

A Framework for Remote Cognitive Diagnostic Assessment and Digital Biomarkers in Dementia

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I have nothing to disclose

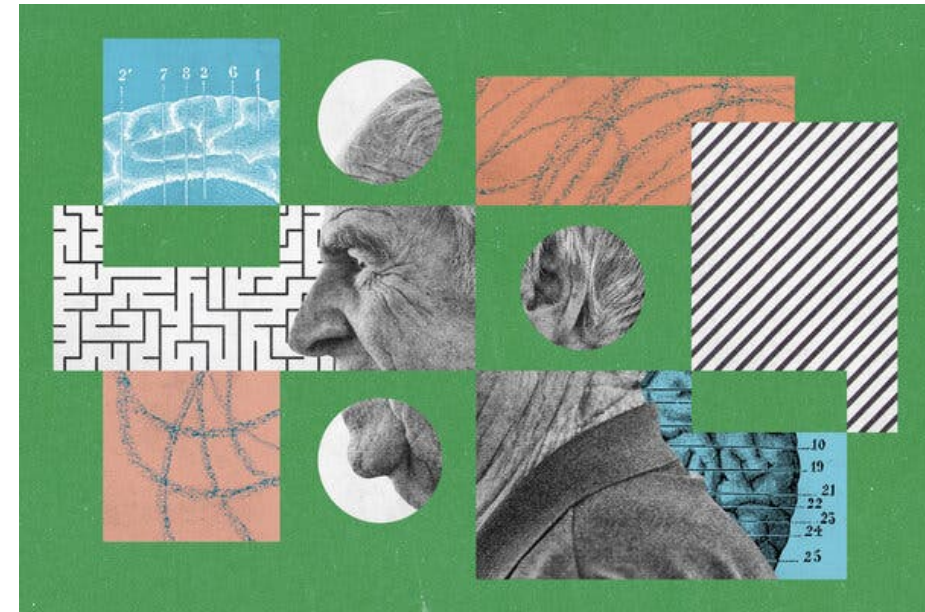


Learning Objectives & Overview



1. Current Framework for Remote Diagnostic Assessment

- To define informant-related and ethical considerations
- To identify a framework for remote cognitive, affective, behavioral and functional assessment



2. Roadmap & Future Directions

- Novel strategies for remote detection of cognition and behavior to predict, detect and track disease progression and treatment response
- Identify gaps including the need for linguistically and culturally valid measures that can be harmonized across platforms and address privacy and ethical concerns

Alzheimer's Disease in Canada



A
Dementia
STRATEGY
FOR CANADA

Together We Aspire



National Objectives

Areas of Focus



Prevent dementia

1. Advance research to identify and assess modifiable risk and protective factors
2. Build the evidence base to inform and promote the adoption of effective interventions
3. Expand awareness of modifiable risk and protective factors and effective interventions
4. Support measures that increase the contribution of social and built environments to healthy living and adoption of healthy living behaviours



Advance therapies and find a cure

1. Establish and review strategic dementia research priorities for Canada
2. Increase dementia research
3. Develop innovative and effective therapeutic approaches
4. Engage people living with dementia and caregivers in the development of therapies
5. Increase adoption of research findings that support the strategy, including in clinical practice and through community supports



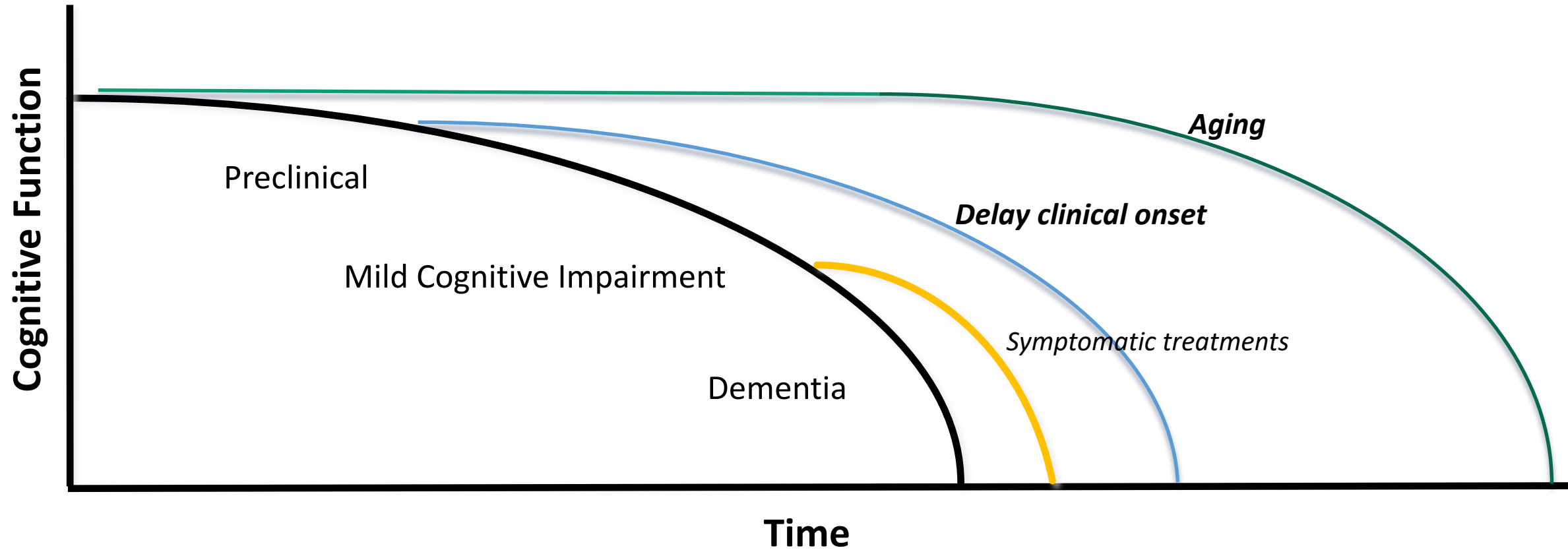
Improve the quality of life of people living with dementia and caregivers

1. Eliminate stigma and promote measures that create supportive and safe dementia-inclusive communities
2. Promote and enable early diagnosis to support planning and action that maximizes quality of life
3. Address the importance of access to quality care, from diagnosis through end of life
4. Build the capacity of care providers, including through improved access to and adoption of evidence-based and culturally appropriate guidelines for standards of care
5. Improve support for family/friend caregivers, including through access to resources and supports



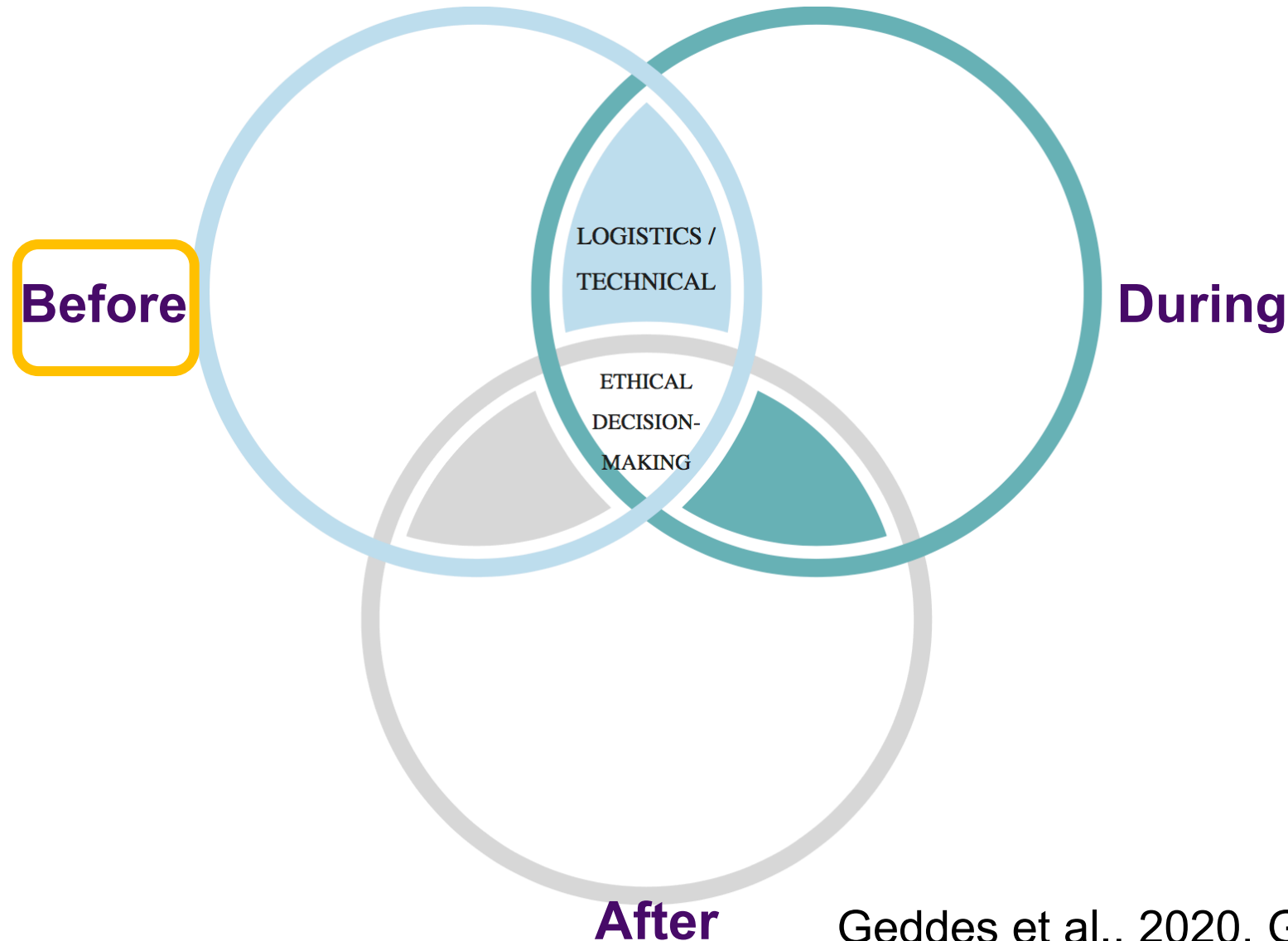


The Alzheimer's Disease Continuum





Strategies to improve remote assessment validity should be considered before, during and after the clinical encounter





Triad: Patient, Clinician and Care Partner





Is Remote Cognitive Assessment The Best Option?

Goal: To develop guidance on determining a patient's suitability for comprehensive remote cognitive diagnostic assessment for dementia

Red flags for remote cognitive diagnostic assessment: A Delphi expert consensus study by the Canadian Consortium on Neurodegeneration in Aging

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1–10

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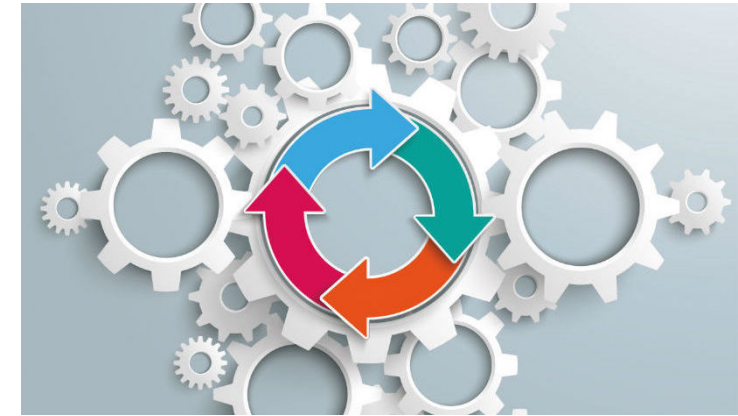
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The Delphi Process



- The Delphi method is an iterative process to systematically establish group consensus while mitigating potential bias
- Core elements of anonymity, iteration, feedback, and consensus
- De-identified data helped minimize the risk of eminence bias
- The number of rounds and consensus criteria were defined prior to beginning the Delphi iterative rounds
- **Goal:** To identify features about the patient, caregiver, clinician, or context that would indicate the need to shift to an in-person encounter



Delphi Process: Red Flags for Remote Cognitive Assessment

PREPARATION

- Defined “red flag”:
 - *Features of the patient, clinician, caregiver, context/situation (or other) indicating that a remote cognitive diagnostic assessment likely should be avoided.*
- Established quality indicators (QI):
 - QI1 - *This flag identified patients who are not well suited for remote cognitive diagnosis.*
 - QI2 - *This flag is reproducible at different times and by clinicians with different levels of experience.*
 - QI3 - *Searching for the flag would not significantly prolong the diagnostic process.*
- Established consensus threshold:
 - Overall mean Likert score of all QIs ≥ 4.0

FIRST ROUND

- Participants consider definition of “red flag” and brainstorm potential flags
 - Data collected from 11 respondents with an average of 12.4 years of clinical experience
 - The respondents generated a total of 148 potential flags
- Potential flags screened for duplicates and responses not meeting definition
 - Flags grouped into 67 unique flags
 - Responses not meeting definition discussed with workgroup and merged into other flags

SECOND ROUND

- Participants score each “red flag” on QIs (above) using Likert scale from 1-5
 - Data collected from 8 respondents

FINAL ROUND

- Participants consider previous round’s average score, and re-score each “red flag”
 - Data collected from 9 respondents

CONSENSUS

- Flags with an overall average score of all QIs ≥ 4.0 considered to have reached consensus.
 - There were 14 flags that met consensus, they are included in the infographic.

Remote Cognitive Assessment Readiness Tool



Patient and caregiver-related considerations

?

The patient does not have access to a functional device that supports videoconferencing.



?

The patient is uncomfortable with using the technology.



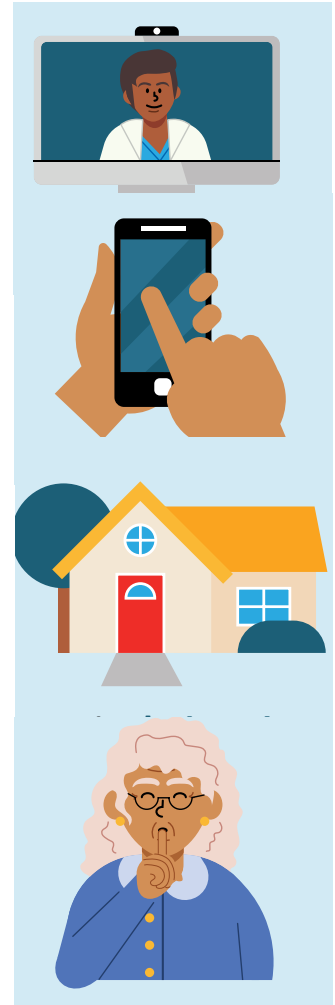
?

A private and safe spot for an assessment is not possible.



?

The patient does not have access to a quiet space without distractions.



Remote Cognitive Assessment Readiness Tool



Patient and caregiver-related considerations

?

The patient is being seen for medico-legal reasons (ex., court order).



?

The patient does not have access to a caregiver during the remote assessment AND is more than mildly impaired.



?

The patient has a preference for an in-person assessment.



?

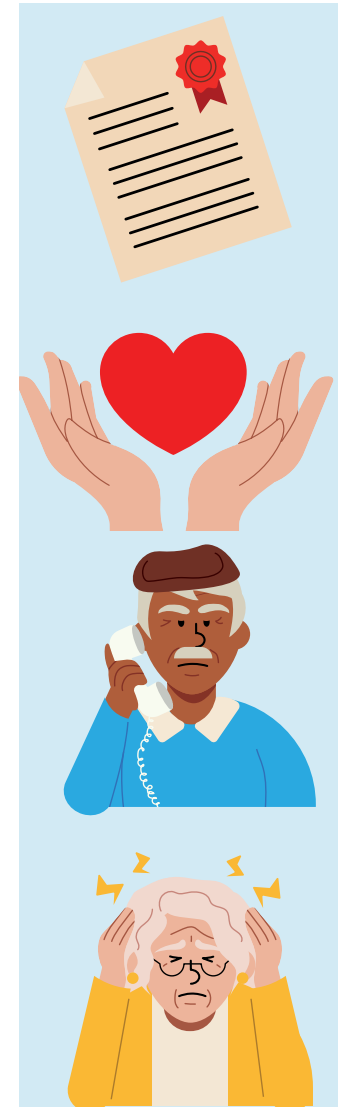
There is a high caregiver burden or discomfort with using technology.



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Remote Cognitive Assessment Readiness Tool

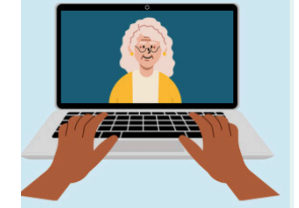


Clinician-related considerations



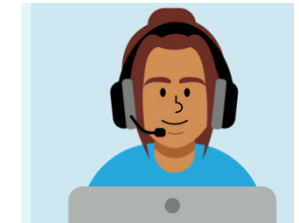
?

The clinician does not have access to a device that supports videoconferencing.



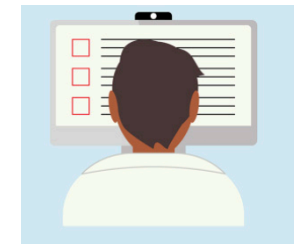
?

The clinician has limited technical support for setup.



?

The clinician does not have experience with and knowledge of the benefits and limitations of remote assessment.



Remote Cognitive Assessment Readiness Tool



Clinician-related considerations



?

The clinician lacks expertise in neurocognitive disorders.



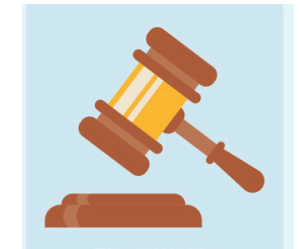
?

The clinician lacks experience with in-person cognitive assessment.



?

The patient is outside the legal jurisdictions of the clinician's medical license.



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<https://ccna-ccnv.ca/remote-cognitive-assessment/>



Are Red Flags Modifiable?

Red flags for remote cognitive assessment	Overall Mean \pm SD
1. The clinician does not have access to a device that supports videoconferencing.	4.9 \pm 0.3
2. The patient does not have access to a functional device that supports videoconferencing.	4.7 \pm 0.4
3. A private and safe spot for an assessment is not possible.	4.6 \pm 0.5
4. The patient does not have access to a quiet space without distractions.	4.5 \pm 0.4
5. The clinician has limited technical support for setup.	4.4 \pm 0.5
6. The clinician lacks expertise in neurocognitive disorders.	4.5 \pm 0.5
7. The clinician does not have experience with and knowledge of the benefits and limitations of remote assessment.	4.1 \pm 0.6
8. There is high caregiver burden or discomfort with using technology.	4.0 \pm 0.6
9. The clinician lacks experience with in-person cognitive assessment.	4.0 \pm 0.8
10. The patient is uncomfortable with using the technology.	4.0 \pm 0.6
11. The patient is outside the legal jurisdictions of the clinician's medical license.	4.9 \pm 0.3
12. The patient is being seen for medico-legal reasons (ex., court order)	4.2 \pm 0.7
13. The patient has preference for in-person assessment.	4.0 \pm 0.7
14. The patient does not have access to a caregiver during the remote assessment AND is more than mildly impaired	4.0 \pm 0.8



Increasing Accessibility of Remote Assessment



- Community-based and rural access to high-speed internet and health resource centers offering internet-enabled, quiet, and secure spaces
- Initiatives to increase technology literacy among older persons
 - Older Adults Technology Service through the American Association of Retired Persons and Connected Canadians
- Limited access to device, high-speed internet and comfort with technology as key barriers to remote cognitive assessment
 - Initiatives: Internet for All in the US, and Universal Broadband Fund in Canada
- Development of more intuitive technology interfaces for patients, and accessible community-based telemedicine hubs
- **Goal:** To reduce the digital divide & catalyze public health initiatives to mitigate modifiable red flags and barriers to remote dementia diagnosis and care.





Sensory Impairment and Remote Assessment



WHO
eyes



- Sensory Impairment can render a remote assessment invalid
- Screening for objective and subjective (e.g., RHHI-S) sensory loss before a remote cognitive assessment is important!





Critical Role of Caregivers



- Multiple red flags identified by the workgroup underscore the key role played by caregivers, particularly if a patient has more than mildly impaired cognition.
- Balance between enhanced specialist access and caregiver burden when using technology
- 68% of patients required caregiver assistance to participate in a videoconferenced clinical encounter
- Telemedicine educational and decision-making resources for clinician, patient and care partner





REMOTE COGNITIVE ASSESSMENT READINESS TOOL

This tool is designed to aid clinicians in **determining if a patient is an appropriate candidate for cognitive assessment via telemedicine** – a medical appointment through a video call.

If one or more of the statements is **TRUE**, then the patient is **not well suited** for cognitive assessment via telemedicine.



Patient and caregiver related considerations



The patient **does not have access to a functional device** that supports video conferencing.



The patient is **uncomfortable with using the technology**.



A **private and safe spot** for an assessment is **not possible**.



The patient does **not have access** to a **quiet space without distractions**.



The patient is **being seen for medico-legal reasons** (i.e.: court order).



The patient **does not have access to a caregiver during the remote assessment** and is **more than mildly impaired**.



The patient has a **preference for an in-person assessment**.



There is a **high caregiver burden** or **discomfort with using technology**.



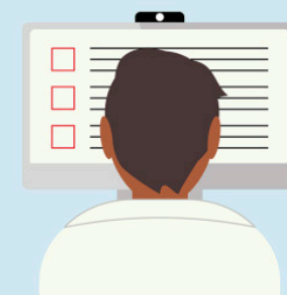
Clinician-related considerations



The clinician **does not have access to a device** that supports video conferencing.



The clinician has **limited technical support** for setup.



The clinician does **not have experience with and knowledge of the benefits and limitations of remote assessment.**

A PDF version of the tool and a clinician feedback form are available at the QR code.

This tool was created using the Delphi group consensus method to synthesize expert opinion among members of the telemedicine workgroup of the Canadian Consortium on Neurodegeneration in Aging (CCNA). The full publication pre-print is available here, and at the QR code.

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Authors: Nathan H.M. Friedman, Sophie Hallot, Inbal Itzhak, Richard Camicioli, Alex Henri-Bhargava, Jacqueline A. Pettersen, Linda Lee, John D. Fisk, Paula McLaughlin, Vladimir Khanassov, Zahinoor Ismail, Morris Freedman, Howard Chertkow, Philippe Desmarais, Megan E. O'Connell, Maiva R. Geddes.



The clinician **lacks expertise in neurocognitive disorders.**



The clinician **lacks experience with in-person cognitive assessment.**



The patient is outside the **legal jurisdictions of the clinician's medical license.**



Framework for Remote Assessment





The Goal of Multidimensional Remote Assessment



- Cognition and behavior are inextricably linked in Alzheimer's disease detection, tracking, risk assessment and prevention
- There is a need for tools and guidance on remote multi-dimensional assessment of cognition, affect, behavior, and function





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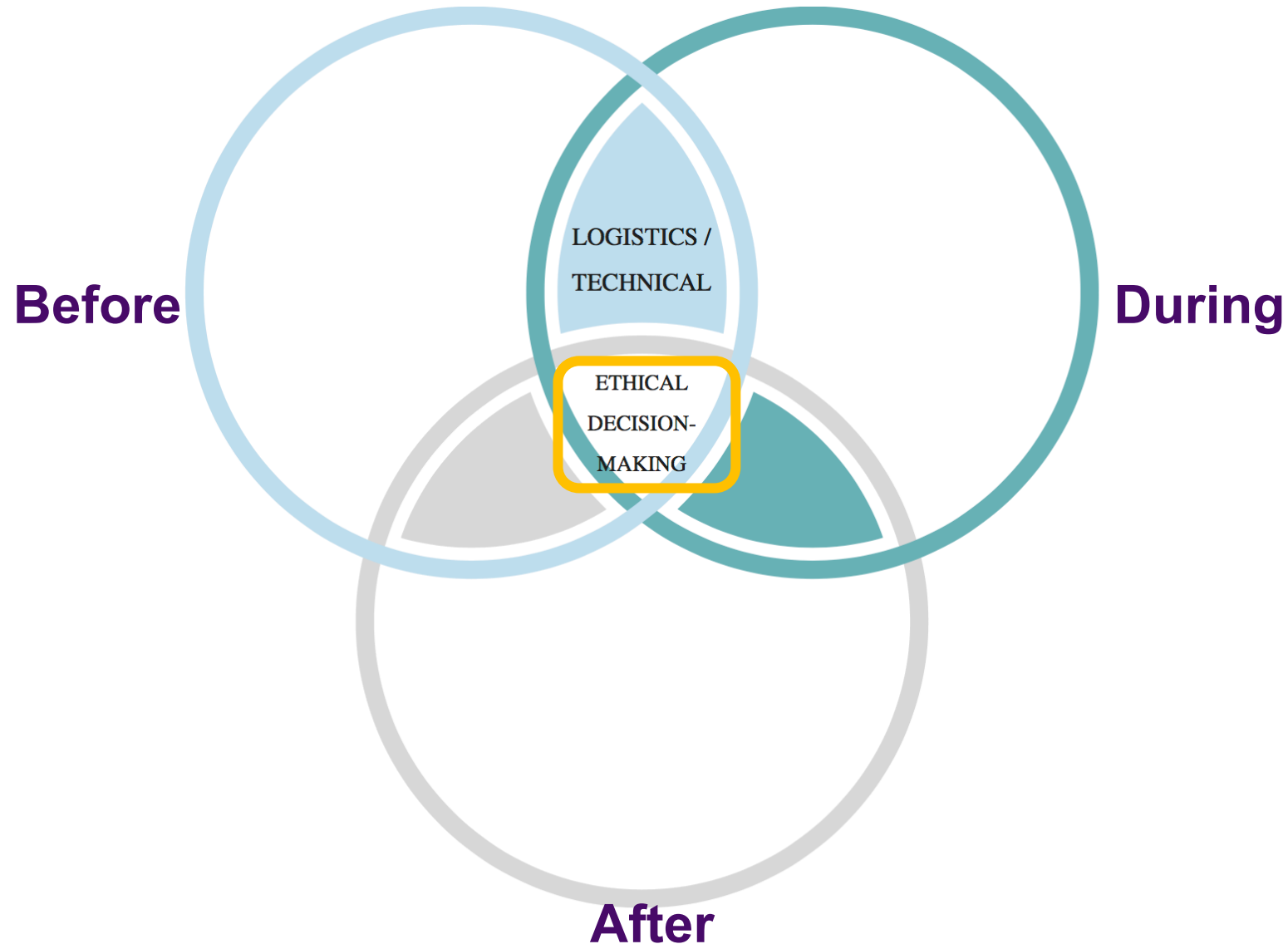
REVIEW ARTICLE

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

Maiya R. Geddes^{1,2,3} | Megan E. O'Connell^{4,5} | John D. Fisk^{6,7,8} | Serge Gauthier² |
Richard Camicioli⁹ | Zahinoor Ismail^{10,11} | for the Alzheimer Society of Canada Task Force
on Dementia Care Best Practices for COVID-19



Strategies to improve remote assessment validity should be considered before, during and after the clinical encounter





Ethical Considerations



- The same ethical principles apply to telemedicine and in-person encounters
- Ethical adoption of technology (Robillard et al., 2018)
- Awareness of limitations and when to shift to in-person encounter
- Handling imminent risk
- Fidelity: The interests and welfare of patient come first
- Minimize obtrusiveness
 - Telephone vs videoconference
- Verbal and non-verbal cues conveying empathy
 - Clinician training





Ethical Considerations

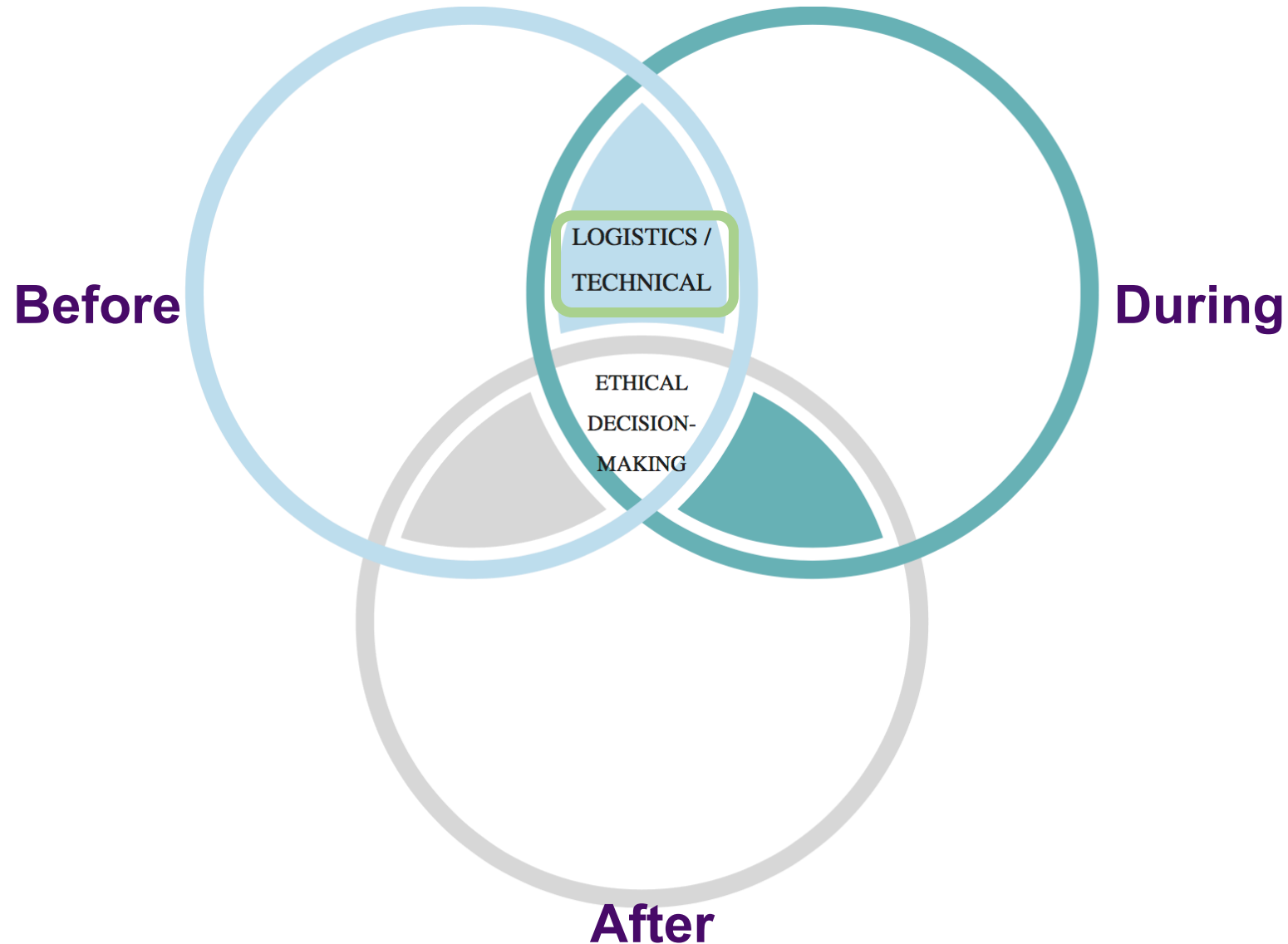


- Benefits
 - **Enhanced access to specialist assessment to facilitate diagnosis, symptom management, pharmacological/behavioral interventions**
 - **Minimize transportation and other costs**
 - Convenience and comfort
- Risks
 - **Privacy/confidentiality, data quality, continuity of care**
 - Reading body language conveying discomfort
 - **Variable/uncontrolled environment**
 - Equitable access across sociodemographic groups
 - Perceptual, language and cognitive barriers
 - **Missing treatable symptoms and signs**
 - **Diagnostic disclosure**





Strategies to improve remote assessment validity should be considered before, during and after the clinical encounter





Logistical Recommendations



- Encrypted platform, universal compatibility across devices
- Quiet, private room without backlighting
- Hide cues (e.g., clock, calendar)
- Optimize sensory input/output
 - Adequate audiovisual set-up, hearing aids, glasses
- Plan in case of technical failure
- Confirm that the session will not be recorded
- Use of screenshare and capture

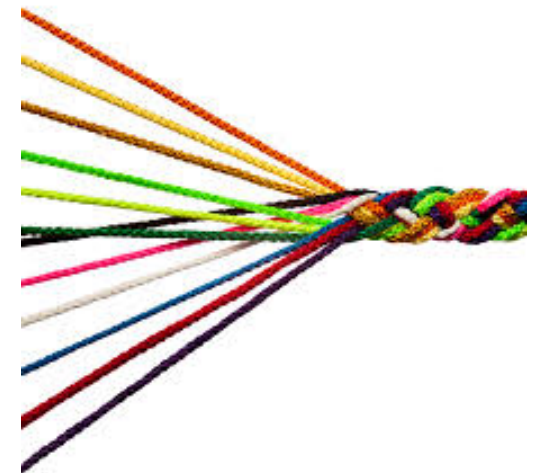




Remote Neurobehavioral Status Exam



- Diagnosis is based on *converging* evidence from:
 - The clinical history
 - Validated but brief remote testing (e.g., cognitive screening and cognitive domain-specific tests, inventories of affect and function)
 - Remote neurological exam

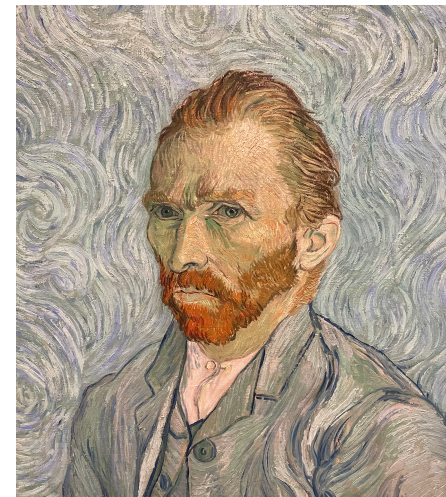




Remote Assessment of Affect, Behavior and Function



- **Neuropsychiatric symptoms** (e.g., Mild Behavioral Impairment Checklist [MBI-C])
- **Affect**
 - Depression (e.g., Cornell Scale for Depression in Dementia [CSDD]; Patient Health Questionnaire-9 [PHQ-9])
 - Anxiety (Rating Anxiety in Dementia [RAID] – sensitive; Penn State Worry Questionnaire - specific)
- **Function** (e.g., AD8; Informant Questionnaire on Cognitive Decline in the Elderly [IQCODE]; Quick Dementia Rating System; FAQ; Lawton-Brody IADL; 4-item IADL scale; Amsterdam IADL questionnaire)
- **Sleep** (e.g., Mayo Sleep Questionnaire)





Cognitive Assessment by Telephone



- More evidence to support remote assessment that relies on verbal responses
- Stand alone measures (e.g., Mental Alternating Test) vs Battery
- Telephone Interview for Cognitive Status (TICS)
- MoCA Blind
 - 22 points; cutoff 19
 - Sensitivity 63%; specificity 98%
 - MoCA 5-minute protocol
- Other options: Telephone modified MMSE (T-3M), MCAS-M, SAGES



Cognitive Assessment by Videoconference



- Videoconferenced scores are comparable to in-person (Yi et al., 2021)
 - Caution with slower internet speeds, scoring close to cutoff, tasks with greater motor response (clock drawing)
 - Domain-specific stand alone tests; dashboard approach vs screening tests

Cullum et al 2014; Costanzo et al 2020; Marra et al 2020; Brearly et al 2017; Castanho et al 2014; Wong et al 2012; Geddes et al 2021

Domain: Attention

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



How might we make cognitive neuroscience more applicable to the real world?



Principles

- Inclusive and generalizable research
- Decrease barriers to interdisciplinary collaboration
- Early stakeholder involvement (clinicians, policy makers, patients...)
- Experiment with novel approaches (Design Thinking)
- Focus on skill building and education
- Rapid translation of tools and processes to practice
- → Real-world impact





AI-Driven Measurement in Gerontological Research: Call for Submissions



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Special Issue: AI-Driven Measurement in Gerontological Research: Digital Metrics, Biomarkers, and Phenotypes in Cognitive, Behavioral, and Psychological Sciences

Guest Co-Editors: Ganesh M. Babulal, PhD, OTD (Washington University School of Medicine), Maiya R. Geddes, MD, FRCPC (Montreal Neurological Institute; McGill University), and Laura Thi Germine, PhD (McLean Hospital; Harvard Medical School).