues to ensure that recommended instruments are not systematically biased.

Given these constraints, consciously weighting the clinical interview data more heavily than the videoconferenced assessment data is ethically advised. Ideally, some portion of the remote assessment is completed with tests that have either normative data or adequate evidence of sensitivity and specificity of the tests adapted for remote delivery. If it is necessary to augment this assessment with remotely delivered assessments for which there is inadequate evidence for validity, we recommend triangulation of data from (1) the clinical interview, (2) validated but brief remote testing (e.g. as, cognitive screening and cognitive domain-specific tests, affect and function inventories), and (3) videoconferenced neuropsychological tests and/or remote neurological exam. If all sources converge, one can have greater confidence in the clinical interpretation and diagnosis.

9 | FUTURE DIRECTIONS AND CONCLUSION

Additional research is required to provide evidence-based guidance on utility, validity, efficacy, tolerability, and safety of remote cognitive and behavioral assessments. In addition, there is a vital role that remote assessment technologies could serve in dementia research including clinical trials and longitudinal studies. Additional patient-centered research on feasibility and acceptability to the patient is also required to determine patients at increased risk of unsatisfactory telemedicine encounters and best methods to mitigate this. Further research on strategies to minimize all risks and burdens of remote cognitive assessment to patients and caregivers is urgently needed. The question of whether telehealth will decrease or widen disparities in access to health care remains unanswered. Whether those with low socioeconomic status and those living in rural areas benefit from telehealth needs study to ensure that the emerging reliance on technology does not marginalize people further. Rigorous validations are required for cognitive tests across a broad spectrum of impairment in order to provide cut-points and normative values in different environments, as well as longitudinal testing of cognitive and non-cognitive instruments to determine clinically meaningful change. Incorporation of remote assessment tools into clinical trials may help validate such measures. Innovative approaches are required to address more challenging features of assessments including subtle behavioral features, task engagement, vision and hearing assessment, social cognition, praxis, and body language. Additional research is required for refinement of computerized cognitive testing that may provide metrics such as response speed and consistency, at millisecond levels, that will complement traditional testing administration methods. Virtual reality platforms may eventually provide methods for remote testing, and integrated tools to monitor multiple aspects of behavior (e.g., movement and sleep) that will facilitate remote health care. Given the range of platforms and devices, harmonization of metrics will be required for broad application to patient care. Telemedicine has great potential to expand the ability to provide remote cognitive assessment during the pandemic and beyond.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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