CANADIAN STROKE BEST PRACTICE RECOMMENDATIONS

Vascular Cognitive Impairment

7th Edition, Update 2024

Vascular Cognitive Impairment Scientific Writing Group

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Vascular Cognitive Impairment, 7th Edition, Update 2024

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INTRODUCTION AND OVERVIEW

Introduction to the Canadian Stroke Best Practice Recommendations

The Canadian Stroke Best Practice Recommendations (CSBPR) provide up-to-date, evidence-based guidelines for the prevention and management of stroke, to promote optimal recovery and reintegration for people with stroke and support their families and informal caregivers. The CSBPR are under the leadership of the Heart and Stroke Foundation of Canada.

The theme of the 7th Edition of the CSBPR is **building connections to optimize individual outcomes**. Individuals with stroke often present to the healthcare system with multiple pre-existing comorbid conditions – some of which may have contributed to their stroke, some of which may be consequences of it, and some of which may be unrelated. Nelson et al. (2016) found that approximately 80% of individuals who survive a stroke have on average five other conditions and a range of psychosocial issues. The interactions among complex comorbid conditions must be considered to ensure treatment and ongoing care planning is personalized and person centred.

In addition, in light of the strong evidence of the intrinsic connections between the heart and brain, management of individuals with stroke should take heart health and its possible association with vascular cognitive impairment into consideration. The healthcare system is often designed in siloes, with planning and organization for different conditions being done separately rather than being integrated across conditions, even related vascular conditions. As individuals move through different settings and phases of care after a stroke, they often report feeling anxious and overwhelmed. Providing individualized care and ensuring connections are made within the community have a significant impact on individuals' short- and long-term outcomes.

The 7th Edition of the CSBPR takes a broad, wholistic focus and takes into consideration issues of multimorbidity and increasing complexity of individuals with vascular conditions. This is particularly relevant for this module on *vascular cognitive impairment.* Vascular cognitive impairment can be influenced by multiple contributing risk factors and etiologies that contribute to vascular disease, neurodegenerative cognitive decline or both. "Pure" vascular cognitive impairment (i.e. cognitive impairment caused only by a stroke or covert cerebrovascular disease without any contributions from underlying neurodegenerative diseases) is rare. Mixed disease, with a contribution from neurodegenerative diseases such as Alzheimer's disease, is more common. The contributing neurodegenerative diseases may have been clinically unrecognized prior to stroke but could contribute to post-stroke cognitive impairment by reducing resilience to brain injury. The relationship between VCI and neurodegeneration is further complicated by the fact that they share risk factors, stroke can accelerate neurodegeneration and neurodegenerative diseases can affect cerebral blood vessels increasing the risk of stroke (e.g., in CAA). Individuals with vascular cognitive impairment may also present with other comorbidities that can contribute to cognitive change. Individuals with multimorbid vascular conditions are more complex, require a coordinated interdisciplinary approach to care and recovery, and are at risk of worse outcomes.

In this edition, a more purposeful review of sex and gender representation in the seminal clinical trials upon which the recommendations are based was undertaken. This was done to determine the extent to which available evidence includes both male and female subjects, in sufficient proportions to be able to detect outcomes and generalize to a broader population. These findings are presented in the evidence summary sections where evidence is available, and integrated into the actual recommendations where appropriate. Finally, the accompanying performance measures were expanded to include system indicators, clinical indicators, and new patient reported outcome measures, to support the wholistic focus.

The goal of disseminating and implementing these recommendations is to optimize evidence-based stroke care across Canada, reduce practice variations in the care of individuals with stroke, vascular cognitive impairment and related sequalae, and narrow the gap between current knowledge and clinical practice.

These recommendations have been developed in collaboration with the Canadian Stroke Consortium and CanStroke Recovery trials platform. We work closely with the Canadian Cardiovascular Society,

Thrombosis Canada, and Hypertension Canada to ensure alignment of recommendations across guidelines where possible and appropriate.

*The CSBPR Vascular Cognitive Impairment 7th Edition, 2024, **supersedes** all recommendations contained in the CSBPR Vascular Cognitive Impairment 6th Edition recommendations released in 2020* (Lanctôt et al. 2020).

Disclaimer: The Canadian Stroke Best Practice Recommendations (CSBPR) are designed to support implementation of best practices in stroke care across Canada. Healthcare systems, health organizations and professional organizations, as well as legislation and standards, vary provincially. The CSBPR provide guidance on a national level; they do not, on the whole, account for provincial variations in legislation or standards. The CSBPR are not intended to supersede any provincial or local law or organizational or professional standard. In considering and implementing the CSBPR, users are encouraged to consult and follow all appropriate legislation or standards.

Scope of the Vascular Cognitive Impairment Module

For the CSBPR 7th edition update, vascular cognitive impairment (VCI) has become a separate module with a primary focus on VCI that results from any of several vascular conditions, such as stroke. This redesigned and expanded module provides guidance across the continuum of care for individuals experiencing VCI including awareness of signs and symptoms, screening, assessment, diagnosis, pharmacological and non-pharmacological management, secondary prevention of VCI, active rehabilitation and end-of-life planning and care. This module also addresses VCI considerations when the VCI is caused by other underlying vascular conditions such as heart failure and hypertension.

The goal is to build on the previous version of these recommendations, and on the work of other high-quality sources, such as the *Canadian Consensus Conference on Diagnosis and Treatment of Dementia (CCCDTD)5: Guidelines for management of vascular cognitive impairment*, to provide clear guidance for a range of healthcare teams and providers across the full continuum of care, working in collaboration when possible.

In Scope: This module will focus on assessment, diagnosis and management of vascular cognitive impairment and it is **targeting individuals who are already exhibiting VCI signs and symptoms**. This will include individuals who present with VCI without overt stroke, those with VCI who have experienced a stroke, or those with VCI secondary to other significant vascular medical conditions (e.g., heart failure, hypertension, atrial fibrillation, cardiac arrest, diabetes, renal failure or other vascular compromise) with or without neurodegenerative disease. *Refer to Figure 1 Heart & Stroke Heart-Brain Associations Map.*

Out of scope: Primary prevention of vascular disease, which may include VCI, stroke, heart disease and other vascular related conditions, will be generally considered out of scope for this module. We recognize the critical importance of primary prevention and strongly promote it and will direct readers to the high-quality primary prevention of vascular disease guidelines that are currently available for guidance (Arnett et al. 2019; Jain et al. 2022; Visseren et al. 2022). We work collaboratively with other health sectors (e.g., Public Health Agency of Canada) and health professional organizations (such as the Canadian Consortium on Neurodegeneration in Aging, Canadian Cardiovascular Society, Hypertension Canada) who produce evidence-based guidance on primary prevention. Therefore, we will defer to those organizations and guidelines for broad primary prevention recommendations. Likewise, this guideline will not address management of the underlying conditions (e.g., heart failure, hypertension, Alzheimer's Disease) that may contribute to vascular cognitive decline, and we defer to individual focused guidelines on these areas for relevant recommendations. Individuals presenting with motor, physical, visual, sensory, and/or communication problems without a cognitive component are out of scope, and their needs are addressed in the Stroke Rehabilitation and Recovery module (Teasell et al. 2020).

Note: The term stroke in these recommendations refers to all types including ischemic, hemorrhagic (SAH and ICH), and cerebral venous thrombosis. If transient ischemic attack is included, it will be stated separately.

Figure 1: Heart & Stroke heart-brain associations map—All cardiovascular conditions can lead to vascular cognitive impairment

Associations of varying strength between several vascular conditions and subsequent development of vascular cognitive impairment is shown in the heat map below. Therefore, within these recommendations, consideration of cognitive decline beyond stroke is warranted. The strength of the associations was determined through an extensive review of the literature and analysis of research findings and review papers by a panel of expert advisors (Heart & Stroke 2019).

Heat map of associations between heart conditions, stroke and vascular cognitive impairment
Read along the horizontal rows to understand the strength of the associated risk of each condition on the left with vascular cognitive impairment.

Strength of Association: No Known Association · Weak · Moderate · Strong

CONDITIONS	Vascular Cognitive Impairment
Atrial Fibrillation	Moderate
Heart Failure	Strong
Stroke	Strong
Congenital Heart Disease	Strong
Heart Valve Disease	Weak
Myocardial Infarction (Heart Attack)	Moderate
Coronary Artery & Vascular Disease	Strong
Cardiac Arrest	Moderate

Lived Experience of VCI – Integrating their Journey into Clinical Guidelines

Vascular cognitive impairment (VCI) is a devastating condition that is both a risk factor for and a consequence of stroke. The experiences of individuals with VCI and their caregivers across the continuum of care are not well defined. To ensure these VCI best practice recommendations reflect and consider the lived experience of individuals with VCI and their families, a VCI Journey Map was created to capture the lived experiences and critical needs from symptom onset to pre-diagnosis, to diagnosis, to management and living with VCI. This journey map complements the recommendations and ensures a person- and family-centred approach to care. *Refer to Appendix Five for the Heart & Stroke Vascular Cognitive Impairment Journey Map. (Swartz et al. 2025)*

Five distinct stages of a VCI journey were identified through a collaborative process working with our Community Consultation and Review Panel (CCRP) and our scientific writing group: symptom onset, pre-

diagnosis, diagnosis, management, and living with VCI. Themes included symptoms, navigating care, managing daily activities, emotions and mental health, and relationship to self and others. Unique elements were identified and plotted along the Map. The key findings that emerged from this process are:

- that there are significant knowledge gaps regarding the individual with VCI and caregiver experience of VCI

- People with lived experience (PWLE) and caregivers identify distinct needs throughout the VCI journey

- the Journey Map can inform planning and provide support to facilitate self-management and system navigation for PWLE and caregivers and foster person-centred care among healthcare professionals.

- Further investigation of PWLE/caregiver needs, and strategies to support identified needs are required.

Definitions and Descriptions

Context: Vascular Cognitive Impairment (VCI) is an overarching term that includes a range of clinical presentations and disease progression from very early mild/minor symptoms at one end of the spectrum to profound vascular dementia at the other extreme. Even within dementia, there are also stages including mild, moderate and severe, as defined by the Scottish Intercollegiate Guidelines Network (SIGN). SIGN publication number 168 addresses assessment, diagnosis, care and support for individuals with dementia and their carers (Scottish Intercollegiate Guidelines Network 2023). As such, it is challenging to define VCI simply and concisely.

Some have proposed the overarching term of 'vascular cognitive disorders', which may be considered in future versions of this guideline. For the purposes of these guidelines, the term "VCI" is intended to include a variety of conditions described in the literature, including "vascular Mild Cognitive Impairment" (v-MCI) whether single-domain or multi-domain, "vascular Cognitive Impairment, No Dementia (v-CIND)", "vascular mild neurocognitive disorder", "vascular major neurocognitive disorder", "mixed dementia: (e.g., cerebrovascular disease with Alzheimer's disease or other neurodegenerative diseases), and "Vascular Dementia" (VaD). Importantly, mixed dementia is the most common pathology causing dementia in older adults.

Vascular Cognitive Impairment

High-level public description: Vascular cognitive impairment is a condition of the brain and its blood vessels that causes challenges with cognitive abilities such as attention, memory, language, processing speed, judgement, and problem solving.

Public-facing definition: Vascular cognitive impairment (VCI) is a condition where damage to the blood vessels of the brain leads to injury of brain tissue, resulting in changes in thinking and memory. VCI may be caused by stroke, tiny clots that block small blood vessels in the brain, bleeding from small blood vessels in the brain, or blood vessel wall disease, resulting in a lack of oxygen and damage to brain cells. Risk factors for VCI may include vascular conditions such as stroke, heart failure, diabetes and high blood pressure, smoking; and modifiable risk factors for VCI more generally. These may include less education, hearing impairment, obesity, depression, physical inactivity, low social contact, excessive alcohol consumption, and air pollution (Livingston et al. 2020). VCI can cause symptoms that range from mild forgetfulness to more serious challenges with attention, memory, language, processing speed, judgement, and problem solving.

The most serious form of VCI is called vascular dementia (VaD). Vascular dementia can cause difficulty with everyday activities like getting dressed and bathing. Vascular dementia and Alzheimer's disease can share some signs and symptoms, can exist separately or together, but they are not the same condition.

Scientific definition: Vascular cognitive impairment refers to a range of new or worsening **cognitive deficits** attributed to or accelerated by **cerebrovascular injury** (Paradise and Sachdev 2019).

a. ***Cognitive deficits:*** The pattern of new or worsening cognitive deficits in VCI may encompass **any or all** cognitive domains, such as attention, learning and memory, language, perception, processing speed, or executive functions like social cognition, problem solving and decision making. VCI can also include impairments related to focal stroke syndromes such as aphasia or spatial neglect.

b. ***Cerebrovascular Injury (vascular pathology):*** The predominant etiology is vascular pathology with a range of presentations (symptomatic or covert), including cortical or subcortical infarct(s), strategic infarcts, small-vessel disease with white matter lesions, lacunar infarcts or brain hemorrhage. These cerebrovascular pathologies can be caused by diverse conditions (such as stroke, heart failure, hypertension, atrial fibrillation, cardiac arrest, diabetes, renal failure or other vascular compromise). These conditions can occur in isolation or along with other neurodegenerative processes, such as Alzheimer's disease, resulting in mixed pathology (also called mixed dementia).

Screening: Screening is a process for evaluating the possible presence of a particular problem. Screening is a purposeful action or query for early identification of individuals who may be at risk of developing a specific condition or disorder or problem. Screening may suggest that an issue may exist. Findings from screens can indicate the need for more comprehensive assessment. Screening is usually brief and used to identify possible concerns, not typically to diagnose. Healthcare providers may use preliminary screening measures to support clinical decision making.

Assessment: Assessment is a process for defining and measuring the nature of that problem, informing a diagnosis, and contributing to developing specific treatment recommendations for addressing the problem or diagnosis. The purpose of assessment is to gather more specific and detailed information to provide a comprehensive understanding of a potential issue. Assessments will include other information to help provide a broader context of results.

Note: Screening and assessment of vascular cognitive impairment must be nuanced by multiple factors. In the current version of these recommendations a section is included called "clinical considerations," where a brief discussion of issues identified in the evidence review or by expert consensus are presented that impact performance or interpretation of cognitive screening and assessment information.

Ideally, both assessment and screening tools should be validated for their specific use and target population to provide the most accurate interpretation of results.

WHO International Classification of Functioning, Disability and Health (World Health Organization 2001)

Impairment: Problems in body function or structure such as a significant deviation or loss *(based on International Classification of Functioning)*

Activity limitation: difficulties an individual may have in executing activities *(based on International Classification of Functioning)*

Participation restrictions: Problems an individual may experience in involvement in life situations *(based on International Classification of Functioning)*

A note about Consent:

In the field of vascular cognitive impairment, the issue of agency to provide consent often arises. Throughout these recommendations, there is reference to the individual with VCI, their family and other informal caregivers. The individual with VCI retains the same rights to privacy of health information as any individual seeking healthcare services, under national and provincial legislation. It is acknowledged that at some point their capacity for providing consent, whether consent for others to be involved in their care and receive their personal health information, or consent for treatments, may

change. Throughout these recommendations, the issue of consent is assumed to have been addressed by the healthcare team members with the individual and their alternate decision-makers where appropriate. *Refer to Section 5 of this module on Advance Care Planning for additional information.*

## Framework for Assessing and Diagnosing Vascular Cognitive Impairment

There are multiple terms used in clinical and research literatures, all of which are subsumed under the umbrella term Vascular Cognitive Impairment. These include Major and Mild neurocognitive disorder (if there is a vascular contribution), vascular dementia (VaD), vascular mild cognitive impairment (vMCI), vascular cognitive impairment no dementia (vCIND), post-stroke dementia, Subcortical ischemic vascular dementia (SIVD), multi-infarct dementia (MID), mixed dementia (if there are co-occurring neurodegenerative disease diagnoses, most commonly Alzheimer's disease and/or Lewy Body Dementia). (Skrobot et al. 2018)

Vascular cognitive impairment is heterogenous in scope, severity and impact. Diagnosis of VCI should include consideration of three main components:

1. Understand cognitive abilities through validated cognitive screens and assessments (Section 1.1);
2. Identify cerebrovascular pathology through neuroimaging (Section 1.3); and
3. Determine functional impact through historical individual and collateral information and, sometimes, observation of the individual's function in their home environment or in a rehabilitation setting (Section 1.2).

Diagnosis generally requires appraisal within all three components, as well as consideration of other underlying risk factors or comorbid conditions that may worsen cerebrovascular pathology, impact cognitive abilities and/or affect function.

Figure 2: Framework for assessing and diagnosing vascular cognitive impairment
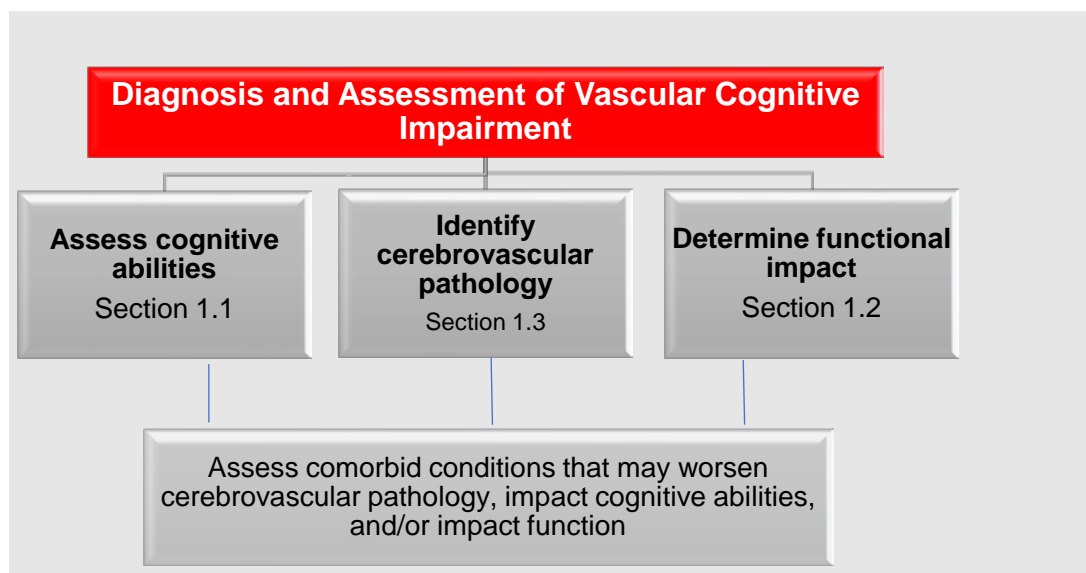
Framework Considerations

- Individuals may present with any of the three above concerns first (e.g., present with cognitive symptoms, then require identification of cerebrovascular pathology or present with cerebrovascular pathology and then assess cognitive abilities – see Figure 2). Thus, all three areas are important to consider when any one of the concerns is raised, and approaches should be tailored to the individual case.

- **Assess comorbid conditions**

  Several comorbid conditions may contribute directly or indirectly to cognitive decline and should be considered and assessed as appropriate:
  - Stroke etiologies, such as large vessel or small vessel atherosclerosis, cardiac conditions, genetic vasculopathies.
  - Medical conditions such as stroke, heart failure, hypertension, atrial fibrillation, cardiac arrest, diabetes, renal failure, other vascular compromise, obstructive sleep apnea, or metabolic diseases (e.g., B12, thyroid, calcium disorders).
  - Neurodegenerative conditions such as Alzheimer's disease, Lewy Body dementia, Parkinson's disease.
  - Neuropsychiatric conditions such as major depressive disorders, anxiety disorders, delirium, bipolar disease.

- **Determine functional impact**
  - Functional impairment exists on a spectrum from mild to severe, with complete dependence. Broadly speaking, many research studies refer to two main categories of neurocognitive impairment, reflecting the *DSM-5 and Vascular Impairment of Cognition Classification Consensus Study* (VICCCs 1 & 2), which defines *mild neurocognitive disorder* and *major neurocognitive disorder*, also referred to as vascular dementia.
    - **Mild vascular neurocognitive disorder** (vascular mild cognitive impairment, *vMCI*) includes cognitive decline from a previous level of cognitive functioning without significant impairment of basic activities of daily living (bADLs) and/or instrumental activities of daily living (iADLs). Symptoms are generally considered milder, and amenable to the use of compensatory strategies to manage daily demands. However, deficits may affect or impair function in some vocational, social, or leisure activities and roles.
    - **Major vascular neurocognitive disorder** (also called vascular dementia, VaD) includes substantial cognitive decline, severe enough to impair functional independence (e.g., significant decline in one or more cognitive domains, requiring assistance with ADLs or iADLs, frequent reminders, safety measures).

Figure 3: Multiple clinical presentations can lead to Vascular Cognitive Impairment, with the main components of clinical pathways covered in these recommendations
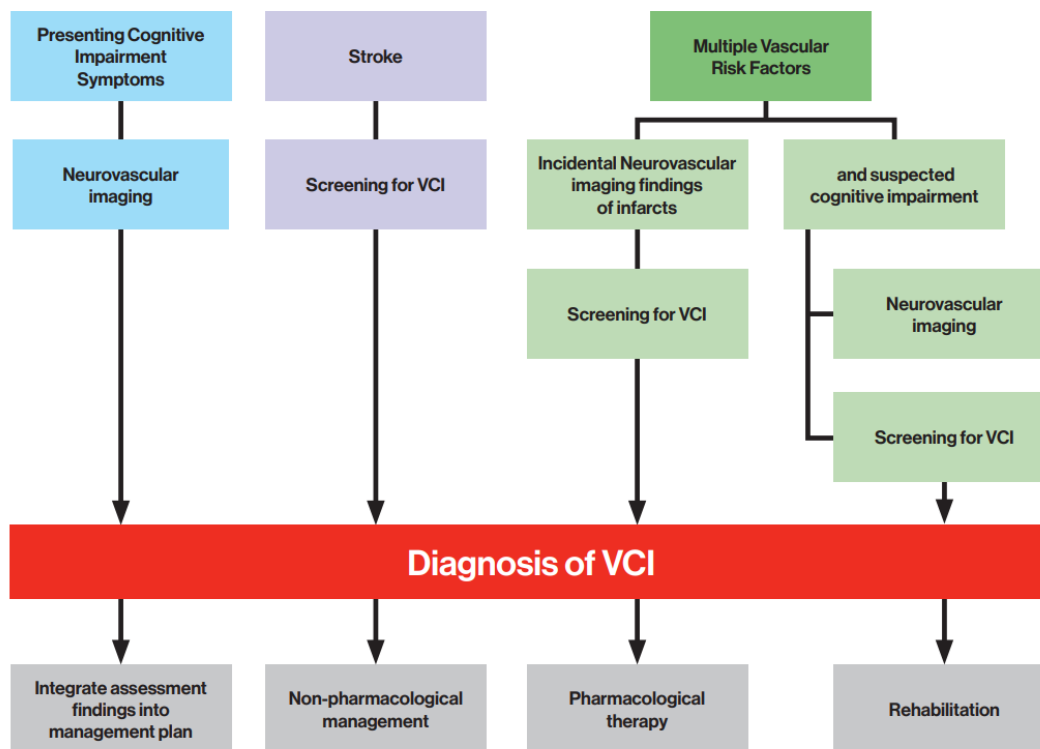
Guideline Development Methodology

The CSBPR presents high-quality, evidence-based stroke care guidelines in a standardized framework. As healthcare providers across all disciplines implement these recommendations, it is expected that practice variations will be reduced and gaps between evidence and practice will start to close, leading to improved outcomes for individuals with stroke.

The methodology used to develop this module followed a thorough and rigorous process. Refer to CSBPR Overview of Methodology for additional detail.

1. Establish an expert interprofessional writing group representing relevant disciplines across the continuum of care and a range of settings and striving for balance regarding gender and diversity. *Refer to Appendix One for a list of writing group members and affiliations.*

2. Consult with the vascular cognitive impairment Community Consultation and Review Panel (CCRP), comprising individuals with stroke, informal caregivers, and family members.

3. Select clinical questions to address in the module using the population/problem, intervention or exposure, comparison, and outcome (PICO) format, where appropriate and applicable.

4. Conduct a systematic search and appraisal of research literature to May 2024, and update evidence summary. Refer to the assigning evidence levels section of this module for more information on the GRADE approach.

5. Conduct a systematic search and appraisal of external reference guideline recommendations.

6. Writing group and community consultation panels review and revise existing recommendations, develop new recommendations, address clinical questions, and adhere to the elements of the Agree 2 criteria where appropriate (Agree Trust). This includes rating the quality of evidence and the strength of the recommendations. In depth discussions regarding risks, benefits and harms

as well as the values and preferences of the target population took place and were considered in setting the wording and evidence levels.

7. Review of the proposed module by the Canadian Stroke Best Practices Advisory Committee, and incorporation of edits as required.

8. Review of the proposed module by external leading experts in Canada and internationally, and incorporation of edits as required. *Refer to Appendix Two for a list of external expert reviewers and affiliations.*

9. Update educational materials and implementation resources.

10. Obtain final approval and endorsement and undertake French translation.

11. Disseminate through publication and public release knowledge translation activities.

12. Continue with ongoing review and update process.

More detail for each of these steps is available in the *CSBPR Overview, Methods and Knowledge Translation* manual on the Canadian Stroke Best Practices website.

Assigning evidence levels

The Grading of Recommendations, Assessment, Development and Evaluation (GRADE) methodology and terminology has been applied throughout these guidelines. With GRADE, each recommendation was assessed for:

1. The **strength of the guidance** (strong or conditional), based on the balance of desirable and undesirable consequences, quality of evidence, values and preferences of those affected, and resource use.

   - A strong recommendation is one for which the guideline panel is confident that the desirable effects of an intervention outweigh its undesirable effects.

   - A conditional recommendation is one for which the guideline panel finds that the desirable effects probably outweigh the undesirable effects, but appreciable uncertainty exists.

   and

2. The **quality of the evidence** (high, moderate, low) upon which the recommendations are formulated: risk of bias, directness of evidence, consistency and precision of results, risk of publication bias, magnitude of the effect, dose-response gradient, and influence of residual plausible confounding (Guyatt et al. 2008).

The writing group was provided with comprehensive evidence tables that included summaries of high-quality evidence identified through the structured literature searches. The group discussed and debated the quality of the evidence and through consensus developed a final set of proposed recommendations. Each recommendation was assigned a rating as to the strength of the recommendation and the quality of the evidence. Where appropriate and feasible, full GRADE review and analysis using relevant GRADE tables has been conducted (GRADE Handbook).

Clinical considerations

The CSBPR uses the additional category of clinical considerations, consisting of expert opinion statements. These are included when it is determined that guidance related to common clinical issues would be helpful, but the topic lacked sufficient evidence to form an actual recommendation.

Conflicts of interest

All potential participants in the recommendation development and review process are required to complete confidentiality agreements and declare all actual and potential conflicts of interest prior to participation. Declared conflicts of interest are reviewed by the co-chairs of the CSBPR Advisory Committee and Heart & Stroke staff to assess the potential impact. Those with significant conflicts with respect to the module topic are not selected for writing group or reviewer roles.

Participants who have conflicts for a particular topic area are identified at the beginning of discussions for that topic and are recused from voting. If a co-chair is in conflict, they are recused from their responsibilities for that discussion and another non-conflicted participant assumes the role for that discussion and vote. Heart & Stroke senior staff members participate in all writing group discussions and intervene if they perceive an untoward bias by a writing group member.

Conflict of interest declarations for the Vascular Cognitive Impairment module writing group members can be found in Appendix One, and external reviewers in Appendix Two.

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Writing group members and external reviewers are volunteers who do not receive any remuneration for their participation. All participants complete a conflict of interest declaration prior to participating.

Citing the Vascular Cognitive Impairment module, 7ᵗʰ Edition, Update 2024

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Comments

The Heart and Stroke Foundation of Canada's stroke team invites your comments, suggestions, and inquiries about the development and application of the CSBPR at strokebestpractices@heartandstroke.ca.

VASCULAR COGNITIVE IMPAIRMENT RECOMMENDATIONS 2024

Section 1   Screening, Assessment and Diagnosis

1. Screening, Assessment and Diagnosis 2024

1.0 Diagnosis of Vascular Cognitive Impairment

i.   All individuals with clinically evident stroke, transient ischemic attack (TIA), covert stroke present on brain imaging without history of symptomatic stroke, overt cardiovascular disease, or significant vascular risk factors should be considered at higher risk for vascular cognitive impairment [Strong recommendation; Moderate quality of evidence]. *Refer to definitions of VCI and Figures 2 and 3 for additional information.*

ii.   Individuals presenting with signs of cognitive impairment should undergo neuroimaging [Strong recommendation; Low quality of evidence].

Refer to Appendix Three for additional information on the presenting signs and symptoms of VCI.

1.1   Screening for Vascular Cognitive Impairment

i.   Individuals presenting with stroke or TIA should be screened for any changes in cognition following stroke compared to their pre-stroke cognitive status. [Strong recommendation; Moderate quality of evidence]. *Note, changes can be reported by the individual, family members, caregivers or clinicians. Refer to Appendix Three for more information on the presenting signs and symptoms of VCI.*

   a.   *Timing:* **Individuals who have experienced a stroke or TIA** should be screened for cognitive impairment prior to discharge from acute care and inpatient rehabilitation setting [Strong recommendation; Moderate quality of evidence].

ii.   Ongoing screening should also take place at transition points and follow-up visits with healthcare professionals (e.g., outpatient and community-based healthcare settings) [Strong recommendation; Moderate quality of evidence].

iii. Individuals who have **significant risk factors for vascular cognitive impairment** (imaging findings of cerebrovascular disease and/or those with multiple vascular risk factors) and have clinically evident or reported (by the individual or an informant) cognitive, perceptual or functional changes should be screened for vascular cognitive impairment [Strong recommendation; Moderate quality of evidence].

   a.   Screening should also be considered when a decline in functional abilities is reported or clinically evident [Strong recommendation; Low quality of evidence].

   b.   Screening may be initiated by asking the individual and informant (if available) about cognitive or functional changes that could indicate cognitive decline, such as missing medication doses, forgetting medical appointments or other changes in activities of daily living or instrumental activities of daily living. This should be followed by cognitive and functional assessments as clinically indicated [Strong recommendation; Low quality of evidence].

iv.   When screening for cognition and function, validated screening tools should be used [Strong recommendation; Moderate quality of evidence]. *Refer to Appendix Four for more information on validated screening and assessment tools.*

v.   When screening results are insufficiently informative, inconsistent with functional skills or indicate anticipated safety risks, then referral for formal cognitive, language and/or functional assessments

should be considered [Strong recommendation; Low quality of evidence]. *Refer to Clinical Consideration Section 1.1, #2 for more information.*

Section 1.1 Clinical Considerations

1. There are many validated screening measures for neurocognitive function. Impairment may be indicated by scores that fall outside of standardized norms (based on factors such as age and educational attainment) or by scores that are decreased from the individual's previous score on the same measure.

2. Screening for VCI is based on inquiring about cognitive or functional declines that may be attributed to cognitive causes. These declines can be reported by the individual or an informant. Examples of functional decline may include missing appointments, difficulty responding to medical instructions, low adherence to medications, safety concerns, difficulties with navigation, financial errors or declines in judgement, or general loss of independence.

3. Individuals may not be aware of their own symptoms and/or difficulties may not be recognized by family and caregivers; therefore, interviewing both individuals and informants may be valuable.

4. MCI thresholds may be overly sensitive in acute settings and may need to be reassessed in outpatient and rehabilitation settings.

5. Transition points across the continuum may include:
   a. During acute care stay, particularly if cognitive or functional concerns are noted.
   b. During rehabilitation in inpatient, outpatient, and home-based settings, according to client progress.
   c. Following hospital discharge from the emergency department or inpatient setting to follow-up in an outpatient or community-based healthcare setting, including long term care.
   d. The use of different equivalent screening forms when available may help limit practice effects when an individual requires repeated screening across transition points.

6. Measures developed for the detection of dementia may not be sensitive enough to detect milder impairment or they may omit clinically relevant cognitive domains related to VCI.

1.2 Assessment of Vascular Cognitive Impairment

i. Individuals with VCI who demonstrate any cognitive impairments (either clinically, by history, by report of the individual or family, or detected in the screening process), whether associated with history of stroke or not, should undergo more detailed assessment by healthcare professionals with the appropriate expertise in neurocognitive assessment and VCI [Strong recommendation; Moderate quality of evidence]. *Refer to Appendix Three for more information on the presenting signs and symptoms of VCI.*

ii. Assessment of VCI should include the impact of **cognitive** deficits on function and safety in activities of daily living, driving, instrumental activities of daily living, social, leisure, financial, vocational and/or academic functioning [Strong recommendation; Low quality of evidence]. *Refer to Appendix Four for more information on validated screening and assessment tools.*

   a. These assessments should be undertaken prior to the individual returning to cognitively demanding activities that may carry a safety risk. [Strong recommendation; Moderate quality of evidence].

iii. Individuals with VCI should also be screened for comorbid conditions that may affect cognition. These may include medical comorbidities, neurodegenerative diseases, sleep disorders, or mood

disorders such as depression, anxiety or apathy [Strong recommendation; Moderate quality of evidence]. *Refer to Rehabilitation, Recovery and Community Participation module for additional information on post-stroke depression, sleep disorders (Lanctôt et al. 2020). See clinical consideration 2 for additional information.*

iv. The results of these assessments should be considered to guide selection and implementation of appropriate remedial, compensatory and/or adaptive intervention strategies according to person-centred needs and goals [Strong recommendation; Moderate quality of evidence].

Section 1.2 Clinical Considerations

1. ***Comorbidities and situational factors***: Cognitive performance should be interpreted in the context of potentially confounding clinical factors that may impact interpretation of results, such as communication and sensorimotor deficits (speech and language, vision, hearing), delirium, hypo-arousal or hyper-arousal, neuropsychiatric symptoms (e.g., lability, depression, apathy and anxiety), other medical conditions (e.g., pain, infections) or medications, as well as socio-demographic and individual factors (e.g., language, sex, gender, ethnicity, cultural norms, geography).

   a. During assessments, especially in acute care settings, environmental factors should be considered, including attempts to maximize privacy, minimize noise and potential distractors, and avoid cues in the room.

   b. Delirium can confound cognitive assessments. New diagnoses (such as stroke) and other reasons for acute care admission, as well as the environment of acute care itself, can trigger or worsen delirium. In the setting of clear delirium, detailed assessment should be deferred; if there are concerns a more subtle delirium could be affecting assessment results, cognitive reassessment over time is helpful.

   c. Depression has a complex relationship with cognition. Depression can worsen the severity of VCI, VCI may limit non-pharmacological strategies for managing post-stroke depression, and depression in the context of stroke can mimic VCI.

2. ***Baseline Function:*** The breadth and depth of an assessment should consider a person's individual background, baseline intellectual functioning, education, occupation, social and leisure activities. Task performance can represent a decline and/or be functionally limiting for an individual even when not scoring in a 'severe' or 'impaired' range on tests. Highest level of education achieved should be recorded and considered in the interpretation of cognitive test scores.

3. ***Life Stage:*** Effects of age, life stage or pre-VCI function should be considered when deciding when, what and how to assess. Decisions about what skills to assess should always consider person-centred goals, which may differ by life stages (e.g., school, work, driving, independent living).

4. ***Personalization:*** Individuals with VCI should have personalized management and rehabilitation plans that include a person-centred approach, shared decision-making, culturally appropriate and agreed-upon goals and preferences.

5. ***Timing:*** The impacts of VCI can change with time, due to evolving pathology, effects of rehabilitation, and changing life demands. Thus, those who have been identified as being at risk or demonstrating VCI should be screened or assessed at the different stages of care.

6. ***Cognitive Domains:*** Cerebrovascular disease can affect any aspect of cognition. Attention, processing speed, and other executive function deficits (skills that help us plan, focus attention, hold and manipulate information in one's mind, or shift from one task to another) are the most commonly affected domains. Memory (amnestic VCI), language, visuospatial abilities can also be affected. Domains can be impacted individually or in combination with other domains.

    a. In-depth neuropsychological assessments may include evaluation of a diverse range of cognitive domains including attention, processing speed, executive function, memory, language, and visual-spatial/perceptual function. Assessment should not be limited to the domains in which the individual or informant reports changes.

    b. There may be focal stroke cognitive syndromes that require specific assessments.

    c. Attention, speed of processing and executive function each include specific sub-elements or abilities that could be assessed (for example, executive function may include initiation, inhibition, shifting, insight, planning and organization, judgment, problem solving, abstract reasoning and social cognition). *Definitions and delineation of the various domains and elements can be found in Evidence-Based Review of Stroke Rehabilitation (EBRSR): Chapter 12 (Saikaley et al. 2022)*

7. **Capacity:** Professionals should be aware that individuals with VCI may present with impairments in decision-making capacity. When screening or assessing for VCI, consider issues of consent and capacity, both to the assessment itself, and when obtaining collateral information.

8. **Assessment Tool Selection:** Cognitive evaluation using standardized assessments is important in determining the nature and severity of cognitive impairments, as well as preserved cognitive abilities and strengths. Within a multi-domain assessment, areas of focus may be guided by clinical presentation, history, investigations, and needs or goals of the individual or their caregiver.

    a. There are many validated assessments for neurocognitive function that assess multiple domains.

    b. Impairment may include scores that fall outside of standardized norms or that differ from the individual's prior documented functioning.

    c. Therapeutic activities, functional assessments, and/or standardized assessments provide additional information by showing the impact of impairments.

    d. The tools used to assess vascular cognitive impairment may be specific to the clinical question being asked, different settings, geographical areas, professions and timelines encountered along the continuum of care. Consider the validity and standardization of the selected tools with regards to factors such as age, culture, fluency in the language used for the assessment, aphasia, physical function, and education levels.

9. **Multiple Assessments:** Although screening and assessment at different stages of care is important for guiding diagnosis and management, it is also important to be aware of the potential impact of multiple assessments, on both validity of the test results, and for the individual with VCI (e.g., practice effects, test fatigue). To avoid practice effects, the use of different equivalent assessment forms is recommended when available.

10. **Assessments in patients with other neurological deficits:** The presence and severity of non-cognitive neurological deficits—including visual field deficits and motor deficits—need to be considered when performing cognitive assessments and understanding the basis of changes in activities of daily living. Additionally, assessing non-language cognitive domains is challenging when aphasia is present. In the setting of other neurological deficits, understanding the impact of changes in cognition may require a careful history, input from an informant, and clinical judgement. In complex cases, formal evaluation by a neuropsychologist and/or repeated assessments may be required.

1.3 Diagnostic Imaging and Laboratory Testing

  i. Individuals with suspected VCI should undergo vascular brain imaging with magnetic resonance imaging (MRI) or computed tomography (CT) to evaluate cerebrovascular disease [Strong recommendation; Low quality of evidence].

    a. MRI is recommended over CT for investigating VCI when there are no contraindications [Strong recommendation; Moderate quality of evidence].

b.   If CT is performed, a non-contrast CT and coronal reformations are recommended to better assess hippocampal atrophy [Strong recommendation; Low quality of evidence] (Smith et al. 2020).

ii.   Laboratory testing for stroke risk and possible contributing factors to cognitive impairment should include CBC, TSH, B12, calcium, electrolytes, creatinine, ALT, lipid panel, HbA1c [Strong recommendation; Low quality of evidence].

Section 1.3 Clinical Considerations

1.   Vascular-related pathology includes multiple cortical or subcortical infarcts, covert infarcts, strategic infarcts, a small-vessel disease with white matter lesions and lacunae, and brain hemorrhage including microhemorrhages and superficial siderosis.

2.   MRI is more sensitive than CT to vascular changes like small brain infarcts and is the modality of choice for describing markers of cerebral small vessel disease and amyloid angiopathy by consensus criteria. MRI can also provide additional information about alternative or concomitant diagnoses, such as focal atrophy patterns associated with neurodegenerative dementias.

   a.   Core imaging sequences include diffusion weighted imaging (DWI), FLAIR, susceptibility scans (either susceptibility-weighted imaging (SWI) or Gradient echo (GRE)), T1-weighted and T2-weighted scans.

   b.   MRI with DWI is most sensitive for acute stroke if completed within the first one to two weeks after stroke symptoms or sudden change in cognition or behaviour.

   c.   More chronic structural changes associated with VCI, including atrophy, chronic infarcts, cortical microinfarcts, lacunes, white matter disease and microbleeds are assessed using a combination of sequences including: T1 and T2, FLAIR and either SWI or GRE.

3.   When MRI is not available or is contraindicated, then imaging with CT is a reasonable consideration.

4.   Imaging, in addition to aiding in diagnosis, can also be used to track changes or progression of the condition over time.

5.   Clinical history and examination findings consistent with stroke can be used as objective evidence of cerebrovascular disease if imaging is not available.

6.   Radiology reports should describe covert cerebrovascular disease according to STRIVE (Duering et al. 2023).

7.   White matter hyperintensities (WMHs) of presumed vascular origin should be reported with the use of a validated visual rating scale such as the Fazekas scale for MRI.

8.   The threshold of vascular damage—in terms of extent and location—that is required to cause clinical cognitive dysfunction is not clear, and will likely vary between patients due to differing levels of cognitive reserve. A recent study pooling information from more than 2,900 post-stroke brain MRIs found that the left frontal, left temporal, left thalamus, and right parietal regions were strategic locations where infarcts were highly likely to impair cognition. There is a consensus, supported by some evidence from observational studies, that beginning confluent or confluent subcortical WMH, on the Fazekas scale, is sufficient to cause clinical cognitive impairment in many individuals. (Staals et al. 2015; Weaver et al. 2021)

Refer to the CCCDTD5 – Vascular Cognitive Impairment guidance for details on imaging procedures for additional information (Smith et al. 2020).

1.4   Diagnostic Criteria for Vascular Cognitive Impairment

i.   As defined in these guidelines (see above), vascular cognitive impairment refers to a range of new or worsening **cognitive deficits (section 1.1-1.2)** attributed to or accelerated by **cerebrovascular injury (section 1.3)**. Diagnosis can be made based on the presence of vascular disease and cognitive impairment as described above (section 1.1-1.3) [Strong recommendation; Low quality of evidence]

ii. Standardized criteria can be used to support the diagnosis of vascular cognitive impairment [Conditional recommendation; Low quality of evidence].

   a. These criteria may include Vascular Behavioral and Cognitive Disorders [VAS-COG] Society criteria, Diagnostic and Statistical Manual of Mental Disorders [DSM-5], Vascular Impairment of Cognition Classification Consensus Study (VICCS), or the American Heart Association consensus statement [Strong recommendation; Low quality of evidence]. (Smith et al. 2020).

Rationale

Vascular cognitive impairment affects up to 60 percent of individuals who have had a stroke and is associated with poorer recovery and decreased function in basic and instrumental activities of daily living and instrumental activities of daily living (El Husseini et al. 2023). In stroke populations, the prevalence of cognitive impairment is about 20% after a first stroke, and over 1/3 with more than one stroke (Craig et al. 2022; Pendlebury and Rothwell 2019). Individuals with VCI may require long-term, ongoing intervention and rehabilitation (Madureira et al. 2001). Cognitive abilities in the areas of executive function, attention and memory appear important in predicting functional status at discharge. In the Oxford Vascular Study (OxVASC), the 5-year cumulative incidence of new post-event VCI was 16·2% after TIA and 33·1% after stroke (Pendlebury and Rothwell 2019). Cognitive impairment is associated with increases in long-term dependence and mortality (61 percent versus 25 percent) (Tatemichi et al. 1990; Tatemichi et al. 1994).

Cognitive impairment due to covert vascular pathology is also increasing. Covert strokes, visualized as lacunes or white matter hyperintensities on T2-weighted images, are common and are associated with cognitive decline, dementia, and stroke. Evidence is emerging that demonstrates that for every clinically evident stroke, there may be up to ten covert strokes. Intracerebral small-vessel disease is a disorder that is on the rise with the aging of the population, leading to an increase in the need of support services over the long term.

In Canada, an estimated 5% of all individuals over the age of 65 years have evidence of vascular cognitive impairment (VCI). The total annual per-patient societal costs associated with caring for individuals with VCI in Canada were estimated using data from the Canadian Study of Health and Aging (Rockwood et al. 2002). Costs were $15,022 for those with mild disease, $14,468 for those with mild to moderate disease, $20,063 for those with moderate disease, and $34,515 for those with severe disease.

Individuals with lived experience (PWLE) stressed the importance of screening for VCI in individuals with stroke, TIA, and those who have significant risk factors for VCI. They emphasized that screening should be ongoing and occur regularly across the continuum of care. They also highlighted the connection between VCI and mental health and noted the importance of including mental health screening in individuals with VCI. They also emphasized that assessments for VCI should be person-centered, addressing the concerns of individuals with VCI and their families, and the impact of cognitive impairment on activities of daily living. Among some individuals with mild VCI, receiving a diagnosis of VCI was difficult as assessments were not sensitive enough to detect mild cognitive deficits.

Individuals with lived experience of VCI noted that receiving a diagnosis of VCI can be difficult and upsetting and emphasized the importance of support and compassion during VCI diagnosis delivery.

System Implications

To ensure people experiencing VCI receive timely assessments, interventions and management, interdisciplinary teams need to have the infrastructure and resources required. These may include the following components established at a systems level.

1. Systems leaders to assess how equity, diversity and inclusion considerations are included in their systems planning for stroke services and for individuals with VCI.

2. Mechanisms in place to ensure individuals with VCI and their families have access to appropriate services and resources in their communities in a timely way following symptom manifestation and diagnosis.

3. Models of care that include technology such as telemedicine, regular telephone follow-up and web-based support.

4. Appropriately resourced hospitals, rehabilitation facilities, home care services, long-term care and other community facilities that care for individuals with VCI, with identified contact people and case managers/system navigators to coordinate manage stroke care transitions.

5. Public education to increase awareness that cognitive decline may be considered as manifestations of vascular disease and stroke.

6. Public education to increase awareness of untreated or uncontrolled hypertension and other vascular risk factors and their relationship to cognitive decline and dementia.

7. Professional education to increase awareness among family physicians and primary care health professionals that individuals who have experienced a stroke, heart conditions and other vascular risk factors, if not treated, will be at high risk for cognitive deficits, even in the absence of overt stroke.

8. Professional education across specialties (e.g., nephrology, ophthalmology, family medicine) to increase awareness that individuals with small-vessel disease should be investigated for stroke risk factors and cognitive impairment.

9. Access to interprofessional teams (including physicians, nursing, psychology, occupational therapy and other relevant specialists) with the expertise to appropriately manage individuals with vascular cognitive impairment across the continuum of care, in specialty clinics and in the community.

10. Mechanisms to ensure good communication and information flow between the range of specialists and programs beyond the core specialist providers to meet the varied needs of individuals with VCI (e.g., mental health specialists, cognitive specialists, geriatric programs).

11. Continuing professional education to ensure proficiency in screening and assessment administration, interpretation and management of individuals who have experienced a stroke demonstrating post stroke and vascular cognitive impairment or at risk of vascular cognitive impairment.

12. Mechanisms for efficient and consistent data collection and data sharing to facilitate communication among the care teams and reduce redundancy.

13. The development and implementation of an equitable and universal pharmacare program, in partnership with the provinces, designed to improve access to cost-effective medicines for all individuals in Canada regardless of geography, age, or ability to pay. This program should include a robust common formulary for which the public payer is the first payer.

Performance Measures

System indicators:

1. Percentage of family/caregivers who received education on individuals who have experienced a stroke's current cognitive functioning including recommendations that consider the individual's best ability to function in the least restrictive environment.

2. Proportion of regions in Canada with access to cognitive experts (such as Neuropsychologists, neurologists, cognitive neurologists, geriatricians) for assessment and management of individuals with VCI.

Process indicators:

3. Percentage of individuals with stroke, heart conditions and other vascular risk factors who undergo cognitive screening at each transition point along the continuum of care (i.e., acute inpatient care, inpatient rehabilitation, outpatient clinics and programs, home-based services, and follow-up clinics) and in the community following inpatient discharge and at any time when there is a suspected change in cognitive status.

4. Proportion of individuals with stroke, heart conditions and other vascular risk factors who are identified with possible cognitive changes detected during screening, who are referred for more in-depth cognitive or neuropsychological assessment at transition points and setting changes across the continuum of care (for example, during inpatient care, inpatient rehabilitation, outpatient and ambulatory clinics or programs (stroke prevention clinics) and/or following inpatient discharge to the community).

5. Proportion of individuals with stroke, heart conditions and other vascular risk factors who are subsequently diagnosed with vascular cognitive impairment following index stroke event.

6. Proportion of individuals with cognitive impairment who undergo brain and cerebrovascular imaging.

Patient-oriented outcome and experience indicators:

7. Self-reported quality of life following diagnosis of VCI using a validated measurement tool, measured longitudinally.

8. Functional outcome scores following diagnosis of VCI, measured longitudinally.

Measurement Notes

- Recommendations for vascular cognitive impairment and corresponding performance measures apply across the continuum of care and should be considered in acute inpatient care, inpatient rehabilitation, outpatient clinics, home-based services, and prevention clinics and/or following inpatient discharge to the community.

- When using these performance measures, it is important to record when and in what context (continuum of care) the measurements were conducted. Data for measurement may be found through primary chart audit. Data quality will be dependent on the quality of documentation by healthcare professionals.

- This is a new area and will require a great deal of education for healthcare professionals, especially in documentation.

- Measures of quality of life and functional outcomes should occur at regular intervals to detect changes over time. This data should be shared across providers and settings to support collaboration and access to relevant data for optimal care of individuals with VCI.

- Benchmarks for VCI indicators are not currently available – with improved data collection and sharing will support the establishment of evidence-based benchmarks.

Implementation Resources and Knowledge Transfer Tools

Resources and tools listed below that are external to Heart & Stroke and the Canadian Stroke Best Practice Recommendations may be useful resources for stroke care. However, their inclusion is not an actual or implied endorsement by the Canadian Stroke Best Practices team or Heart & Stroke. The reader is encouraged to review these resources and tools critically and implement them into practice at their discretion.

Health Care Provider Information

- Canadian Stroke Best Practice Recommendations Vascular Cognitive Impairment Module Figure 1: Heart & Stroke Heart-Brain Associations Map—All Cardiovascular Conditions can lead to Vascular Cognitive Impairment
- Canadian Stroke Best Practice Recommendations Vascular Cognitive Impairment Module Definitions and Descriptions
- Canadian Stroke Best Practice Recommendations Vascular Cognitive Impairment Module Figure 2: Framework for Assessing and Diagnosing Vascular Cognitive Impairment
- Canadian Stroke Best Practice Recommendations Vascular Cognitive Impairment Module Appendix Three: Signs and Symptoms of Vascular Cognitive Impairment
- Canadian Stroke Best Practice Recommendations Vascular Cognitive Impairment Module Appendix Four: Screening Tools for Vascular Cognitive Impairment
- Canadian Stroke Best Practice Recommendations Vascular Cognitive Impairment Module Appendix Five: Lived Experience of Vascular Cognitive Impairment Journey Map
- Heart & Stroke: Taking Action for Optimal Community and Long-Term Stroke Care (TACLS) A Resource for Healthcare Providers: https://www.strokebestpractices.ca/resources/professional-resources/tacls
- Canadian Consensus Conference on Diagnosis and Treatment of Dementia (CCCDTD)5: Guidelines for management of vascular cognitive impairment: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7657196/
- SIGN (Scottish Intercollegiate Guidelines Network) 168 Assessment, diagnosis, care and support for people with dementia and their carers: https://www.sign.ac.uk/
- Vascular Harmonization Guidelines http://stroke.ahajournals.org/content/37/9/2220.full
- Evidence-based Review of Post-Stroke Cognitive Disorders (EBRSR): http://www.ebrsr.com/evidence-review/12-post-stroke-cognitive-disorders
- CanStroke Recovery Trials: https://canadianstroke.ca/
- AHA/ASA Scientific Statement on Vascular Contributions to Cognitive Impairment and Dementia: https://www.ahajournals.org/doi/full/10.1161/STR.0b013e3182299496
- NHS Psychological care after stroke: https://www.nice.org.uk/media/default/sharedlearning/531_strokepsychologicalsupportfinal.pdf
- Stroke Engine, Assessment by Topic, Cognition: https://strokengine.ca/en/assessments-by-topic/
- First Nations cognitive assessment tool): https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8190538/
- CIHI: Understanding health care trajectories of people living with dementia: https://www.cihi.ca/en/understanding-health-care-trajectories-of-people-living-with-dementia
- Government of Canada: Dementia in Canada: https://www.canada.ca/en/public-health/services/publications/diseases-conditions/dementia.html

- Brain Institute: Stroke and Transient Ischemic Attack:
  https://braininstitute.ca/img/Stroke_Chart-Pack_230301_112049.pdf
- Brain Institute: Stroke Infographic: https://braininstitute.ca/img/Stroke_Infographic.pdf

Information for People with VCI, their Families and Caregivers

- Heart & Stroke: Vascular Cognitive Impairment Infographic and Journey Map:
  https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/vascular-cognitive-impairment/csbpr7-infographic-vci.pdf
- Heart & Stroke: Your Stroke Journey https://www.heartandstroke.ca/-/media/pdf-files/canada/your-stroke-journey/en-your-stroke-journey-v20.pdf?rev=01a46257b0634561b49b56066a4fb4be
- Heart & Stroke: Post-Stroke Checklist https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/002-17_csbp_post_stroke_checklist_85x11_en_v1.pdf?rev=748ae8f5d51743fa8c7628b773f0f36b
- Heart & Stroke: Virtual Healthcare Checklist https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/csbp-infographic-virtual-healthcare-checklist.pdf?rev=bf2f5b0e9e4a49cfbfc251208b6a15e2
- Heart & Stroke: Secondary Prevention Infographic https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/csbpr7-infographic-secondaryprevention-final.pdf?rev=9f0dcf0ade22483ba9ae4113b2f0f3eb
- Heart & Stroke: Rehabilitation and Recovery Infographic https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/rehabilitation-nov2019/csbp-infographic-rehabilitation.pdf?rev=a2cff1fb27424c84bbd44b568d58d1b4
- Heart & Stroke: Transitions and Community Participation Infographic https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.pdf?rev=595e990a17e14232aa3b1c731d983ce3
- Heart & Stroke: Vascular Cognitive Impairment https://www.heartandstroke.ca/stroke/what-is-stroke/vascular-cognitive-impairment
- Heart & Stroke: Stroke Recovery and Support https://www.heartandstroke.ca/stroke/recovery-and-support
- Heart & Stroke: Depression, Energy, Thinking and Perception https://www.heartandstroke.ca/stroke/recovery-and-support/emotions
- Heart & Stroke: Online and Peer Support https://www.heartandstroke.ca/heart-disease/recovery-and-support/the-power-of-community
- Heart & Stroke: Support for family care partners https://www.heartandstroke.ca/stroke/recovery-and-support/family-care-partners-need-care-too
- Heart & Stroke: Recognizing and Handling Stress https://www.heartandstroke.ca/heart/recovery-and-support/emotions-and-feelings/stress
- Stroke Engine: http://strokengine.ca/

Summary of the Evidence

Screening and Assessment

Despite the widespread adoption of screening and assessment methods for VCI post stroke, there are few studies that have examined their association with stroke outcome (McKinney et al. 2002) reported no significant differences in outcomes (Extended ADL, Cognitive Failures Questionnaire, General Health Questionnaire-28 for patients and carers and Carer Strain Index) at 3 or 6 months among 112 patients with stroke, who received a detailed battery of cognitive assessments to assess specific cognitive

functions, compared with patients who received no further assessment after initial cognitive screening. However, there were significant losses to follow-up, limiting the availability of outcome data. In the OSC CARE trial (Demeyere et al. 2019), 821 patients, who had sustained a stroke within the previous 10 weeks were randomized to receive domain-specific cognitive screening, using the Oxford Cognitive Screen (OCS) + tailored management advice (one page domain specific leaflets) or general cognitive screening using the MoCA. At baseline, 75% of patients in the OCS group were cognitively impaired in ≥1 domain vs. 58% of patients in the MoCA group, based on a score <26. At 6 months, there were no significant differences between groups in either of the primary outcomes (Stroke Impact Scale and change in stroke severity, assessed using the NIHSS), or in change in cognitive status.

The most commonly used tests for the screening of cognitive function post stroke are the MoCA and the MMSE. The sensitivities and specificities of the MMSE to detect dementia or multidomain cognitive impairment were estimated at 88% and 62%, respectively, when pooling data from 5 studies (Lees et al. 2014). Using data from 16 studies, a meta-analysis embedded in the European Stroke Organization guidelines on post-stroke cognitive impairment (Quinn et al. 2021), the overall sensitivity of the MMSE was 73% and the specificity, 79%. These test characteristics disregarded timing of assessment and used a cut-off that provided the best fit of sensitivity/specificity. The sensitivity was higher in the acute (<3 months) vs. chronic studies (80% vs. 60%), while the specificity was higher in chronic studies (81% vs. 74%). Using cutoffs of 22-24 vs. 25-27, yielded similar specificities (74% and 72%), with slightly better specificity at lower thresholds (82% vs. 76%).

The estimates of sensitivity and specificity for MoCA to detect dementia or multidomain cognitive impairment at a cut-point of <26 were reported to be 84% and 45%, respectively, pooling the results from 4 studies (Lees et al. 2014). In other studies, including patients with acute stroke, sensitivities and specificities were 85% and 88% (cut point 22/23), (Zuo et al. 2016) and 82% and 76% (cut point 26/27)(Cumming et al. 2013). Using data from the same European Stroke Organization guideline, pooling data from 17 studies, the overall sensitivity of MoCA was 84% and the specificity, 71%. At the lower MoCA threshold of 21–23 sensitivity was 84% and specificity 78%. A cutoff of 24–26 had similar sensitivity (86%) but lower specificity (59%). MoCA performed in the "post acute" period had higher specificity (80%), compared with the acute period (61%). Overall, the MoCA appears more sensitive to the presence of VCI compared to the MMSE, particularly with mild deficits (Dong et al. 2010; Godefroy et al. 2011; Pendlebury et al. 2012; Toglia et al. 2011), although equivalence has been noted in other studies, notably with patients of moderate to severe strokes (Dong et al. 2012).

Screening for pre-stroke cognitive impairment, which can be helpful to inform the diagnostic process, can be accomplished using validated instruments such as the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE) or its variations that use informant reports (Jorm and Korten 1988). Other instruments may be useful. As part of the 5th Canadian Consensus Conference on the Diagnosis and Treatment of Dementia, the literature on informant-based tools for assessment and monitoring of cognition, behavior, and function in neurocognitive disorders (NCDs), was reviewed (Choudhury et al. 2022). Nineteen tools were identified. Among them 5 assessed cognition and function, 5 assessed function (mainly ADL), 7 assessed behaviors, and 2 assessed cognition, function and behavior.

In patients with cognitive impairment identified on screening tests, a more detailed assessment is required to determine which cognitive domains have been affected, and to determine the nature and extent of the impairment. For selected patients, those wishing to return to work or school may be candidates to undergo through examination using neuropsychological battery (NPB), considered the gold standard for detection of cognitive impairments. An example of one such battery, The National Institute of Neurological disorders and Stroke— Canadian Stroke Network Vascular Cognitive Impairment Harmonized battery aims to maximize information obtained from relatively few tests with well-validated tasks, and which can assess impairments across different cognitive domains. The battery consists of 3 sets of tests that can be performed in 60, 30, or 5 minutes (Hachinski et al. 2006).

Since clinical signs and symptoms of VCI are often insufficient to confirm a final diagnosis and usually cannot differentiate among the various etiologies, neuroimaging plays an important role in the management of patients with impaired cognition. Neuroimaging, using magnetic resonance imaging (MRI) can be used to detect infarcts, white matter changes and lacunar infarcts, and microbleeds and is preferred over computed tomography (CT) as it has greater sensitivity for detecting these abnormalities.

Sex, gender and other equity-related considerations

The incidence of post stroke cognitive impairment (PSCI) is generally considered to be similar between the sexes, although some studies report a higher incidence in women (Dong et al. 2020; Mellon et al. 2015). Exalto et al. (2023) reported the incidence of PSCI 15 months after stroke was 51%, with no difference between men and women, although there were differences in affected cognitive domains. The most commonly affected domain wase visuospatial perception/construction, in women and verbal memory for men. Women more often had impairment in the domains of attention, executive functioning, and language, whereas men were more likely to have impairment in verbal memory. In the same study, the sensitivity and specificity of MoCA for detecting cognitive impairment did not differ between the sexes, while the sensitivity of MMSE was significantly higher in women, and the specificity, higher in men. The differences in the performance of the two screening tests may reflect differences between the two tests, whereby there is a greater focus on verbal abilities in the MMSE, while MoCA contains more items testing executive and visuoconstructive function and covers more cognitive domains.

Section 2   Management of Vascular Cognitive Impairment

2. Management of Vascular Cognitive Impairment 2024

Notes

VCI is a complex and heterogeneous syndrome that creates challenges for care processes and clinical decision making. Clinical management of VCI thus requires a collaborative process designed to achieve optimal well-being by care coordination and continuity. The main elements of management include evidence-based interventions, education of individuals with VCI and family, person-centred perspectives, and systems approaches to improve care navigation and continuity.

2.1   Principles of Vascular Cognitive Impairment Management

i.   Individuals with VCI should have a personalized management plan that includes a person-centred approach, shared decision-making, and culturally appropriate and agreed-upon goals and preferences [Strong recommendation; Low quality of evidence].

    a.   The management care plan should include follow-up and monitoring and be revisited regularly as VCI evolves over time [Strong recommendation; Low quality of evidence].

    b.   Treatment goals and selected interventions should consider the strengths and weaknesses of the affected individual's cognitive profile (including clinical presentation and severity), communication abilities, etiology/prognosis, comorbid conditions, decisional capacity, care and living environment (including family and caregiver availability) [Strong recommendation; Low quality of evidence].

    c.   Interventions should consider the long-term goals to maintain and/or to facilitate resumption of desired activities and participation (e.g., self-care, home and financial management, leisure, driving, return to work), in the context of best available evidence [Strong recommendation; Low quality of evidence].

ii.   Non-pharmacological and pharmacological approaches to management of VCI and cognitive rehabilitation should be used [Strong recommendation; Moderate quality of evidence].

iii.   Management of vascular risk factors should be optimized [Strong recommendation; High quality of evidence]. *Refer to the CSBPR Secondary Prevention of Stroke module and C-CHANGE guidelines for additional information. (Gladstone et al. 2022; Jain et al. 2022) Refer to Palliative Care section 5.2 for additional information.*

iv.   The individual with VCI, their family and caregivers, should be educated at multiple points and transitions in their journey with VCI about the expected clinical course and impact on cognition and function [Strong recommendation; Moderate quality of evidence]. *Refer to Appendix Five, VCI Journey Map for additional information.*

Section 2.1 Clinical Considerations

1.   A coordinated management care plan should support continuity of care across the trajectory of vascular cognitive impairment and the continuum of care.

2.   The approach to management of VCI should consider elements of goal setting, social support, cognitive scaffolding (using specific approaches to cognitive tasks such as checklists), lifestyle management, task training, and environment.

3.   In individuals with significant comorbidities and/or for whom goals of care considerations prioritize comfort and/or palliative approaches, discussions regarding less aggressive or withdrawal of vascular risk reduction strategies may become appropriate. *Refer to Palliative Care section 5.2 for additional information.*

2.2 Non-Pharmacological Management of VCI

i. Individuals with VCI should be assessed for medical (e.g., hypertension, diabetes, lipids, atrial fibrillation, sleep disorders) and lifestyle vascular risk factors (e.g., diet, sodium intake, cholesterol, exercise, weight, alcohol intake, smoking) [Strong recommendation; Moderate quality of evidence].

ii. Medical and lifestyle vascular risk factors should be managed to achieve maximum risk reduction for first-ever or recurrent stroke, as these are associated with cognitive impairment [Strong recommendation; Moderate quality of evidence].

iii. Referrals to appropriate specialists should be made to support and manage specific medical and lifestyle vascular risk factors and comorbidities (e.g., dysphagia) where required [Strong recommendation; Moderate quality of evidence].

iv. Individuals with vascular cognitive impairment may require additional support (e.g., communication tools, memory aids, caregiver and family participation and support) as appropriate to optimize participation in goal-setting and/or engagement in interventions [Strong recommendation; Low quality of evidence]

Refer to CSBPR Secondary Prevention of Stroke module (Gladstone et al. 2022) for additional information. Refer to Sections 2.6 to 2.9 below for additional information on specific non-pharmacological strategies.

2.3 Pharmacological Management of VCI

i. Cholinesterase inhibitors (donepezil, rivastigmine and galantamine)* and the N-methyl-D-aspartate (NMDA) receptor antagonist memantine* may be considered in individual persons with vascular or mixed dementia, based on randomized trials showing small magnitude benefits in cognitive outcomes [Conditional recommendation; High quality of evidence]. *Refer to Section 2.3 clinical considerations 1 and 2 for additional information on cholinesterase inhibitors.*

ii. Physicians who are following individuals with VCI should pay close attention to the medications that the individual is prescribed, as certain classes of medication may increase the risk of cognitive fluctuations or cognitive decline [Strong recommendation; Moderate quality of evidence].

*Note: These medications are currently approved by Health Canada for the treatment of Alzheimer's disease. They have not received approval for vascular cognitive impairment. Many dementias include both Alzheimer's disease and vascular dementia (i.e., mixed) pathology.

Refer to Section 2.4 for recommendations on anti-thrombotic use and Section 2.5 for Management of Hypertension. Also refer to Canadian Stroke Best Practice Recommendations for Secondary Prevention of Ischemic Stroke for general guidance on stroke prevention (Gladstone et al. 2022).

Section 2.3 Clinical Considerations

1. The use of cholinesterase inhibitors for pure VCI without Alzheimer's disease is controversial. The use of these medications should be based on clinical judgment that small improvements in cognition would have a meaningful impact on the quality of life of the individual. Adverse events can occur. Severity of VCI should be considered in decisions for pharmacological management.

2. Consideration can be given for discontinuing cholinesterase inhibitors if adverse events occur, if there is no apparent benefit and/or if their use is no longer consistent with goals of care due to progression to severe impairments.

3. There may be a role for psychostimulants for selected individuals with VCI (e.g., those with significant apathy or inattentiveness impacting their daily function), although the evidence is

currently insufficient to issue a recommendation. Further studies are required for safety and efficacy in this population.

2.4 Anti-Thrombotic Agents

i. Antiplatelet or antithrombotic use should be guided by existing primary and secondary stroke or vascular prevention indications [Strong recommendation; High quality of evidence]. (Bainey et al. 2024; Gladstone et al. 2022; Heran et al. 2022)

ii. VCI should not be considered as a contraindication for guideline-based antithrombotic therapy [Strong recommendation; Low quality of evidence].

iii. The effects of low dose acetylsalicylic acid (ASA) in individuals with VCI or vascular dementia who have covert brain infarcts detected on neuroimaging **without** history of stroke have not been defined. The use of ASA in this setting could be considered, but the benefit is unclear [Conditional recommendation; Low quality of evidence]. (Smith et al. 2020)

Refer to the CSBPR Secondary Prevention of Stroke module (Gladstone et al. 2022), CSBPR Acetylsalicylic Acid (ASA) for Prevention of Vascular Events module (Wein et al. 2020) and C-CHANGE guidelines (Jain et al. 2022) for additional information.

2.5 Management of Hypertension

i. Long-term treatment of hypertension may reduce cognitive decline and should be addressed for all individuals with elevated blood pressure who are at high risk for or have already experienced VCI [Strong recommendation; Moderate quality of evidence].

ii. For individuals with cognitive disorders in which a vascular contribution is known or suspected, antihypertensive therapy should be strongly considered for individuals with an average diastolic blood pressure consistently ≥90 mmHg, or for individuals with an average systolic blood pressure consistently ≥140 mmHg [Strong recommendation; Moderate quality of evidence].
Refer to the CSBPR Secondary Prevention of Stroke module (Gladstone et al. 2022), Hypertension Canada (Rabi et al. 2020), and C-CHANGE guidelines (Jain et al. 2022) for additional information.

    a. Antihypertensive therapy and specific blood pressure targets should be guided by existing primary and secondary stroke or vascular prevention indications [Strong recommendation; High quality of evidence]. *Refer to the CSBPR Secondary Prevention of Stroke module (Gladstone et al. 2022), Hypertension Canada (Rabi et al. 2020), and C-CHANGE guidelines (Jain et al. 2022) for additional information.*

2.6 Management of Mood in Vascular Cognitive Impairment

i. Healthcare providers should monitor individuals with VCI for changes in mood and behaviour, based on clinical presentation and/or the individual or their caregiver reports over the trajectory of VCI [Strong recommendation; Moderate quality of evidence].

    a. Depression, anxiety, apathy and emotional reactivity are common in individuals with VCI and can be assessed using validated tools and/or interviews [Strong recommendation; Moderate quality of evidence]. *Refer to the CSBPR Rehabilitation, Recovery and Participation module, Mood section for additional information.(Lanctôt et al. 2020)*

ii. Treatment for mood and anxiety may include psychotherapy, non-pharmacological therapies (such as exercise), and/or pharmacotherapy alone or in combination [Strong recommendation; High quality of evidence], as appropriate to the individual's health state and presence of cognitive and communication deficits [Strong recommendation; Moderate quality of evidence].

Refer to the CSBPR Rehabilitation, Recovery and Participation module, Mood section for additional information.(Lanctôt et al. 2020)

iii. For patients with mild VCI it is reasonable to consider either cognitive-behavioural therapy, interpersonal therapy or behavioural activation as one of the first-line treatments for depressive and anxious symptoms, as a monotherapy [Strong recommendation; Moderate quality of evidence].

iv. For individuals with severe VCI (showing marked cognitive deficits, poor initiation or self-direction), personalized treatments to enhance quality of life and to reduce behavioural and psychological symptoms, should be considered. Such approaches can include environmental management and behavioural activation, physical activity, music therapy, and reminiscence therapy [Strong recommendation; Low quality of evidence].

Section 2.6 Clinical Considerations

1. When choosing interventions for mood issues in individuals with VCI, clinicians should consider the nature of the issues and the cognitive profile of a specific individual with VCI. The nature and degree of the cognitive impairment [e.g., memory, executive functions] may be important in determining feasibility of a specific intervention or appropriate goals.

2. Cognitive-behavioural therapy and interpersonal therapy may be more appropriate for individuals with sufficient attention, memory and executive skills. Behavioral activation may be more appropriate for individuals who require supported engagement.

3. Monitoring and screening for changes in mood and behaviour may be on the same schedule as other clinic-specific routine screening protocols for monitoring other chronic diseases, at transitions of care and/or other annual or follow-up visits.

4. Agitation, irritability, emotional reactivity can be behavioural consequences of VCI and may be appropriately addressed through behavioural interventions, family interventions and/or medication under the supervision and support of qualified healthcare providers.

5. It is important to identify and address barriers in adjustment to the diagnosis and changes in cognition and function across the trajectory of vascular cognitive impairment.

6. For individuals with known or suspected VCI and communication difficulties, screening, assessment, and management of depression and/or anxiety should be performed using measures and approaches that are appropriate for their cognitive and communication levels, and when possible, validated for this purpose. *Refer to CSBPR Rehabilitation, Recovery and Participation module, Mood section for additional information.(Lanctôt et al. 2020)*

2.7 Behaviour Management

i. Individuals with known or suspected VCI should be screened for behaviour changes that may cause distress or disruption, including through interviews with the individual, family members and members of their healthcare team [Strong recommendation; Moderate quality of evidence].

ii. For individuals demonstrating new behavioural changes, investigating and treating potential underlying causes should be undertaken (e.g., pain or presence of a urinary tract infection as underlying causes) [Strong recommendation; Moderate quality of evidence].

iii. Non-pharmacological strategies should be considered as first-line management of an individual with VCI who is displaying behaviour changes [Strong recommendation; Moderate quality of evidence].

   a. For those individuals with mild VCI, cognitive behavioral, interpersonal, and / or problem-solving deficits, psychotherapeutic strategies may be considered to facilitate adaptive coping [Conditional recommendation; Low quality of evidence].

iv. Structured and tailored activities that are individualized and aligned to current capabilities and take into account previous roles and interests may be considered [Strong recommendation; Low quality of evidence]. (Scottish Intercollegiate Guidelines Network 2023).

v.   Pharmacological intervention may be considered if the individual, their family or other caregivers are severely distressed, or there is an immediate risk of harm to the individual with VCI or others (i.e., very severe symptoms) [Strong recommendation; Low quality of evidence].

a. If pharmacological management is used, this should complement, not replace, non-pharmacological approaches [Strong recommendation; Low quality of evidence].

b. Pharmacological strategies for behavioural management can have potential harm. Involvement of specialists in adult behaviour management should be considered [Strong recommendation; Low quality of evidence].

vi. In complex cases, referral to a specialist in behavioral management in the context of neurocognitive impairment should be considered [Conditional recommendation; Low quality of evidence].

vii. For individuals with severe symptoms of VCI, activity-based interventions that are tailored to individual abilities and preferences (e.g., Montessori activities for older adults with VCI, activation interventions) can increase positive affect [Strong recommendation; Moderate quality of evidence] and reduce agitation [Conditional recommendation; Moderate quality of evidence].

Section 2.7 Clinical Considerations

1. The focus of intervention may vary over the trajectory of an individual's experience with VCI, and with progression from milder VCI to severe VCI and dementia. When the level of impairment is severe the focus will evolve, from treatment interventions designed to impact on disability and quality of life, to interventions that are designed to promote the quality of life of individuals living with dementia.

2. For individuals with moderate to severe VCI and agitation, the antecedent-behaviour-consequences (ABC) charting approach can be used for behavioural management. The ABC approach can include systematic tracking of agitation, over several days, to identify environmental and somatic/ physical triggers for agitation that can be used to inform behavioural management strategies.

3. For individuals with mild VCI living in less structured environments (e.g., at home or retirement home), behavioral charting may help to identify environmental and somatic/physical triggers for agitation to inform strategies to minimize the impact of these factors.

4. In the context of severe VCI/dementia, supporting the ability of the caregiver to provide care for their family member or friend, as well as their ability to be a partner in care may be appropriate.

5. The specifics of the services provided will need to align with the specific environmental contexts of individuals (e.g., rural vs. urban communities).

6. If pharmacological treatment of behavior is required (which is not the first line), most evidence comes from treatment of behavioural symptoms in dementia in general rather than VCI specifically. The Canadian Coalition for Seniors' Mental Health has issued detailed guidelines for managing behavioral symptoms of dementia. In this recommendation, the reader is referred to Section 5 (managing agitation in dementia), recommendations 3-9 review non-pharmacological strategies and 10-30 highlight considerations for pharmacological management including medications that may be beneficial or may cause harm. Sections 6 (managing psychosis in dementia), 7 (managing depressive symptoms in dementia) and 8 (managing anxiety in dementia) may also be helpful. (Canadian Coalition for Seniors' Mental Health 2024)

2.8   Safety and Risk Management

i.   The presence of VCI may increase safety risks for ADL/IADL related activities. Individuals with VCI should be assessed and monitored for safety risks [Strong recommendation; Low quality of evidence]. *Refer to Box 2A for additional information.*

ii.   Assessment of individuals for potential safety risks may include an understanding of the relationship between the individual's cognitive status (e.g., insight, memory, planning) and the individual's:

   a.   autonomy and decision-making capacity [Strong recommendation; Low quality of evidence].

   b.   behavioural status (e.g., agitation or apathy) [Strong recommendation; Low quality of evidence].

   c.   environment (such as the physical environment, and social determinants of health) [Strong recommendation; Low quality of evidence].

   d.   risk for falls [Strong recommendation; Moderate quality of evidence].

   e.   activities and occupations (e.g., ADLs, IADLs and leisure activities) [Strong recommendation; Low quality of evidence].

   f.   driving status [Strong recommendation; Moderate quality of evidence].

iii.   The individual, family and care providers should be provided with education regarding safety risks and mitigation strategies [Strong recommendation; Low quality of evidence].

iv.   Physical exercise, balance training, and environmental aids should be considered to reduce the risk of falls [Strong recommendation; Low quality of evidence]. *For additional information related to stroke and falls risk, refer to CSBPR Rehabilitation and Recovery following Stroke.(Teasell et al. 2020)*

Section 2.8 Clinical Considerations

1.   The assessment of safety and risk may include information from the individual with VCI and those familiar with the individual (e.g., family, care providers). This information may include cognitive functioning, life demands, setting familiarity, potential impact on safety of others and currently available supports for the individual's quality of life and current ability to function in the least restrictive environment.

2.   An individualized safety plan should be developed in partnership with the individual with VCI, their family and caregivers, and the healthcare team, and may include:

   a.   identifying personal supports (e.g., family/caregivers to observe, check-in and/or support health and/or financial decision making);

   b.   technological supports (e.g., personal alarm systems);

   c.   environmental changes/supports (e.g., nightlights to reduce falls in low light, modification of cooking equipment, creating routine and structure to tasks);

   d.   considerations for future anticipated needs and supports;

   e.   regular review and updating as required.

2.9   Environmental Supports

i.   The physical environment should be assessed for factors that may impact the ability of individuals to perform ADL [Strong recommendation; Moderate quality of evidence]. *Refer to Box 2A for additional information on impact of VCI on ADLs.*

ii.   The use of assistive technologies (e.g., automatic prompting for ADL, automatic lighting) should be considered to aid functional skills, such as during mealtime, hygiene and self-care (e.g., handwashing, dental care, dressing, and toileting), and orientation to time [Strong recommendation; Low quality of evidence].

iii.   The use of cues (e.g., signs, pictures, arrows) should be considered to orient an individual to time and setting [Strong recommendation; Low quality of evidence].

iv.   The use of individually tailored environmental adaptations, such as ambient features (e.g., music, lighting, personal photographs), and leisure activities (e.g., gardening) should be considered [Strong recommendation; Low quality of evidence].

2.9.1   Environmental Supports for Individuals with VCI and Aphasia

i.   Individuals with VCI and aphasia should be assessed for their potential to benefit from using augmentative and alternative communication or other communication support tools (e.g., iPad, tablet, electronic devices, alphabet board) [Strong recommendation; Low quality of evidence].

ii.   Treatment to improve functional communication should include supported conversation techniques for potential communication partners of the individual with aphasia [Strong recommendation; High quality of evidence].

Section 2.9 Clinical Considerations

1.   Factors to consider when assessing an individual's physical environment:

     a.   size of the environment (smaller environments may be more manageable);

     b.   architectural layout (rooms that are enclosed with an obvious function are more supportive than open concept);

     c.   homelike atmosphere (e.g., private bedrooms, larger windows)

     d.   physical layout of the environment and potential hazards (such as carpets or furniture that may increase tripping risk).

2.   When determining appropriate environmental supports, the above recommendations may need to be nuanced to the individual's setting (e.g., home vs congregate setting) given that there may be variability in supports in a shared space, availability of supports (e.g., lives alone, family/staff availability) and/or financial resources.

3.   The impact of aphasia on functional activities, participation and quality of life, including the impact on relationships, vocation and leisure, should be assessed and addressed across the continuum of care.

Box 2A   Examples of Activities of Daily Living impacted by Cognitive changes

The following activities are examples of Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADL) that may be impacted by vascular cognitive impairment. This box provides examples of ADLs and IADLs that may need to be considered or adapted as part of a safety plan.*

Activities of Daily Living (ADLs)

- Bathing / personal hygiene
- Dressing / selecting appropriate clothing
- Feeding (e.g., swallowing, food handling, healthy dietary choices)
- Toileting
- Household mobility and transfers (including fall risk)

Instrumental Activities of Daily Living (IADLs)

- Driving
- Parenting and caring for others
- Community mobility
- Shopping (including purchase choice)
- Cleaning
- Kitchen safety (e.g., meal preparation, discarding spoiled foods, fire safety)
- Medication safety and adherence
- Healthcare decisions
- Financial decisions
- Home safety
- Living alone or spending time home alone

* Note this is not a comprehensive list. Rather it represents more common and frequent areas of concern.

Rationale

Cognitive impairment is reported in up to 60% of individuals recovering from ischemic stroke at 6 months and has been associated with lower quality of life, and an increased risk of mortality and institutionalization (El Husseini et al. 2023.) Disturbances in mood and behavior are also frequently affected. Comprehensive management of cognitive impairment, whether resulting from stroke or other etiologies, encompasses both non-pharmacological and pharmacological interventions to address a wide range of issues related to recovery, such as vascular risk factor reduction, and the performance of activities of daily living and instrumental activities of daily living, safety, behaviour, among others.

People with lived experience highlighted the importance of person-centred care in the management of VCI. They emphasized the need for strong communication (both written and verbal) and collaboration with healthcare providers, the individual and their families, to understand who is involved in care, be actively involved in care planning, and identify meaningful and appropriate goals. They also noted that education on vascular risk factors and ongoing management and follow-up is important in the management of VCI. They also highlighted the importance of access to mental health services and support for mood, anxiety, and behavioral changes.

System Implications

To ensure people experiencing a VCI receive timely assessments, interventions and management, interdisciplinary teams need to have the infrastructure and resources required. These may include the following components established at a systems level.

1. Systems leaders to understand and address structural and systemic barriers to seeking and receiving care for individuals with VCI which lead to disparities in health outcomes for equity-deserving groups.

2. Protocols to involve individuals with VCI and families in healthcare team transition planning meetings and collaborative decision-making regarding goal setting at all transition points.

3. Resources and mechanisms to plan and deliver community-based services which consider the needs of the individuals with VCI and family/caregiver (e.g., home care services, psychological support).

4. Models of care that include technology such as telemedicine, regular telephone follow-up and web-based support.

5. Appropriately resourced hospitals, rehabilitation facilities, home care services, long-term care and other community facilities that care for individuals with VCI, with identified contact people and case managers/system navigators to coordinate manage stroke care transitions.

6. Professional education to increase awareness and competence among family physicians and primary care health professionals in the management of individuals with VCI.

7. Professional education across specialties (e.g., nephrology, ophthalmology, family medicine) regarding the need for comprehensive care for individuals with VCI and increased collaboration and coordination across specialties.

8. Access to interprofessional teams (including physicians, nursing, psychology, occupational therapy and other relevant specialists) with the expertise to appropriately manage individuals with vascular cognitive impairment across the continuum of care, in specialty clinics and in the community. This includes access to experts with knowledge about younger individuals with VCI.

9. Mechanisms to ensure good communication and information flow between the range of specialists and programs beyond the core specialist providers to meet the varied needs of individuals post stroke (e.g., mental health specialists, cognitive specialists, geriatric programs, home support programs) recognizing that continuity of care is very important in planning health services for individuals with VCI.

10. Mechanisms to periodically re-evaluate individuals with VCI as this condition can be progressive over time, to ensure individuals have access to ongoing care to meet their changing needs.

11. Mechanisms for efficient and consistent data collection and data sharing to facilitate communication among the care teams and reduce redundancy.

12. Coordination and development of strong partnerships in the community, and adequate resources to ensure access to comprehensive services and support. This is especially important in more rural and remote geographic locations where telehealth technologies should be optimized.

13. The development and implementation of an equitable and universal pharmacare program, implemented in partnership with the provinces, designed to improve access to cost-effective medicines for all individuals in Canada regardless of geography, age, or ability to pay. This program should include a robust common formulary for which the public payer is the first payer.

14. Access to safe communities and environments for people with changing cognitive needs who wish to remain in their homes and communities.

Performance Measures

System indicators:

1. Proportion of regions in Canada with access to cognitive experts for assessment and management of individuals with VCI.

Process indicators:

2. Percentage of family/caregivers who received education on individuals who have experienced a stroke's current cognitive functioning including recommendations that consider the individual's best ability to function in the least restrictive environment.

3. Proportion of individuals with VCI who are prescribed optimal medications to manage vascular risk factors (e.g., hypertension, diabetes, heart failure).

Patient-oriented outcome and experience indicators:

4. Self-reported quality of life following diagnosis of VCI using a validated measurement tool, measured longitudinally.

5. Functional outcome scores following diagnosis of VCI, measured longitudinally.

Measurement Notes

- When using these performance measures, it is important to record when and in what context (continuum of care) the measurements were conducted. Data for measurement may be found through primary chart audit. Data quality will be dependent on the quality of documentation by healthcare professionals.

- This is a new area and will require a great deal of education for healthcare professionals, especially in documentation.

- Measures of quality of life and functional outcomes should occur at regular intervals to detect changes over time. This data should be shared across providers and settings to support collaboration and access to relevant data for optimal care of individuals with VCI.

- Benchmarks for VCI indicators are not currently available – with improved data collection and sharing will support the establishment of evidence-based benchmarks.

Implementation Resources and Knowledge Transfer Tools

Resources and tools listed below that are external to Heart & Stroke and the Canadian Stroke Best Practice Recommendations may be useful resources for stroke care. However, their inclusion is not an actual or implied endorsement by the Canadian Stroke Best Practices team or Heart & Stroke. The reader is encouraged to review these resources and tools critically and implement them into practice at their discretion.

Health Care Provider Information

- [Canadian Stroke Best Practice Recommendations Vascular Cognitive Impairment Module: Box 2A Examples of Activities of Daily Living impacted by Cognitive Changes](#)
- [Canadian Stroke Best Practice Recommendations Vascular Cognitive Impairment Module Appendix Five: Lived Experience of Vascular Cognitive Impairment Journey Map](#)
- [Canadian Stroke Best Practice Recommendations Secondary Prevention of Stroke Module:](#) https://www.strokebestpractices.ca/recommendations/secondary-prevention-of-stroke
- *Canadian Stroke Best Practice Recommendations Rehabilitation, Recovery and Community Participation following Stroke Module:* https://www.strokebestpractices.ca/recommendations/stroke-rehabilitation
- Heart & Stroke: Taking Action for Optimal Community and Long-Term Stroke Care (TACLS) A Resource for Healthcare Providers: https://www.strokebestpractices.ca/resources/professional-resources/tacls
- C-CHANGE Guidelines: https://www.cchangeguidelines.com/
- Hypertension Canada: https://hypertension.ca/guidelines/
- CAMH Dementia, Medications for Treating Behavioural and Psychological Symptoms: https://www.camh.ca/en/professionals/treating-conditions-and-disorders/dementia/dementia---treatment/dementia---medications-for-treating-behavioural-and-psychological-symptoms
- Canadian Consensus Conference on Diagnosis and Treatment of Dementia (CCCDTD)5: Guidelines for management of vascular cognitive impairment: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7657196/
- SIGN (Scottish Intercollegiate Guidelines Network) 168 Assessment, diagnosis, care and support for people with dementia and their carers: https://www.sign.ac.uk/
- Vascular Harmonization Guidelines http://stroke.ahajournals.org/content/37/9/2220.full

- CanStroke Recovery Trials: https://canadianstroke.ca/
- Evidence-based Review of Post-Stroke Cognitive Disorders (EBRSR): http://www.ebrsr.com/evidence-review/12-post-stroke-cognitive-disorders
- AHA/ASA Scientific Statement on Vascular Contributions to Cognitive Impairment and Dementia: https://www.ahajournals.org/doi/full/10.1161/STR.0b013e3182299496
- NHS Psychological care after stroke: https://www.nice.org.uk/media/default/sharedlearning/531_strokepsychologicalsupportfinal.pdf
- Stroke Engine, Assessments by Topic, Cognition: https://strokengine.ca/en/assessments-by-topic/
- Stroke Engine, Interventions by Topic, Cognition: https://strokengine.ca/en/interventions-by-topic/
- Stroke Engine Learning Module: https://strokengine.ca/en/resources/e-learning/executive-function-e-learning-module/

Information for People with VCI, their Families and Caregivers

- Heart & Stroke: Vascular Cognitive Impairment Infographic and Journey Map: https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/vascular-cognitive-impairment/csbpr7-infographic-vci.pdf
- Heart & Stroke: Your Stroke Journey https://www.heartandstroke.ca/-/media/pdf-files/canada/your-stroke-journey/en-your-stroke-journey-v20.pdf?rev=01a46257b0634561b49b56066a4fb4be
- Heart & Stroke: Post-Stroke Checklist https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/002-17_csbp_post_stroke_checklist_85x11_en_v1.pdf?rev=748ae8f5d51743fa8c7628b773f0f36b
- Heart & Stroke: Virtual Healthcare Checklist https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/csbp-infographic-virtual-healthcare-checklist.pdf?rev=bf2f5b0e9e4a49cfbfc251208b6a15e2
- Heart & Stroke: Secondary Prevention Infographic https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/csbpr7-infographic-secondaryprevention-final.pdf?rev=9f0dcf0ade22483ba9ae4113b2f0f3eb
- Heart & Stroke: Rehabilitation and Recovery Infographic https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/rehabilitation-nov2019/csbp-infographic-rehabilitation.pdf?rev=a2cff1fb27424c84bbd44b568d58d1b4
- Heart & Stroke: Transitions and Community Participation Infographic https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.pdf?rev=595e990a17e14232aa3b1c731d983ce3
- Heart & Stroke: Vascular Cognitive Impairment https://www.heartandstroke.ca/stroke/what-is-stroke/vascular-cognitive-impairment
- Heart & Stroke: Stroke Recovery and Support https://www.heartandstroke.ca/stroke/recovery-and-support
- Heart & Stroke: Depression, Energy, Thinking and Perception https://www.heartandstroke.ca/stroke/recovery-and-support/emotions
- Heart & Stroke: Online and Peer Support https://www.heartandstroke.ca/heart-disease/recovery-and-support/the-power-of-community
- Heart & Stroke: Support for family care partners https://www.heartandstroke.ca/stroke/recovery-and-support/family-care-partners-need-care-too

- Heart & Stroke: Recognizing and Handling Stress
  https://www.heartandstroke.ca/heart/recovery-and-support/emotions-and-feelings/stress
- Canadian Psychological Association
  https://cpa.ca/psychology-works-fact-sheet-vascular-cognitive-impairment/
- Stroke Engine http://strokengine.ca/

Summary of the Evidence

Vascular Risk Factor Reduction

Selected vascular risk factors, such as hypertension, diabetes, and smoking at midlife are each associated with a 20% to 40% increased risk of dementia (Rundek et al. 2022). Hypertension has been consistently associated with poor cognitive performance. The risk of VCI in late life was increased by 20% in individuals with hypertension in midlife (Ou et al. 2020). The risk of vascular dementia was also increased significantly in individuals with hypertension in late life (RR=2.12, 95% CI, 1.50–2.99). McGrath et al. (McGrath et al. 2017) reported that each 10-mmHg increment in systolic BP during midlife was associated with a significantly increased risk of dementia (HR=1.17, 95% CI 1.05–1.31). The risk of vascular dementia was significantly higher in individuals with diabetes in a systematic review including 2,310,330 individuals (Chatterjee et al. 2016). After a mean duration of follow-up ranging from 3 to15 years, the risk was 2.34 times higher in women (95% CI 1.86–2.94) and 1.73 times higher in men (95% CI 1.61–1.85). The risk of VCI was increased by 31% and 33% in individuals who were obese, compared with those who were normal weight (Albanese et al. 2017; Ma et al. 2020). The risk was higher in women with abdominal obesity, but not in men (HR=1.39; 95% CI, 1.12–1.66 vs. (HR= 0.84; 95% CI, 0.55–1.19) in the English Longitudinal Study of Ageing (Ma et al. 2020).

Lifestyle factors may also positively and negatively affect the risk of dementia/VCI. The risk of VCI has been shown to be increased in individuals who consume heavy amounts of alcohol, defined as >14 units/week (HR=1.02, 95% CI 0.77 to 1.35), compared with those consuming 1-14 drinks per week, over an average of 23 years of follow-up (Sabia et al. 2018). Regular physical activity has been associated with a significantly reduced risk of VCI by up to 35% (Kivimäki et al. 2019; Middleton et al. 2008; Sofi et al. 2011), while smoking can increase VCI risk by 40% (Gottesman et al. 2017). Adherence to a Mediterranean or MIND diet may reduce the risk of VCI (McEvoy et al. 2017).

Non lifestyle factors associated with an increased risk of VCI include depression, social isolation, air pollution, hearing loss, traumatic brain injury and lower levels of educational attainment. The estimated percentage reduction in VCI prevalence if each individual risk factor was eliminated range from 2% to 8% (Livingston et al. 2020).

Pharmacological Management of VCI

Cholinergic agents, including donepezil, rivastigmine and galantamine have been used in the treatment of dementia of the Alzheimer's type and vascular dementia. The usefulness of these agents has also been investigated in the treatment of post stroke cognitive deficits. In a network meta-analysis (Battle et al. 2021), using the results from 7 trials, 10 mg donepezil ranked first in terms of benefit for improving cognition, compared with the other drugs and placebo but was 3rd in harm. Galantamine ranked second in terms of both benefit and harm. Rivastigmine had the lowest ranking in both benefit and harm estimates.

The use of the MNDA receptor antagonist, memantine has also been reported to improve cognitive, function in individuals with vascular dementia. In a recent Cochrane review (McShane et al. 2019) including the results from 2 trials, while there was no significant difference in mean change in Clinician's Interview-Based Impression of Change scores from baseline to end of study between group (20 mg memantine or placebo; SMD= -0.02, 95% CI -0.23 to 0.19), the mean decrease in ADAS-Cog scores at 28 weeks was significantly greater in the memantine group (-2.15, 95% CI -3.25 to -1.05).

Management of hypertension

The benefit of antihypertensive agents to reduce the risk of dementia or cognitive decline in individuals with vascular risk factors but without an overt stroke was investigated in the INFINITY trial (White et al.

2019). There was no significant difference between groups (intensive treatment [24- hour SBP target ≤130 mmHg] vs. standard treatment [≤145 mmHg]) at 36 months in any of the 7 assessments of cognitive function test, except for the California Computerized Assessment Package Sequential Reaction Time (mean change: -23.2 vs. 32.6 msec), which favoured the intensive group. In contrast, the SPRINT MIND investigators (Williamson et al. 2019) reported that among individuals with SBP >130 mmHg and at least one additional risk factor, the risk of mild cognitive impairment (MCI) was significantly lower in the intensive therapy group after a median of 5.11 years. (287 vs. 353 cases per 1,000 persons years; HR=0.81; 95% CI, 0.69-0.95, p=0.007). The risk of the composite outcome (MCI and a composite outcome of MCI or probable dementia) was also significantly lower in the intensive group (20.2 vs. 24.1 cases per 1,000 person-years; HR=0.85, 95% CI 0.74-0.97, p=0.01).

Management of Mood

Mood disorders, including depression, anxiety and apathy are common in individuals with post stroke VCI. Psychological interventions such as cognitive behavioral therapies (CBT), which include behavioural activation, problem-solving therapy and CBT, all considered forms of CBT have been shown to improve mood in individuals with VCI. In a Cochrane review (Orgeta et al. 2022), which included 2,599 individuals with mild to moderate dementia and mild cognitive impairment, CBT was associated with a significant reduction in depressive symptoms (SMD= -0.23, 95% CI -0.37 to -0.10), increased odds of depression remission (OR=1.84, 95% CI 1.18 to 2.88), as well as improvements in the performance of activities of daily living and quality of life. CBT did not reduce symptoms of anxiety. Supportive and counselling interventions, which were also examined in the same review were not as effective as CBT interventions, compared with usual care. Cognitive behavioral therapy can also be provided virtually (Mehta et al. 2019). Physical activity has also been shown to reduce depressive symptoms in individuals with MCI (Leng et al. 2018). In individuals with advanced dementia living in institutions, music therapy was shown to significantly improve mood/depression and emotional well-being (van der Steen et al. 2018).

Behavior Management

Behavioral disturbances, which can be difficult to manage, frequently manifest in Individuals with severe VCI. A Cochrane review (Möhler et al. 2023) included 11 RCTs and 1,071 participants with dementia living in long-term care facilities, which compared an activity plan tailored to the individual's present or past preferences, which could also be adapted to their cognitive and functional status with a control condition or usual care. The interventions varied in terms of the theoretical basis (e.g., Treatment Routes for Exploring Agitation [TREA], Montessori-based activities). There was significantly greater improvement in the intervention group in positive affect compared with usual care at the end of follow-up ranging from 10 days to 9 months; however, there were no significant differences between groups in the reduction of challenging behavior, or improvement in negative affect. Simulated presence therapy (SPT), which was performed using an audio or video recording prepared by family members or surrogates and included positive experiences from the participant's past life was shown to reduce symptoms of agitation in individuals with severe dementia living in nursing homes (Abraha et al. 2020). In a network meta-analysis (Leng et al. 2020), including 65 RCTs of individuals with agitation due to dementia, massage therapy was most likely to be rank 1 (43%), animal-assisted intervention ranked 2 (16%), personally tailored intervention ranked 3 (18%), and pet robot intervention ranked 4 (11%).

Both typical and atypical antipsychotic were shown to reduce agitation and psychosis in a Cochrane review (Mühlbauer et al. 2021) of 24 RCTs that included 6,090 individuals with Alzheimer's Disease or vascular dementia with neuropsychiatric symptoms. In another Cochrane review (Dudas et al. 2018), of 10 RCTs including 1,592 patients with VCI and depression, treatment with antidepressants (serotonergic, tricyclic, MAOI and SSRI) did not significantly improve symptoms of depression at 6-13 weeks (SMD= -0.10, 95% CI -0.26 to 0.06), but did increase the odds of remission (OR=2.57, 95% CI 1.44 to 4.59). Serotonergic antidepressants significantly improved overall neuropsychiatric symptoms, agitation and depression in individuals with VCI, both with and without a major depressive disorder at baseline. In subgroup analysis, SSRIs as a class was found to significantly reduce overall neuropsychiatric symptoms, but non-SSRIs did not, while both drug classes reduced agitation.

Safety and Risk Management

Physical activity interventions including home-based exercises, group exercise programs, strength and balance exercises, and Tai Chi were shown to significantly reduce the incidence of falls (incidence rate ratio=0.70, 95% CI 0.52 to 0.95) compared to usual care in individuals with mild to moderate dementia, living in the community (Li et al. 2021). Safety items, such as grab rail, a sensor night light, an electronic bracelet and a teleassistance support centre, included in a safety toolkit, also helped to reduce the number of Individuals who fell (RR=0.50, 95% CI 0.32- 0.78) compared with individuals who received usual care (Brims and Oliver 2019).

In a systematic review of 53 studies including individuals with VCI (Toepper and Falkenstein 2019), the effects of severity and type of VCI on driving fitness were reviewed. The results suggest that drivers with vascular dementia exhibit severe driving difficulties. Patients with multi-infarct dementia show poorer on-road driving skills than older Individuals with diabetes, healthy older individuals, or healthy young drivers. Driving scores were inversely associated with cognitive skills, number of collisions, and violations per 1,000 miles driven. About 70% of drivers with very mild and mild vascular dementia fail an on-road driving test, compared to 11% of health seniors. Financial decision-making was also shown to be impaired in individuals with Alzheimer's disease (AD) and MCI, compared with a healthy control group (Bangma et al. 2021), although in another systematic review (Sudo et al. 2017), in individuals with mild AD, basic monetary skills, and the ability to conduct cash transactions remained intact.

Environmental Supports

A systematic review including 72 studies of individuals with VCI across the spectrum of severity explored the role of the physical environment in supporting bodily performance in everyday activities (Woodbridge et al. 2018). Nineteen studies evaluated the impact of the physical environment on overall performance across all everyday activities. Factors assessed were size of the environment, quality of the environment, architectural layout, homelike atmosphere, and tailored individual adaptations. The results from these studies were largely positive. Across the remaining studies that evaluated strategies for assisting mealtimes, improving hygiene and self-care, improving oriental to time and space, improving leisure activities, and improving communication, the results were mixed.

Sex, gender and other equity-related considerations

Volgman et al. (2019) conducted an extensive review of the influence of sex on cardiovascular risk factors and cognitive decline and identified several factors that contributed to the increased prevalence of dementia in women, including a higher burden of traditional cardiovascular risk factors such as obesity, diabetes and hypertension, cardiac abnormalities (e.g., atrial fibrillation). Other factors included hypertensive disorders of pregnancy, increased longevity, and under-treatment with anticoagulants.

Using data from the 19,000 individuals in the UK Biobank, (Kaur et al. 2024) reported high low-density lipoprotein, low education, and high blood pressure had a greater effect on the rate of cognitive decline in the executive function for women compared with men. In the population based Canadian Study of Health & Ageing, which recruited individuals aged ≥65 years and examined the association between physical activity and the development of incident cognitive impairment over a 5-year period, a difference between the sexes was found (Middleton et al. 2008). In women, moderate to high levels of physical activity (vs. low physical activity) were highly protective for the development of vascular cognitive impairment (without dementia), with no corresponding risk reduction in men.

While sex differences in the pharmacological treatment of cognitive impairment exist and are increasingly recognized, they are poorly understood. The specific mechanisms and implications may vary based on the medication type, and are likely influenced by differences in pharmacokinetics and the hormonal environment. Sex and gender were not explored as potential effect size moderators in most of the trials examining cardiovascular risk factor reduction. In the SPRINT-MIND trial (Williamson et al. 2019) intensive treatment to reduce blood pressure did not significantly reduce the risk of probable dementia overall, compared with less intensive treatment, with no difference between men and women in subgroup analysis.

Section 3   Cognitive Rehabilitation

3. Cognitive Rehabilitation 2024

Notes

➢ *This section addresses specific elements of rehabilitation for individuals with vascular cognitive impairment, regardless of underlying cause.*

- *Additional recommendations and information related to cognitive rehabilitation can be found in the CSBPR Rehabilitation, Recovery and Community Participation modules.(Mountain et al. 2020; Teasell et al. 2020).*

➢ *Evidence supporting rehabilitation of cognitive challenges related to vascular cognitive impairment is growing, but current evidence is in general derived from investigations with a limited number of patient groups, including stroke, acquired brain injury (ABI), MCI or mixed dementia. Studies with these mixed populations were included if they specified inclusion of individuals with a vascular etiology.*

3.0 Assessment and Planning for VCI Rehabilitation

i.   All individuals with a diagnosis of VCI should be assessed to determine their cognitive rehabilitation needs using validated assessment tools where available [Strong recommendation; Low quality of evidence].

ii.   Individuals with VCI, caregivers and families should be engaged in the development of a cognitive rehabilitation treatment plan that addresses current impairments and limitations, is goal-oriented and involves shared decision-making [Strong recommendation; Low quality of evidence].

   a.   Cognitive rehabilitation treatment plans should take into account the evolving nature of VCI and be regularly reviewed and adapted as the individual's cognitive status changes [Strong recommendation; Low quality of evidence].

   b.   Interventions should be individualized, based on best available evidence, and have the long-term aim to facilitate resumption or continued safe participation of desired activities (e.g., self-care, home and financial management, leisure, driving, return to work) [Strong recommendation; Low quality of evidence].

   c.   Interventions should consider pharmacological and non-pharmacological approaches[Strong recommendation; Low quality of evidence].

iii. A multipronged approach to rehabilitation should be considered that includes both domain specific (e.g., attention, memory, executive function) and global strategies (e.g., physical activity and exercise) [Strong recommendation; High quality of evidence]. *Refer to the CSBPR Rehabilitation, Recovery and Community Participation module for additional information.(Mountain et al. 2020; Teasell et al. 2020)*

Section 3.0 Clinical Considerations

1.   A comprehensive assessment of cognitive strengths and weaknesses as outlined in Section 1.2, is required to consider the impact of challenges (such as impaired visuo-perceptual function, learning abilities, and awareness and insight into changes) on motivation, ability to engage in planning and treatment, and specific approaches to treatment delivery.

2.   For treatment planning, consider the prognosis for cognitive recovery or decline, and the potential impact of other existing comorbidities (such as fatigue, pain, depression/ or anxiety) on the individual's ability to participate in and benefit from cognitive rehabilitation.

3. The availability of social support and the existing physical environment may impact participation, safety, and outcomes. Modifying the social and/or physical environment and embedding structure and routine may be considered to optimize specific cognitive rehabilitation techniques.

4. Both compensatory and remedial approaches may be applied in a person-centred approach to optimize function.

5. In addition to interventions tailored for specific cognitive domains, other approaches that directly impact brain function or health (e.g., non-invasive brain stimulation, and physical activity) have received growing attention as modulators of cognition.

6. Multimodal approaches (e.g., diet, social activities, music, health education) may be considered to improve cognitive performance or to prevent cognitive decline.

Additional recommendations and information related to cognitive rehabilitation can be found in the CSBPR Rehabilitation, Recovery and Community Participation module (Mountain et al. 2020; Teasell et al. 2020)

Rationale

Stroke and VCI can result in deficits across multiple cognitive domains. Cognitive rehabilitation strategies, including single and multidomain interventions, using both remedial and compensatory approaches, can be used help to restore executive functioning (problem solving, decision-making, planning), attention, memory, and cognitive-communication skills.

People with lived experience highlight the importance of equitable access to cognitive rehabilitation. They emphasized that individuals with VCI, their family and caregivers should be actively engaged in the development of cognitive rehabilitation treatment plans that are individualized and focus on person-centred goals.

System Implications

To ensure people experiencing VCI receive timely assessments, interventions and management, interdisciplinary teams need to have the infrastructure and resources required. These may include the following components established at a systems level.

1. An adequate complement of clinicians experienced in cognitive rehabilitation available in all regions.

2. A clear process for referral of patients to rehabilitation professionals and programs following diagnosis and when need to re-access over time.

3. Standardized, validated, and expert consensus-based screening assessment tools and training specific to cognitive impairment and rehabilitation.

4. A process for timely referral to specialized cognitive rehabilitation services in all centres (for example, electronic referral system and standardized assessment tools).

5. Mechanisms to periodically re-evaluate individuals with VCI as this condition can be progressive over time, to ensure individuals with VCI have access to ongoing rehabilitation to meet their changing needs.

6. Coordination and development of strong partnerships in the community, and adequate resources to ensure access to comprehensive rehabilitation services and support. This is especially important in more rural and remote geographic locations where telehealth technologies should be optimized.

7. Access to safe communities and environments for people with changing cognitive needs who wish to remain in their homes and communities.

Performance Measures

System indicators:

1. Number of cognitive rehabilitation programs available in Canada by region.

2. Percentage of Telehealth/Telestroke coverage to remote communities to support organized stroke care across the continuum, including providing rehabilitation assessments and therapies for stroke patients.

Process indicators:

3. Proportion of individuals with VCI who undergo an initial cognitive rehabilitation assessment following diagnosis.

4. Percentage of individuals with VCI who receive a referral for inpatient or outpatient cognitive rehabilitation (either facility-based or community- based programs).

5. Median length of time between referral for cognitive rehabilitation to commencement of cognitive rehabilitation therapy.

Patient-oriented outcome and experience indicators:

6. Self-reported quality of life following diagnosis of VCI using a validated measurement tool, measured longitudinally.

7. Functional outcome scores following diagnosis of VCI, measured longitudinally.

Measurement Notes

- Measures of quality of life and functional outcomes should occur at regular intervals to detect changes over time. This data should be shared across providers and settings to support collaboration and access to relevant data for optimal care of individuals with VCI.

- Benchmarks for VCI indicators are not currently available – with improved data collection and sharing will support the establishment of evidence-based benchmarks.

Implementation Resources and Knowledge Transfer Tools

Resources and tools listed below that are external to Heart & Stroke and the Canadian Stroke Best Practice Recommendations may be useful resources for stroke care. However, their inclusion is not an actual or implied endorsement by the Canadian Stroke Best Practices team or Heart & Stroke. The reader is encouraged to review these resources and tools critically and implement them into practice at their discretion.

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- Heart & Stroke: Taking Action for Optimal Community and Long-Term Stroke Care (TACLS) A Resource for Healthcare Providers: https://www.strokebestpractices.ca/resources/professional-resources/tacls
- Vascular Harmonization Guidelines http://stroke.ahajournals.org/content/37/9/2220.full
- Evidence-based Review of Post-Stroke Cognitive Disorders (EBRSR): http://www.ebrsr.com/evidence-review/12-post-stroke-cognitive-disorders
- CanStroke Recovery Trials: https://canadianstroke.ca/

- Canadian Consensus Conference on Diagnosis and Treatment of Dementia (CCCDTD)5: Guidelines for management of vascular cognitive impairment: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7657196/
- SIGN (Scottish Intercollegiate Guidelines Network) 168 Assessment, diagnosis, care and support for people with dementia and their carers: https://www.sign.ac.uk/
- AHA/ASA Scientific Statement on Vascular Contributions to Cognitive Impairment and Dementia: https://www.ahajournals.org/doi/full/10.1161/STR.0b013e3182299496
- NHS Psychological care after stroke: https://www.nice.org.uk/media/default/sharedlearning/531_strokepsychologicalsupportfinal.pdf
- Stroke Engine, Cognition section: https://strokengine.ca/en/assessments-by-topic/
- Stroke Engine, Cognitive Rehabilitation: https://strokengine.ca/en/interventions/cognitive-rehabilitation/

Information for People with VCI, their Families and Caregivers

- Heart & Stroke: Vascular Cognitive Impairment Infographic and Journey Map

- Heart & Stroke: Your Stroke Journey https://www.heartandstroke.ca/-/media/pdf-files/canada/your-stroke-journey/en-your-stroke-journey-v20.pdf?rev=01a46257b0634561b49b56066a4fb4be

- Heart & Stroke: Post-Stroke Checklist https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/002-17_csbp_post_stroke_checklist_85x11_en_v1.pdf?rev=748ae8f5d51743fa8c7628b773f0f36b
- Heart & Stroke: Virtual Healthcare Checklist https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/csbp-infographic-virtual-healthcare-checklist.pdf?rev=bf2f5b0e9e4a49cfbfc251208b6a15e2
- Heart & Stroke: Secondary Prevention Infographic https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/csbpr7-infographic-secondaryprevention-final.pdf?rev=9f0dcf0ade22483ba9ae4113b2f0f3eb
- Heart & Stroke: Rehabilitation and Recovery Infographic https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/rehabilitation-nov2019/csbp-infographic-rehabilitation.pdf?rev=a2cff1fb27424c84bbd44b568d58d1b4
- Heart & Stroke: Transitions and Community Participation Infographic https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.pdf?rev=595e990a17e14232aa3b1c731d983ce3
- Heart & Stroke: Vascular Cognitive Impairment https://www.heartandstroke.ca/stroke/what-is-stroke/vascular-cognitive-impairment
- Heart & Stroke: Stroke Recovery and Support https://www.heartandstroke.ca/stroke/recovery-and-support
- Heart & Stroke: Services and Resources https://www.heartandstroke.ca/services-and-resources?_ga=2.83697684.366011391.1701091115-1887574775.1664374909
- Heart & Stroke: Depression, Energy, Thinking and Perception https://www.heartandstroke.ca/stroke/recovery-and-support/emotions
- Heart & Stroke: Online and Peer Support https://www.heartandstroke.ca/heart-disease/recovery-and-support/the-power-of-community

- Heart & Stroke: Support for family care partners https://www.heartandstroke.ca/stroke/recovery-and-support/family-care-partners-need-care-too

- Heart & Stroke: Recognizing and Handling Stress https://www.heartandstroke.ca/heart/recovery-and-support/emotions-and-feelings/stress

- Stroke Engine: http://strokengine.ca/

Summary of the Evidence

Cognitive Rehabilitation

VCI (no stroke)

In a Cochrane review (Bahar-Fuchs et al. 2019), which included data from 33 RCTs of individuals with mild to moderate VCI, multi and single domain cognitive interventions were associated with significant improvements in in the composite measure of global cognition, when assessed immediately after the intervention (SMD=0.42, 95% CI 0.23 to 0.62) and at 3-12- month follow-up (SMD=0.65, 95% CI 0.11 to 1.2), compared with active and passive interventions. A multi-domain adaptive internet-based training program resulted in significantly increased mean MoCA scores from baseline, compared with an active intervention control group (lower difficulty tasks) at 7 weeks (mean change of 3.36 vs. -0.85, p=0.013) in the Cog-VACCINE trial (Tang et al. 2019). In this trial, participants were recruited from neurology and geriatric clinics from 3 hospitals, with complaints of cognitive impairment involving memory or other cognitive domains lasting ≥3 months, but without dementia.

Post-stroke VCI

Among the earliest and most pronounced cognitive abnormalities are deficits in attention and executive function. Small to medium effect sizes for cognitive recovery (Hedge's *g* 0.35-0.48) have been reported in these domains in systematic reviews including individuals with stroke who received cognitive rehabilitation (Saa et al. 2021) (Rogers et al. 2018). Effect sizes were higher in trials that provided interventions earlier following stroke, and in trials that provided an intervention for a longer duration. In a systematic review including the results of 64 RCTs, including 4,005 individuals with/without cognitive impairment following stroke, trials compared cognitive rehabilitation strategies to improve cognitive function with a control group (O'Donoghue et al. 2022). Multiple component interventions were associated with higher mean MoCA scores, improved measures of memory, and better functional status, compared with individuals receiving standard care. There were no significant differences between groups comparing cognitive rehabilitation interventions with an active control in any of the outcomes assessed (general cognitive functioning, memory, executive function, or attention), nor was there a difference between groups comparing cognitive rehabilitation interventions vs. wait list control (memory).

While physical activity has been shown to prevent the development of VCI in healthy older adults (Gallaway et al. 2017; Verdelho et al. 2012), it may also help to improve cognitive outcomes in individuals with existing forms of VCI. In a systematic review & meta-analysis including 18 RCTs of 802 elderly participants with dementia (primarily Alzheimer's dementia) living both in care facilities and the community, physical activity was associated with an improvement in global cognitive function (SMD=0.42, 95% CI 0.23 to 0.62)(Groot et al. 2016). The duration of the intervention ranged from 6 to 52 weeks. This positive effect was accompanied by improvements in activities of daily living.

Sex, gender and other equity-related considerations

Sex and gender were not explored as potential effect size moderators in any of the literature reviewed on cognitive rehabilitation. In the Cochrane review of 33 cognitive rehabilitation trials including individuals with mild to moderate dementia (Bahar-Fuchs et al. 2019), no subgroup analyses were conducted based on sex, nor was it explored in a systematic review and meta-regression (Saa et al. 2021) of 43 intervention and observational trials examining changes in cognition post stroke. Separate literature searches conducted to identify sex and gender differences associated with cognitive rehabilitation strategies did not yield any results.

Section 4   Support for Individuals with VCI, Their Families and Caregivers

4.0. Support for Individuals with VCI, Their Families and Caregivers 2024

Notes

- *When someone experiences vascular cognitive impairment, their family and informal caregivers play a pivotal role, and are also personally affected along this journey. Understanding the caregivers' circumstances, abilities, and concerns are important when providing comprehensive person- and family-centred care.*
- *Support for families and caregivers may address the following domains: education, training, counselling, development of a support structure, and financial assistance (based on AHA stroke rehabilitation and recovery guideline, (Winstein et al. 2016).*
- *Consent: Refer to Introduction regarding issues related to consent when providing support to an individual with VCI.*
- *For more in-depth recommendations and information, refer to the Rehabilitation, Recovery and Community Participation following Stroke module.*

4.1   Education Related to VCI

i.   Clinicians should assess individuals with VCI, family and caregiver's needs for information, education and training relevant to the impact of VCI on the individual and caregiver, to support the cognition and everyday function of the individual with VCI [Strong recommendation; Moderate quality of evidence].

ii.   An individualized education plan should be developed and implemented based on the assessment of learning needs and goals of individuals with VCI and their families and caregivers, and be culturally sensitive and appropriate to literacy levels [Strong recommendation; Moderate quality of evidence].

iii. Education should address knowledge of VCI and its potential progression over time, practical skills, safety considerations, personal coping, and problem-solving strategies to manage ongoing challenges [Strong recommendation; Moderate quality of evidence].

iv.   Caregivers should be provided personalized training for caregiving skills in the context of specific cognitive difficulties and severity, behaviors, and psychological symptoms of VCI [Strong recommendation; High quality of evidence].

v.   Educational needs change over time and as the VCI progresses; assessments, education, discussions and training should occur on an ongoing basis and be provided in writing as well as verbally [Strong recommendation; Moderate quality of evidence].

4.2   Support for Family and Caregivers

i.   The extent, quality and capacity of support provided by family and caregivers of an individual with VCI should be assessed to ensure sustainability [Conditional recommendation; Moderate quality of evidence].

    a.   Areas to consider include levels of individual coping of family/caregivers, risk for mental health issues, social context, culture, and societal structures, and other physical and psychosocial issues (e.g. financial, environmental, abuse, housing etc.) that may impact their caregiving responsibilities [Conditional recommendation, Moderate quality of evidence].

    Note: Where concerns are identified, encourage family members to reach out to primary care, mental health agencies, social workers or community support agencies as

appropriate.

ii. Appropriate resources and sources of support that address family and caregiver needs should be shared over the trajectory of VCI and across the care continuum [Strong recommendation; Moderate quality of evidence].

Section 4 Clinical Considerations

1. It is important to understand the support network and cultural contexts (e.g., caregivers, family, friends) for the individual with VCI and their caregivers to help personalize treatment.

2. Consider services that can enhance, or supplement care provided by family and caregivers – e.g., respite care, day programming, community services. Referrals may be required to access some of these and/or extra resources.

3. Healthcare providers and community services should consider and address stigma and how the individual with VCI and their caregivers view the condition and options for care, based on their knowledge, experience and cultural beliefs, to encourage health-seeking behaviours and uptake of care and services. (Scottish Intercollegiate Guidelines Network 2023)

4. Education should include the progressive nature of VCI and encourage individuals with VCI to consider making plans for their personal, health and financial affairs.

5. The format of any information shared should be tailored to the needs and preferences of the individual with VCI and their family and caregivers. Consider literacy and language, additional support needs and cultural sensitivity. (Scottish Intercollegiate Guidelines Network 2023)

6. Education regarding caregiving skills is best provided when developing a care plan (if applicable), at transitions in care, or in the context of new or worsening barriers to care, or changes in clinical status that require changes in caregiving strategies.

7. All care settings should have up-to-date inventories of community resources available to support self-management and offer guidance and assistance in obtaining needed services.

Rationale

Individuals living with VCI are often cared for by informal caregivers, such as a spouse, sibling, or an adult child. Informal caregivers often report being stressed and anxious, feelings restricted and having poorer quality of life. Education is an ongoing and vital part of the recovery and forward planning process for individuals with VCI, family members and caregivers. Increased screening, assessment and surveillance of individual with VCI, family and caregiver needs and coping will provide a holistic person- and family-centered approach to care and optimally lead to better outcomes and adaptation.

People with lived experience highlighted that education and support needs can change over time. They emphasized that education and support for VCI should be tailored to the needs of the individual with VCI, their family and caregivers. Support for daily activities and vocational roles was also highly valued by PWLE, as well as peer support. They also emphasized the importance of resources and support for caregivers. This also includes education to caregivers on VCI, its potential impact on daily life, activities, mood and behavior, as well as VCI management. Education to caregivers may also reduce the burden of explaining for the individual with VCI and help them feel heard and understood.

System Implications

To ensure people experiencing VCI receive timely assessments, interventions and management, interdisciplinary teams need to have the infrastructure and resources required. These may include the following components established at a systems level.

1. Protocols to involve individuals with VCI and families in healthcare team transition planning meetings and collaborative decision-making regarding goal setting at all transition points.

2. Resources and mechanisms to plan and deliver community-based services which consider the needs of the individuals with VCI and family/caregiver (e.g., home care services, psychological support).

3. Models of care that include technology such as telemedicine, regular telephone follow-up and web-based support.

4. Appropriately resourced hospitals, rehabilitation facilities, home care services, long-term care and other community facilities that care for individuals with VCI, with identified contact people and case managers/system navigators to coordinate and manage care transitions for individuals with VCI, that include addressing related conditions such as stroke.

5. Ongoing education and training of healthcare professionals on person- and family-centred stroke care in all settings that care for individuals with VCI.

6. Opportunities for education and training for individuals with VCI, families and caregivers to provide peer support when requested.

7. Access to educational resources that are culturally, ethnically, and linguistically appropriate.

8. Access to self-management support services through telemedicine technologies, especially in rural areas and where there are local resource gaps.

9. Coordinated efforts among stakeholders such as the Heart and Stroke Foundation, public health agencies, provincial ministries of health, non-government organizations (NGOs), hospitals and clinics, and individual care providers across the continuum of care to produce education materials with consistent information.

10. Community resources, such as support groups and respite care, to provide ongoing support and education across the VCI trajectory.

Performance Measures

System indicators:

1. Number of community-based services (such as rehabilitation programs, geriatric day programs, homecare services, respite care) available for individuals with VCI and their families.

Process indicators:

2. Proportion of individuals with VCI with documentation of education provided at each stage of care.

3. Total number of encounters focused on education for each individual with VCI, and the time spent on education during a healthcare encounter.

Patient-oriented outcome and experience indicators:

4. Percentage of individuals with VCI and their families who reported feeling adequately prepared for self-care and self-efficacy.

5. Self-reported quality of life following diagnosis of VCI using a validated measurement tool, measured longitudinally.

6. Functional outcome scores following diagnosis of VCI, measured longitudinally.

Measurement Notes

- Quantity and method of education are very important elements of these recommendations. Measurement of education for individuals with stroke and families should be expanded when feasible to capture these aspects, although this is challenging to accomplish.

- Where possible, standardized mechanisms for testing individuals with VCI, family and caregiver knowledge pre- and post-education should be included in the education sessions.

- Data sources include all documents, charts, and records related to care across the healthcare system (primary care, acute care, follow-up clinics, inpatient and outpatient rehabilitation programs, community programs and services) and may be obtained through primary chart audit or review, and various logging and audit practices of individual groups.

- Documentation quality (generally weak) by healthcare professionals involved in the individuals care may affect ability to monitor this indicator reliably.

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- Vascular Harmonization Guidelines http://stroke.ahajournals.org/content/37/9/2220.full
- Evidence-based Review of Post-Stroke Cognitive Disorders (EBRSR): http://www.ebrsr.com/evidence-review/12-post-stroke-cognitive-disorders
- Evidence-based Review of Post-Stroke Depression and Mood Disorders: http://www.ebrsr.com/evidence-review/18-post-stroke-depression-and-mood-disorders
- AHA/ASA Scientific Statement on Vascular Contributions to Cognitive Impairment and Dementia: https://www.ahajournals.org/doi/full/10.1161/STR.0b013e3182299496
- NHS Psychological care after stroke: https://www.nice.org.uk/media/default/sharedlearning/531_strokepsychologicalsupportfinal.pdf
- Stroke Engine, Cognition section: https://strokengine.ca/en/assessments-by-topic/

Information for People with VCI, their Families and Caregivers
- Heart & Stroke: Vascular Cognitive Impairment Infographic and Journey Map: https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/vascular-cognitive-impairment/csbpr7-infographic-vci.pdf
- Heart & Stroke: Your Stroke Journey https://www.heartandstroke.ca/-/media/pdf-files/canada/your-stroke-journey/en-your-stroke-journey-v20.pdf?rev=01a46257b0634561b49b56066a4fb4be

- Heart & Stroke: Post-Stroke Checklist https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/002-17_csbp_post_stroke_checklist_85x11_en_v1.pdf?rev=748ae8f5d51743fa8c7628b773f0f36b
- Heart & Stroke: Virtual Healthcare Checklist https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/csbp-infographic-virtual-healthcare-checklist.pdf?rev=bf2f5b0e9e4a49cfbfc251208b6a15e2
- Heart & Stroke: Secondary Prevention Infographic https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/csbpr7-infographic-secondaryprevention-final.pdf?rev=9f0dcf0ade22483ba9ae4113b2f0f3eb
- Heart & Stroke: Rehabilitation and Recovery Infographic https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/rehabilitation-nov2019/csbp-infographic-rehabilitation.pdf?rev=a2cff1fb27424c84bbd44b568d58d1b4
- Heart & Stroke: Transitions and Community Participation Infographic https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.pdf?rev=595e990a17e14232aa3b1c731d983ce3
- Heart & Stroke: Vascular Cognitive Impairment https://www.heartandstroke.ca/stroke/what-is-stroke/vascular-cognitive-impairment
- Heart & Stroke: Stroke Recovery and Support https://www.heartandstroke.ca/stroke/recovery-and-support
- Heart & Stroke: Services and Resources https://www.heartandstroke.ca/services-and-resources?_ga=2.83697684.366011391.1701091115-1887574775.1664374909
- Heart & Stroke: Depression, Energy, Thinking and Perception https://www.heartandstroke.ca/stroke/recovery-and-support/emotions
- Heart & Stroke: Online and Peer Support https://www.heartandstroke.ca/heart-disease/recovery-and-support/the-power-of-community
- Heart & Stroke: Support for family care partners https://www.heartandstroke.ca/stroke/recovery-and-support/family-care-partners-need-care-too
- Heart & Stroke: Recognizing and Handling Stress https://www.heartandstroke.ca/heart/recovery-and-support/emotions-and-feelings/stress
- Government of Canada: Dementia Awareness Resource Toolkit: https://www.canada.ca/en/public-health/services/diseases/dementia/awareness-resources-toolkit.html
- Stroke Engine: http://strokengine.ca/
- Enhancing Care Program for Ontario Care Partners: https://carersontario.ca/

Summary of the Evidence

Support for Individuals with VCI, their Families and Caregivers

Education and training are essential components to enhance engagement in caregivers of individuals with VCI or vascular dementia. A systematic review of 48 RCTs including informal caregivers for individuals with VCI examined interventions which were focused on improving the carer's mental health. Interventions included psychoeducation, leisure and physical activity, counselling, cognitive behavioural approaches and befriending and peer-support (Wiegelmann et al. 2021). The results were mixed. Of 26 interventions that assessed the subjective burden of the caregiver, there were significant improvements in the intervention group in 12 trials (46.2%). Among 24 interventions that assessed caregiver depression, there were improvements in 9 trials (37.5%) associated with the intervention. In a minority of studies (5 trials, 21.7%), caregiver quality of life was improved in the intervention group. Problem-solving

based interventions reduced depression and anxiety levels, as well as caregiver burden, among caregivers of elderly individuals with a variety of chronic conditions (Tao and Zhang 2019). Among 34 RCTs included in a systematic review of informal carers of individuals with VCI who were living in the community, interventions designed to reduce burden/stress trials were found to have a small, but significant effect (SMD=-0.18, 95% CI -0.30 to -0.05). Interventions examined included multicomponent interventions, skills training or education, support and counseling and physical activity (Williams et al. 2019). A Cochrane review (Liu et al. 2018) included 5 RCTs involving 201 unpaid carers of individuals with any type of VCI examining mindfulness-based stress reduction (MBSR) techniques such as yoga and meditation. At the end of treatment, carer depressive symptoms and anxiety were significantly lower in the MBSR group compared with the active control group (SMD=-0.63, 95% CI -0.98 to -0.28, and MD= -7.5, 95% CI -13.11 to -1.89, respectively), although the certainty of the results were low, assessed using the GRADE system.

Sex, gender and other equity-related considerations

Unpaid caregiver burden disproportionately affects women and may be associated with negative health consequences. The increased stress of caregiving may also represent a potential risk factor for cognitive decline and dementia in female caregivers (Volgman et al. 2019). Pillemer et al. (2018) examined the baseline measures of 211 community-residing caregivers of people with dementia, reporting some degree of distress at baseline who were participants of a longitudinal study. There were significant gender differences, whereby women experienced a greater level of overall burden, assessed using the Zarit Burden Interview, and reported higher levels of depression, compared with men. A recent scoping review (Arbel et al. 2019) including the results of 61 studies sought to synthesize the literature related to sex and gender differences among dementia spousal caregivers. The areas with the greatest evidence base relating to sex differences were depression, burden, objective physical health, and informal supports. Research gaps that were identified were related to quality and type of literature (e.g, a lack of qualitative, longitudinal studies) and the use of secondary analyses to investigate sex and gender differences.

Section 5   Palliative and End-of-Life Care

5.0 Palliative and End-of-Life Care 2024

Refer to Acute Stroke Management module, Sections 10 (Advance Care Planning) and 11 (Palliative Care) for comprehensive recommendations on these topics. The recommendations presented below are specifically nuanced to the VCI population and based on specific evidence in populations with VCI and or dementia. (Heran et al. 2022)

5.1   Advance Care Planning

i.   Individuals with VCI, as well as their families and informal caregivers, should be informed about advance care planning options as early as possible following diagnosis due to the progressive nature of VCI [Strong recommendation; Low quality of evidence].

ii.   Respectful and empathetic advance care planning should be integrated as part of a comprehensive care plan, taking into consideration the individual's capacity for understanding and decision-making, their values and preferences, information regarding the individual's health trajectory, understanding, prognosis, medically appropriate treatments and future medical care [Strong recommendation; Moderate quality of evidence]. *Refer to definition of Consent in Overview section for additional information.*

iii.   Advance care planning discussions should be documented and reassessed regularly with the individual with VCI, the healthcare team and substitute decision-maker, especially when there is a change in the individual's health status [Strong recommendation; Low quality of evidence].

5.2   Palliative and End-of-Life Care

i.   A palliative approach should be considered when there is advanced vascular dementia, to optimize care and quality of life [Strong recommendation; Low quality of evidence].

ii.   The care team should have discussions with the individual with VCI, and substitute decision-makers regarding the individual's goals of care that include consideration of the individual's capacity, diagnosis, prognosis, values, wishes (advance care plans), and whether care should focus on comfort or on prolonging life [Strong recommendation; Low quality of evidence].

a.   There should be regular communication with the individual with VCI, their family, and informal caregivers to ensure their goals and needs are being met and to reflect any changes in diagnosis or prognosis [Strong recommendation; Low quality of evidence].

b.   Topics to be discussed with individuals with VCI, families, and informal caregivers may include the appropriateness of life-sustaining measures, including mechanical ventilation, enteral/intravenous feeding, and intravenous fluids; less aggressive or withdrawal of vascular risk reduction strategies; and the purpose of all medications, including those for symptom management [Strong recommendation; Low quality of evidence].

iii.   Palliative care discussions should be documented and reassessed regularly with the healthcare team and substitute decision-maker [Strong recommendation; Low quality of evidence].

iv.   Individuals with VCI, families, informal caregivers, and the healthcare team should have access to palliative care specialists, particularly for consultation about individuals with difficult-to-control symptoms, complex or conflicted end-of-life decision-making, or complex psycho-social family issues [Strong recommendation; Low quality of evidence].

v.   Individuals with VCI, families, informal caregivers, and the healthcare team should have access to additional supports including spiritual care, grief counselling, and mental health professionals [Strong recommendation; Low quality of evidence].

vi. Each member of the healthcare team should understand their roles and responsibilities as defined by their respective provincial or territorial college or professional organization regarding discussions about medical assistance in dying (MAiD), particularly when they involve individuals with VCI [Strong recommendation; Low quality of evidence].

Section 5 Clinical Considerations

1. Education should include the progressive nature of VCI and encourage individuals with VCI to consider making plans for their personal, health and financial affairs.

2. Discuss the importance of the individual with VCI and their family and caregivers participating in advance care planning discussions, what it involves, why it is important, and the benefits of establishing an advance care plan. Therse plans may need to be reviewed periodically as VCI may change or progress over time.

3. Providers should be aware of relevant provincial legislation related to determining capacity. If the individual has been deemed incapable of making specific decisions regarding their personal care, or financial capacity by the appropriate assessor or evaluator, the lawful substitute decision maker(s) should be identified.

4. Referral to the local MAiD resource centre can be considered if further discussions are required.

5. *In the field of vascular cognitive impairment, the issue of agency to provide consent often arises.* Throughout these recommendations, there is reference to the individual with VCI, their family and other informal caregivers. The individual with VCI retains the same rights to privacy of health information as any individual seeking healthcare services, under national and provincial legislation. It is acknowledged that at some point their capacity for providing consent, whether consent for others to be involved in their care and receive their personal health information, or consent for treatments, may change. Throughout these recommendations, the issue of consent is assumed to have been addressed by the healthcare team members with the individual and their alternate decision-makers where appropriate.

Rationale

Palliative care and advance care planning (ACP) are two critical components of end-of-life care as patients in the advanced stages of dementia, their caregivers and family members navigate their way through the healthcare system. Advance care planning can give individuals with VCI or dementia a sense of control over an uncertain future while enabling them to participate directly in the decision-making process about future care. Palliative care focuses on the management of relief from pain and other distressing symptoms, such as agitation and swallowing difficulties, while helping to support the family physically, emotionally and spiritually.

People with lived experience stressed the importance of advance care planning among family members and loved ones and discussed how the concept may not be well-known. They talked about the difficulty that family members may experience when making healthcare decisions for someone else, especially if those discussions did not take place when the individual was competent and able to participate. People with lived experienced explained that although these types of conversations may be new or challenging, they ultimately allow the individual to have some control and allow their voice to be heard. These conversations can also support family members when they are faced with stressful decisions about the individual's health. They also emphasized the importance of having advance care planning conversations throughout their lives, and to be aware that one conversation may not be enough as people's wants and wishes can change over time. They also discussed the value of having a resource to guide these discussions, especially for those who haven't considered advance care planning previously.

People with lived experience recognized that palliative and end-of-life discussion can be very challenging. They suggested it would be helpful if one person from the healthcare team could be designated to ensure appropriate conversations are held with the appropriate parties about palliative and end-of-life care needs. They stated that sometimes people need "permission" to know it's okay to bring up the topic with family, friends, and loved ones, or with a healthcare provider, and having someone initiate the conversation in a supportive environment can be helpful. They expressed that palliative and end-of-life care wishes should be brought up and discussed before they are required, to help give the individual some control and let them express what they want and need for this time in their life.

System Implications

To ensure people experiencing VCI receive timely assessments, interventions and management, interdisciplinary teams need to have the infrastructure and resources required. These may include the following components established at a systems level.

1. Protocols for advance care planning to elicit goals for care and preferences of individuals with VCI and their family, and ensuring these are documented and communicated to decision-makers and healthcare team members.

2. Information on advance care planning and links to local support organizations and their services for staff to share with individuals with VCI and families.

3. Communication and skills training for physicians, nurses, and allied health professionals that addresses supporting patients and their families through advance care planning and dealing with potential conflicts over an individual with VCI's wishes and decisions.

Performance Measures

System indicators:

1. Proportion of hospitals and communities with access to palliative care services for individuals with VCI.

Process indicators:

2. Proportion of individuals with VCI who have been approached to participate in advance care planning and/or who have a documented conversation with a healthcare provider.

3. Proportion of individuals with VCI who identify a substitute decision-maker.

4. Proportion of individuals with VCI who complete a personal or advance care plan and have it documented on their chart.

Patient-oriented outcome and experience indicators:

5. Proportion of individuals with VCI with advance care plans whose actual care was consistent with the care defined in their plan.

Measurement Notes

- Documentation for the advance care plan measures may appear in consult notes, nursing notes, social work notes, or physician notes.

- A copy of the advance care plan should ideally be included in the individual's hospital and community care charts.

- Data quality may be an issue with some of these performance measures. Improved documentation should be promoted among healthcare professionals.

- Individuals with VCI and family experience surveys should be used to monitor care quality which includes end-of life experiences.

Implementation Resources and Knowledge Transfer Tools

Resources and tools listed below that are external to Heart & Stroke and the Canadian Stroke Best Practice Recommendations may be useful resources for stroke care. However, their inclusion is not an actual or implied endorsement by the Canadian Stroke Best Practices team or Heart & Stroke. The reader is encouraged to review these resources and tools critically and implement them into practice at their discretion.

Healthcare provider information

- Advance Care Planning in Canada: http://www.advancecareplanning.ca/

- Canadian Virtual Hospice: My Grief Learning Modules: https://mygrief.ca/

- Canadian Virtual Hospice: The Learning Hub: https://www.virtualhospice.ca/learninghub

- Canadian Hospice Palliative Care Association Resource: https://www.chpca.ca/knowledge/resources/

- Canadian Virtual Hospice: Decisions: https://www.virtualhospice.ca/en_US/Main+Site+Navigation/Home/Topics/Topics/Decisions.aspx

- Palliative Care Education for All Care Providers: http://pallium.ca/

- Burton and Payne Palliative Care Pathway: http://www.biomedcentral.com/1472-684X/11/22

- Bernacki RE, Block SD. Serious Illness Communications Checklist. Virtual Mentor. 2013;15(12):1045–9. https://www.researchgate.net/profile/Rachelle_Bernacki/publication/259316398_Serious_Illness_Communications_Checklist/links/54463d190cf2f14fb80f2c96/Serious-Illness-Communications-Checklist.pdf

- Registered Nurses Association of Ontario Guidelines for End-of-Life Care: https://rnao.ca/bpg/guidelines/endoflife-care-during-last-days-and-hours

Information for people with lived experience of VCI, including family, friends and caregivers

- Heart & Stroke: Vascular Cognitive Impairment Infographic and Journey Map: https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/vascular-cognitive-impairment/csbpr7-infographic-vci.pdf

- Heart & Stroke: Your Stroke Journey: https://www.heartandstroke.ca/-/media/1-stroke%20best-practices/resources/patient-resources/en-your-stroke-journey-v21

- Heart & Stroke: Post-Stroke Checklist: https://www.heartandstroke.ca/-/media/1-stroke-best-practices/resources/patient-resources/002-17_csbp_post_stroke_checklist_85x11_en_v1

- Heart & Stroke: End-of-Life Care and Palliative Care https://www.heartandstroke.ca/stroke/recovery-and-support/end-of-life-care-and-palliative-care

- Canadian Virtual Hospice: My Grief Learning Modules: https://mygrief.ca/

- Canadian Virtual Hospice: The Learning Hub: https://www.virtualhospice.ca/learninghub

- Advance Care Planning in Canada: http://www.advancecareplanning.ca/

- Canadian Hospice Palliative Care Association Resources:
  https://www.chpca.ca/knowledge/resources/

- Canadian Virtual Hospice: Decisions:
  https://www.virtualhospice.ca/en_US/Main+Site+Navigation/Home/Topics/Topics/Decisions.aspx

- Government of Canada Medical Assistance in Dying: Overview
  https://www.canada.ca/en/health-canada/services/health-services-benefits/medical-assistance-dying.html

- MAiD Family Support: https://maidfamilysupport.ca/

Summary of the Evidence

Palliative and End of life Care

Advance Care Planning
As VCI worsens, most of the decision-making responsibility is left to the health care proxies, typically family members. One key component that should be included is advance care planning (ACP). Elements to consider in advance care planning (ACP) include the patients' prognosis, treatment options, goals of care, and the identification and documentation of end-of-life wishes. In a study of 40 dyads (Huang et al. 2020), including individuals diagnosed with mild cognitive impairment or mild dementia >55 years of age and their family caregivers, an ACP information intervention was conducted in two parts by a senior nurse. The nurse reviewed the contents of an ACP manual, which included topics on the symptoms of end-stage dementia (ESD) and the common end-of-life (EoL) life-sustaining medical treatments, such as CPR, mechanical ventilation, tube feeding, intravenous infusion, and antibiotics. In the second part, the nurse conducted a 60-minute session involving family-centered strategies, aimed at developing an ACP. Following the intervention, there was significant improvement in mean Knowledge of ESD treatment scores, Knowledge of ACP and Decisional conflicts in EoL Care scores, in both patients and caregivers. In a review of reviews, including 19 reviews of individuals with dementia or cognitive impairment and their carers, ACP was associated with decreased hospitalizations, increased concordance between care received and prior wishes and increased completion of ACP documents (Wendrich-van Dael et al. 2020). Bryant et al. included 4 studies of individuals with dementia and/or a carer/ family member (Bryant et al. 2019). The effectiveness of interventions to increase participation in ACP was evaluated. Three interventions used varied structured one-on-one family meetings or consultations with caregivers to deliver education and provide an opportunity to complete an ACP, and the final study used face-to-face group sessions with caregivers, aimed to enhance knowledge, self-efficacy and behavioural skills to make end-of-life treatment plan. The results were mixed. In one study, only 32% of caregivers developed an ACP after the intervention; however, more caregivers in the intervention group changed their decisions regarding life-saving interventions and to have a Medical Order for Life-Sustaining Treatments (MOLST) added to their relative's chart, and to have decided on medical options to be listed in the individual with dementia's advance directive.

Palliative and End-of-Life Care
Early referral to palliative care services has been associated with more inpatient hospice utilization, prevention of overly aggressive treatments, and improved comfort and quality of life for individuals with dementia and their families (Amano et al. 2015) A recent Cochrane review (Walsh et al. 2021) included the results of 9 RCTs including individuals with advanced dementia, and their family members, examining a variety of interventions to improve the palliative care process. These interventions were associated with improvements in mean comfort in dying scores, and an improved likelihood of having a palliative care plan in place (RR=5.84, 95% CI 1.37 to 25.02), although the certainty of the evidence was very low.

Sex, gender and other equity-related considerations

In an online opinion survey of 1,523 randomly selected Canadians from the general population, examining knowledge and attitudes, women were more likely than men to engage in advance care planning activities and to discuss their wishes with family and friends (Teixeira et al. 2015). Another finding was that only a small proportion of respondents were aware of advance care planning.

Individuals with advanced dementia are typically institutionalized, and are commonly subjected to burdensome interventions toward the end of life. These interventions can include transitions between health care facilities, invasive procedures, physical restraints, medications of uncertain benefit and non oral feeding. (Stall et al. 2019) reported sex-specific differences in the frequency of such interventions during the final 30 days of life in a large Ontario cohort of nursing home residents with advanced dementia. Men were 33% more likely to receive antibiotics and 41% more likely to be transitioned to another level of care, usually to an acute care hospital, compared with women. The authors suggest that these differences might be associated more with sociocultural factors than with biological factors.

Appendix One: Vascular Cognitive Impairment Writing Group 2024

Name	Professional role	Location	Declared conflicts of interest
Richard Swartz, MD Ph.D. FRCPC	Stroke Neurologist; Medical Director North East GTA Regional Stroke Program; Director, University of Toronto Stroke Program; Assistant Professor, Department of Medicine (Neurology), Sunnybrook Health Science Centre Associate Professor, University of Toronto Writing Group Co-Chair	Toronto, Ontario	Research grants from the Canadian Institutes for Health Research (CIHR), Ontario Brain Institute (OBI), National Institute of Health (NIH); member of advisory board for Hoffman-LaRoche; and stock options in FollowMD.
Stewart Longman, PhD	Neuropsychologist, Alberta Health Services, Foothills Medical Centre Writing Group Co-Chair	Calgary, Alberta	Support for attending meetings and/or travel for CASEM Annual Sport Medicine Conference
Eric E. Smith, MD, MPH	Medical Director, Alberta Health Services, Cognitive Neurosciences Clinic Professor University of Calgary, Department of Clinical Neurosciences		Royalties or licenses from UpToDate (Royalties paid to him for chapter on diagnosis of VCI); Participation on a Data Safety Monitoring Board or Advisory Board for National Institutes of Health Discovery project; Leadership or fiduciary roles Deputy Editor, Stroke
Anita D. Mountain, MD FRCPC	ABI Program Co- Lead & Assistant Professor, Dalhousie University, Department of Medicine, Division of Physical Medicine and Rehabilitation	Halifax, Nova Scotia	Grants from Brain Canada, Heart and Stroke Foundation of Canada, Canadian Partnership for Stroke Recovery/CIHR/Governors of the University of Calgary; Site Qualified Investigator for FLOW Trial/MODEX Trial/CAMAROS Trial.

Melissa Austin, MSc. (OT)	Occupational Therapy Practice Leader,Vancouver Coastal Health Clinical Instructor, The University of British Columbia, Department of Occupational Science and Occupational Therapy, Faculty of Medicine	British Columbia	No conflicts to declare
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Sherri Carter Ph.D., R.Psych.	Psychologist, Acquired Brain Injury Program, Nova Scotia Rehabilitation Centre Clinical Associate,	Halifax, Nova Scotia	No conflicts to declare

	Dalhousie University, Department of Psychology and Neuroscience		
Nelly Chow, BA,BSW,RSW	Social Worker, Alberta Health Services, Department of Clinical Neurosciences, Neuro Rehabilitation	Calgary, Alberta	No conflicts to declare
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Gail A. Eskes, Ph.D., R. Psych.	Professor, Dalhousie University, Departments of Psychiatry and Psychology & Neuroscience	Halifax, Nova Scotia	Grants or contracts from Nova Scotia Health, CIHR Health Research Training Platform, Innovacorp, Dalhousie University - NSH, Dalhousie - Operating funds; CIHR - Training Grant; payment or honoraria from Mount Allison University; Parkinson Canada; Patents planned, issued, or pending: UK Patent pending for cognitive enhancement technology.
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Lesley Fellows, MDCM, Dphil	Neurologist, McGill University, Health Centre Stroke Program

Professor, McGill University, Department of Neurology & Neurosurgery | Montreal, Quebec | Grants from the Canadian Institutes of Health Research, FRQS (Fonds de recherche du Québec). |
| Norine Foley, MSc | Partner, workHORSE Consulting Group | London, Ontario | No conflicts to declare |
| Aravind Ganesh, MD, DPhil, FRCPC | Vascular and Cognitive Neurologist, Department of Clinical Neurosciences Faculty of Medicine, University of Calgary

Assistant Professor, University of Calgary, Cumming School of Medicine, Department of Clinical Neurosciences | Calgary, Alberta | New investigator award from the Heart and Stroke Foundation of Canada; research grants from the Canadian Institutes of Health Research, Canadian Cardiovascular Society, Alberta Innovates, Campus Alberta Neuroscience, Government of Canada – INOVAIT Program, Government of Canada – New Frontiers in Research Fund, Microvention, Alzheimer Society of Canada, Alzheimer Society of Alberta and Northwest Territories, Heart and Stroke Foundation of Canada, Panmure House, Brain Canada, MSI Foundation, France-Canada Research Fund;

Consulting fees from MD Analytics, My Medical Panel, Figure 1, CTC Communications Corp, Atheneum, Deep Bench, Research on Mind, Creative Research Designs, Alpha Sights, 42mr; Payment or honoraria from Figure 1, Alexion, Biogen, Servier Canada; Expert Testimony: Grosso Harper Law, Lerners Law; Support for attending meetings and/or travel: American Academy of Neurology, Association of Indian Neurologists in America, American Heart Association, University of Calgary; patents |

			planned, issued or pending: Patent filed for (1) a system for patient monitoring and delivery of remote ischemic conditioning or other cuff-based therapies and (2) systems and methods for enhancing the efficiency of initiating, conducting and funding research projects; Leadership or fiduciary role paid or unpaid: Member of editorial board for Neurology: Clinical Practice, Neurology, Stroke; Stock or stock options: SnapDx Inc, Collavidence Inc (LetsGetProof) - Patient monitoring and decision support technology, Research crowdfunding and collaboration platform.
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Carol Léonard, PhD	Associate Professor, University of Ottawa, School of Rehabilitation Sciences, Department of Audiology and Speech-Language Pathology	Ottawa, Ontario	No conflicts to declare
Patrice Lindsay RN, PhD	Lead PWLE Engagement Strategy and Stroke, Heart and Stroke Foundation of Canada	Toronto, Ontario	Member of the March of Dimes Canada After Stroke advisory committee (no financial remuneration)
Rebecca Lund MSc.OT	Manager, Stroke, Heart and Stroke Foundation of Canada	Kingston, Ontario	No conflicts to declare
Chelsy Martin MScPT	Project Lead, Canadian Stroke Best Practices, Heart and Stroke Foundation of Canada	Ottawa, Ontario	No conflicts to declare
Ronak Patel, PhD, C.	Clinical Neuropsychologist and	Winnipeg, Manitoba	No conflicts to declare

Psych., ABPP-CN	Assistant Professor, University of Manitoba, Department of Clinical Health Psychology, Max Rady College of Medicine, Rady Faculty of Health Sciences		
Sepideh Pooyania, MD. FRCPC	Stroke Rehabilitation Service Chief, Winnipeg Regional Health Authority, Department of Rehabilitation Sciences Associate Professor, University of Manitoba, Section of Physical Medicine and Rehabilitation Max Rady College of Medicine	Winnipeg, Manitoba	No conflicts to declare
Valérie Poulin, OT, Ph.D.	Professor, Université du Québec à Trois-Rivières, Department of occupational therapy,	Trois-Rivières, Quebec	No conflicts to declare
Fatima Quraishi, OT Reg. (Ont.), MBA	Director Regional Stroke Program Southeast Toronto Stroke Network, Unity Health Toronto Adjunct Lecturer, University of Toronto, Department of Occupational Science and Occupational Therapy, Faculty of Medicine	Toronto, Ontario	No conflicts to declare
Pamela Roach, Ph.D	Assistant Professor, University of Calgary, Departments of Family Medicine and Community Health Sciences, Cumming School of Medicine	Calgary, Alberta	No conflicts to declare
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	Program, Parkwood Institute Professor, Fanshawe College, OTA/PTA program		
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Appendix Two: Vascular Cognitive Impairment External Reviewers 2024

Name	Professional role	Location	Declared conflicts of interest
Joy Boyce, OT Reg. (NS)	Occupational Therapist, Nova Scotia Health Authority Early Supported Stroke Discharge Coordinator	Halifax, NS	No conflicts to declare
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Mary-Lou Halabi, Bsc., MScOT	Lead - Special Projects - Stroke, Cardiovascular Health and Stroke Strategic Clinical Network™ Cardiovascular Health and Stroke Strategic Clinical Network, Alberta Health Services	Edmonton, Alberta	No conflicts to declare
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Raed Joundi, MD, MSc, DPhil, FRPCPC	Stroke Neurologist, Associate Professor McMaster University	Hamilton, ON	Clinical trial, Bayer Site Principal Investigator for OCEANIC trial
Elise Lamy, Erg.	Occupational therapist programme de neurologie à l'Hôpital de réadaptation Villa Medica, à Montréal	Montreal, QC	No conflicts to declare
Anik Laneville, OT Reg. (Ont), BSc OT	Occupational Therapist Best Practice Team Champlain Regional Stroke Network	Ottawa, ON	No conflicts to declare

Haakon B. Nygaard, MD, PhD	Associate Professor, University of British Columbia, Division of Neurology, Department of Medicine, Faculty of Medicine Fipke Professor in Alzheimer's Research Director, UBCH Clinic for Alzheimer Disease and Related Disorders	Vancouver, BC	Grant or an honorarium from a for-profit or not-for-profit organization, Biogen, Hoffman-la Roche, Eisai Paid Alzheimer's advisory board member Patent for a drug, product, or device, Yale University Inventor Distribution Agreement, OCR 4677 "PrionProtein as a Receptor for Amyloid-Beta Oligomers."2009
Terence J Quinn FWSO, FESO, FRCP, MD, MBChB (hons), Bsc (hons)	David Cargill Chair and Honorary Consultant Physician in Geriatric and Stroke Medicine School of Cardiovascular and Metabolic Health College of Medical, Veterinary and Life Sciences, University of Glasgow	Glasgow	No conflicts to declare
Jennifer Rabin, PhD, CPsych	Assistant Professor, University of Toronto, Division of Neurology, Department of Medicine, Sunnybrook Health Sciences Centre Scientist, Hurvitz Brain Sciences Program, Sunnybrook Research Institute	Toronto, ON	Harquail Centre for Neuromodulation, Sandra BlackCentre for Brain Resilience & Supports my salary Grant or an honorarium from a for-profit or not-for-profit organization, CIHR, NSERC, Alzheimer's Society of Canada,Alzheimer's Association, University of Toronto Funding for research
Angela Roberts, MA, PhD CASLPO-reg (SLP)	Assistant Professor of Communication Sciences & Disorders and Computer Science Canada Research Chair, Data Analytics and Digital Health in Cognitive Aging and Dementia	London, ON	Grant or an honorarium from a for-profit or not-for-profit organization, National Institutes of Health; Canadian Research Chairs program Principal Investigator Patent for a drug, product, or device, U.S. Patent office

	Director Collaborative Specialization Machine Learning in Health and Biomedical Science University of Western Ontario		Description of Co-inventor wearable devices and technologies formeasuring speech and swallowing Clinical trial, National Institutes of Health Principal Investigator
Paolo Vitali MD, PhD, FRCPC	Cognitive Neurologist, McGill University Research Centre for Studies on Aging Assistant Professor, McGill University, Department of Neurology and Neurosurgery, Faculty of Medicine		Grant or an honorarium from a for-profit or not-for-profit organization, NovoNordisk, Eisai, Lilly, IntelGenx Corp. Advisory consultant for NovoNordisk and Eisai Medical education grant from Lilly, clinical trial support from NovoNordisk, Member of the Data Safety Monitoring Board (DSMB) supporting IntelGenx Corp Received payment from an organization (including gifts, other consideration, or in-kind compensation). NovoNordisk, Eisai Clinical trial, NovoNordisk, Dian-Tu

Appendix Three: Signs and Symptoms of Vascular Cognitive Impairment

	Examples of PWLE & Family reported signs and symptoms	Examples of clinical interview, clinical observations, or findings on clinical examination	Experiences reflected in VCI Journey Map
Executive Function	Difficulties figuring out new strategies Poor monitoring of the environment for safety Unsafe driving Difficulty with multitasking Disliking busy, crowded, or distracting environments Changes in ability to manage bill payments, finances, medications, appointments, scheduling, and/or social plans Needing new strategies to manage daily activities or hide challenges Partner/spouse/child/carer needing to provide more support Loses train of thought easily Misplaces / loses objects & may think they have been stolen Problems with decision-making and learning from feedback Making poor decisions Struggling with job performance Impaired social cognition: interpreting social contexts, emotion recognition, empathy	Impairments in: o sustaining attention o speed of information processing o forming verbal &/or nonverbal concepts o verbal &/or nonverbal reasoning o recognizing own impairments Reduced cognitive flexibility (set shifting) Perseverations in conversation or on tasks Impaired response control Increased susceptibility to delirium Decline in ability to analyze a situation, develop an effective plan, and communicate that plan to others Problems with executive tasks on exam (e.g., serial 7's, go, no-go) or bedside screening (e.g., clock drawing, Trails B) Does not initiate tasks, conversations Poor judgement, does not appreciate consequences of poor decisions	Changes misattributed to lifestyle stress, hearing loss, age Challenges participating in daily activities & roles in the community Develop / use strategies to manage daily activities Hide challenges by developing compensatory strategies Accommodations for return to work Grieve losses Uncertainty Discuss plan for future
Memory	Unusual difficulties		Changes misattributed to

	recalling names or finding words Repeating questions or stories Forgetting appointments, medications Needing to use new strategies to manage daily activities Loses train of thought easily Partner/spouse/child/carer needing to provide more support Misplaces / loses objects and may think they have been stolen	Difficulties remembering o new information o recent activities o to turn off the stove o to turn off the tap o to take medications o to pay bills o how to get to familiar places Impairments in learning & retrieval of information (verbal/non-verbal) Poor 3- or 5-word recall	lifestyle stress, hearing loss, age
Other Focal	Speech problems New difficulties with math New problems following routes, getting to places Difficulty understanding left vs. right Getting lost Problems using objects or tools like phones, toothbrushes	Impairments in word finding or naming Acalculia Extinction, neglect Visuospatial challenges Left-right confusion Apraxia	Cognitive difficulties not recognized by individual, partner, family &/or health care providers Develop & use strategies to manage daily activities Living accommodation Limited access to health care providers / services Changes to roles & relationships as family assists Uncertainty Impact on identity & self-determination
Global/Functional	Challenges participating in daily activities & roles in the community Changes misattributed to lifestyle stress, hearing loss, age Family members and caregivers needing to provide more support	o easily distracted o can only focus on one thing at a time o tires easily on tasks requiring cognitive effort o does not take initiative o slow to think / speak o irritable, 'short fuse' o repetitive Disagrees with others about what can do independently or safely Would the individual with	Changes to roles & relationships as family assists Impact on identity & self-determination Impact on capacity to give consent or exercise own authority Uncertainty Diagnosis may/may not occur Accommodations for

		VCI or their family or caregivers feel comfortable letting the individual; with VCI drive a young child or loved one by themselves?	return to work
			Grieve losses
			Impact on identity & self-determination
			Uncertainty
			Discuss plan for future

Appendix Four: Summary of selected screening and initial assessment tools for vascular cognitive impairment

This table provides additional information on a selection of cognitive screening and assessment tools that have been identified through the literature review for the Canadian Stroke Best Practice Recommendations: Vascular Cognitive Impairment, 7th Edition Update 2024. This is not intended to be an exhaustive list, rather as a starting place for researchers and clinicians in identifying validated tools. A full reference list can be found at the end of the table.

Assessment Tool	Purpose	Items and Administration	Availability
Quick Screening Tools (≤5 minutes to administer)			
6-Item Cognitive Impairment test (6-CIT) **Brooke & Bullock 1999**	A dementia screening tool designed for use in primary care.	6 items: 1. What year is it? (correct-0; incorrect 4) 2. What month is it? (correct-0; incorrect-3) 3. About what time is it (within one hour)? (correct-0; incorrect-3) 4. Count backwards from 20-1. (no errors-0; 1 error-2; ≥1 error-4) 5. Say the months of the year in reverse. (no errors-0; 1 error-2; ≥1 error-4) 6. Repeat an address phase given after Q2. (no errors-0; errors range from 2-10 depending on the number of errors). Total scores range from 0 to 28. Scores of 0-7 are considered normal, while scores ≥ 8 are more significant. Test takes 3-4 minutes to complete. Does not require specialized training for administration	Free https://www.mindwell-leeds.org.uk/wp-content/uploads/2021/03/6CIT.pdf
Clock Drawing Test (CDT) **Sunderland et al. 1989**	A screening tool for cognitive impairment.	Involves a command to draw a clock or to copy a clock. Score Interpretation: No universal system for scoring exists. Individual scoring systems are based on the number of deviations from what is expected from the drawing. Takes approximately 1-2 minutes to complete by the individual with VCI. Does not require additional equipment or specialized training for administration.	Free http://www.strokengine.ca/?s=clock+drawing
Memory Impairment Screen (MIS) **Buschke et al. 1999**	A brief screening tool to evaluate memory.	1. A sheet of paper with 4 words in ≥24 upper case font is presented to the individual with VCI. 2. Tell the individual with VCI that each item belongs to a different category. Give a category cue and ask individual with VCI to indicate which of the words belongs in the stated category (e.g., "Which one is the game?").	Free Available on many websites https://www.cogsclub.org.uk/professionals/files/The_Memory_Impa

Assessment Tool	Purpose	Items and Administration	Availability
		Allow up to 5 attempts. Failure to complete this task indicates possible cognitive impairment. 3. When the individual with VCI identifies all 4 words, remove the sheet of paper. Tell the individual with VCI that he or she will be asked to remember the words in a few minutes. 4. Engage individual with VCI in distractor activity for 2 to 3 minutes, such as counting to 20 and back, counting back from 100 by 7, spelling WORLD backwards. 5. FREE RECALL — 2 points per word: Ask individual with VCI to state as many of the 4 words he or she can recall. Allow at least 5 seconds per item for free recall. Continue to step 6 if no more words have been recalled for 10 seconds. 6. CUED RECALL — 1 point per word: Read the appropriate category cue for each word not recalled during free recall (e.g., "What was the game?"). Scores range from 0 to 8. Scores of 5-8 indicate no cognitive impairment; scores ≤ 4 indicate possible cognitive impairment. Takes <5 minutes to complete.	irment_Screen.pdf https://www.alz.org/media/documents/memory-impairment-screening-mis.pdf
Mini Cog **Borson et al. 2003**	A rapid screening test for Alzheimer's disease	There are 2 components, word recall (scores range from 0-3 with one point awarded for each word correctly recalled) and a clock drawing test where the individual with VCI is asked to place the numbers in a provided circle and set the hands to ten past eleven (0-2 points). Total scores range from 0-5. Cut offs of <3 and <4 have been used to identify possible deficits. Test takes 3-4 minutes to complete.	Free https://mini-cog.com/
The General Practitioner Assessment of Cognition (GPCOG) **Brodaty et al. 2002**	A brief screening tool for VCI	Patient portion (5 components) 1. The test administrator or healthcare provider asks the individual to repeat and remember a name and address (e.g., John Brown, 42 West Street, Kensington) and recall it in a few minutes. 2. The individual is asked to state today's date. 3. The test administrator provides a blank page with a circle and asks the individual to make a clock drawing with all of the numbers drawn correctly on the face of the clock. 4. The individual is then asked to draw in the clock's hands so that it reads 10 minutes past 11 o'clock. 5.The test administrator asks the individual to describe something specific that has happened in the news in the last week. Scores range from 0 to 9 points. In the name and address recall section, one	Free https://www.alz.org/media/documents/gpcog-screening-test-english.pdf

Assessment Tool	Purpose	Items and Administration	Availability
		point is given for correctly providing each of the answers (for a score of up to five points).	
		First name, last name, street number, street name and city name.	
		One point is given for saying the correct date. The exact date required to get credit.	
		One point is given for correctly drawing the clock. Another point is given for correctly drawing the hands of the clock to show 10 minutes past 11 o'clock.	
		A point is awarded for telling the administrator something specific from recent news in the past week.	
		No further assessment is needed if the individual scores the maximum total of 9 points. If an individual with VCI scores 5-8, proceed with Step 2, informant section. Test takes 2-5 minutes to complete. Informant section	
		The test administrator asks a caregiver or family member if the individual has more difficulty than they used to five to 10 years ago with the following tasks: recent memory, memory for conversations held a few days ago, word-finding difficulty, managing finances, medication management or the ability to handle transportation needs.	
		If the informant indicates a decline in three or more of these areas, the individual likely has cognitive impairment.	
6-Item Screener (SIS) **Callahan et al. 2002**	A brief screen for cognitive impairment	There is a 3-item recall component (apple, table, penny), whereby the patients should be able to repeat the words three items initially, and then recall them after 5 minutes; there is also a 3-item temporal orientation component (day of the week, month, year). Scores range from 0-6. Scores of 4-6 indicate that impairment is less likely, while scores of 0-3 indicate that impairment is likely. Test takes 1-2 minutes to complete.	Free https://www.merckmanuals.com/medical-calculators/CognitiveImpairment6.htm
Depression, Obstructive Sleep Apnea and Cognitive Impairment (DOC) Screen **Swartz et al. 2017**	To identify patients who are at high-risk for depression, obstructive sleep apnea (OSA) and cognitive impairment	The DOC Screen is an integrated tool that combines the PHQ-2, a screening tool with 2 questions regarding mood, scored from 0 to 3, (total 0 to 6); The STOP questionnaire, a 4-question screen for OSA (total scores range from 0-4); and a 10-point version of the MoCA (5-word recall (5 points), clock drawing (3 points), and abstraction (2 points). Total scores range from 0-20. For interpretation of data, raw scores from each of the 3 domains are entered into a form on the DOC screen	Free http://www.docscreen.ca/

Assessment Tool	Purpose	Items and Administration	Availability
		website. Takes approximately 5 minutes to complete. No specialized equipment or training is required.	
Eight-item Informant Interview to Differentiate Aging and Dementia (AD8®) **Galvin et al. 2005**	An **informant-based** interview, to be completed by a spouse, adult child, friend who knew the older adult well. Developed to help discriminate between signs of normal aging and mild VCI.	8 items enquiring about changes in the past year (response categories are yes [1 point], no [0 points], and don't know) 1. Problems with judgment (e.g., problems making decisions, bad financial decisions, problems with thinking). 2. Less interest in hobbies/activities 3. Repeats the same things over and over (questions, stories, or statements) 4. Trouble learning how to use a tool, appliance, or gadget (e.g., VCR, computer, microwave, remote control) 5. Forgets correct month or year 6. Trouble handling complicated financial affairs (e.g., balancing checkbook, income taxes, paying bills) 7. Trouble remembering appointments 8. Daily problems with thinking and/or memory Scores of 0-1 indicate normal cognition, scores of ≥2 indicate impaired cognition.	The user is required to agree to the terms of a license agreement from Washington University and to complete and submit an access form in order to download the tool, which may be used for clinical and research purposes. https://otm.wustl.edu/ad8-terms-agreement/
Mini Addenbrooke's Cognitive Examination (Mini ACE) **Hsieh et al. 2015**	A brief screening test for mild cognitive impairment and dementia	Five components Attention: day, date, month year (0-4 points) Memory: recall of name and address (0-7 points) Fluency: name as many animals as possible in one minute (0-7 points) Clock drawing +hands at 10 past 5 (0-5 points) Recall of name and address (0-7 points) Total scores ranged from 0-30. There are 2 cut-offs: 25 and 21. The latter is recommended when the test is used with general clinical populations as part of a VCI assessment. The test takes 5 minutes to complete. Training is required, in the form of watching a video (30-60 minutes).	Free https://remedy.bnssg.icb.nhs.uk/media/2787/mini-ace.pdf
Screening Tools (≥5 minutes to administer)			
Addenbrooke's Cognitive Examination (ACE) **Hsieh et al. 2013**	A test to aid in the detection of cognitive impairment, especially in the detection of Alzheimer's disease and fronto-temporal dementia	Includes 3 components assessing attention (scores range from 0-18), three components assessing memory (scores range from 0-26), fluency (scores range from 0-14), language (0-26), and visuospatial ability (scores range from 0-16). Total scores range from 0-100. Scores <88 and <82 have been recommended as cut-off points	Free https://www.sydney.edu.au/brain-mind/resources-for-clinicians/dementia-test.html

Assessment Tool	Purpose	Items and Administration	Availability
		for suspicion of VCI. Test takes approximately 15-30 minutes to complete (and 15 minutes to score). Training is required. A training course is available through the University of Glasgow. (There are 3 US versions of the test)	
Free Cog **Burns et al. 2021**	A hybrid screening instrument incorporating tests of cognitive and executive function	Components include: General knowledge (0-1 points) Orientation to time (0-3 points); place (0-3 points) Registration: repeat five words to be recalled later (no points awarded) Calculation (0-3 points) Attention/calculation (0-2 points) Memory recall of 5 previously presented words (0-5 points) Verbal fluency in 1 minute (0-1 point) Language: Naming (0-2); Repetition (0-1); Write a sentence (0-1) Visuospatial draw a clock with hands set at 10 past 11:00 (0-3) Executive function 5 questions relating to social function, travel, home, emergency, and care function (0-5 points) Total possible score of 30 points. A score of ≤22 is indicative of mild cognitive impairment. No formal training is required. The test takes 5-10 minutes to complete.	Free https://psychscenehub.com/wp-content/uploads/2021/03/FInal-Free-Cog-Tool-1.pdf
Montreal Cognitive Assessment (MoCA) **Nasreddine et al. 2005**	The MoCA is a screening tool for mild cognitive impairment.	Eleven items relating to 8 cognitive domains (visuospatial, executive, naming, memory, language, abstraction, delayed recall, and orientation). Items are in the form of questions or tasks. Score Interpretation: Maximum score is 30; higher scores indicate greater cognitive functioning. Total score ≥26 is considered normal. The test takes approximately 5-10 minutes to administer, requires extra equipment (stopwatch and score sheet) and some training (required reading).	Free http://www.mocatest.org/
Mini-Mental State Examination (MMSE) **Folstein et al. 1975**	The MMSE is a **screening** tool for cognitive impairment.	Eleven items relating to 6 cognitive domains (orientation – in time and space, registration, attention and calculation, recall, language and read and obey). Items are in the form of questions or tasks. Maximum score is 30, where higher scores indicate greater cognitive functioning. A score	Available for purchase. http://www4.parinc.com/Products/Product.aspx?ProductID=MMSE

Assessment Tool	Purpose	Items and Administration	Availability
		of <24 indicates possible cognitive impairment. The test takes approximately 10 minutes to administer. No specialized training required. A newer version, MMSE-2® is also available.	
Rowland Universal Dementia Assessment Scale (RUDAS) **Storey et al. 2004**	Designed to detect VCI in culturally and linguistically diverse populations	Memory: repeat and later recall four items (not scored) Visuospatial (body orientation): identify eight body parts (possible score 0-5) Praxis: copy the testers action or exercise (possible score 0-2) Drawing: draw a 3-D square box (possible score 0-3) Judgement - Crossing the Street: (possible score 0-4) Memory: recall items from beginning of the test (possible score 0-8) Language: Name as many animals as you can in 60 seconds (scores 0-8) Total possible score is 30 points. A score of ≤22 is the threshold for possible dementia. The test takes 10-15 minutes to complete.	Free https://www.dementia.org.au/sites/default/files/20110311_2011RUDASAdminScoringGuide.pdf
Informant Questionnaire on Cognitive Decline in the Elderly (Short IQCODE) **Jorm 1994**	**Informant** based test designed to assess cognitive decline and dementia in elderly people, to be completed by a relative or friend who has known the elderly individual for 10 years or more.	Sixteen items with a 5-point scoring for each question ranging from much worse (5 point) to much improved (1 point). 1. Remembering things about family and friends (e.g., occupations, birthdays) 2. Remembering things that have happened recently? 3. Recalling conversations a few days later? 4. Remembering his/her address and telephone number? 5. Remembering what day and month it is? 6. Remembering where things are usually kept? 7. Remembering where to find things which have been put in a different place from usual? 8. Knowing how to work familiar machines around the house? 9. Learning to use a new gadget or machine around the house? 10. Learning new things in general? 11. Following a story in a book or on TV? 12. Making decisions on everyday matters? 13. Handling money for shopping? 14. Handling financial matters - e.g., the pension, dealing with the bank? 15. Handling other everyday arithmetic problems - e.g., knowing how much food to	Free https://patient.info/doctor/informant-questionnaire-on-cognitive-decline-in-the-elderly-iqcode

Assessment Tool	Purpose	Items and Administration	Availability
		buy, knowing how long between visits from family or friends? 16. Using his/her intelligence to understand what's going on and to reason things through? Cut-off scores of 3.38-3.88/question have been reported to identify possible VCI (Jorm et al. 2004). The test takes approximately 5-7 minutes to complete. A 26-item (original version) of this test is also available.	
Test Your Memory (TYM) **Brown et al. 2009**	A **self-assessment** test that covers a broad range of cognitive domains	Questions include: Orientation to person and time Copy a sentence. Who is the Prime Minister? In what year the World War I start? Complete 4 simple arithmetic calculations List four creatures beginning with S. Explain why a carrot is like a potato and a why a lion is like a wolf. Name 5 items on drawing. Join circles together to form a letter. Draw a clock face. Write down sentence copied earlier. Total possible score is 50 points. Scores <33 indicate severe cognitive impairment, while scores between 33 and 45 (if 80+ years of age) or 33 and 46 (if younger than 80 years of age), indicate mild cognitive impairment. Test takes 5-10 minutes to complete.	Free https://www.bmj.com/content/suppl/2009/06/04/bmj.b2030.DC1/broj611491.ww1_default.pdf
Multifactorial Memory Questionnaire (MMQ) **Troyer & Rich 2002**	A **self-report questionnaire** that assesses multiple dimensions of metamemory, useful for clinical assessment and interventions.	Composed of 3 subscales 1. MMQ Satisfaction includes 18 questions related to: "how I feel about my memory" Each question is scored on a 5-point scale from strongly disagree (0) to strongly agree (4). 2. MMQ Ability includes 20 questions related to memory mistakes. Each question is scored on a 5-point scale from never (0) to all the time (4). 3. MMQ Strategy includes 19 questions related to the use of memory strategies. Each question is scored on a 5-point scale from never (0) to all the time (4). The test taker should be told to base responses on their experience during the previous 2 weeks. Raw scores for each section are converted to T scores based on normative data.	Free www.baycrest.org/mmq.

Assessment Tool	Purpose	Items and Administration	Availability
		Interpretation of scores is presented in Table 4.1 of the MMQ manual, available at: https://www.baycrest.org/Baycrest_Centre/media/content/form_files/MMQ-Manual-2018_ebook.pdf	
Screening Tools for Remote Use			
Tele-Free-Cog **Larner et al. 2021**	Adapted from original tool for use during the Covid-19 pandemic.	An adaptation of the Free-Cog that excludes three components, 'visuospatial' (clock face) 'language' (name ear/fingernail and 'write a sentence') and orientation to place. The denominator is reduced from 30 to 21. For diagnosis of VCI a cur-off of ≤10 has been shown to have a sensitivity of 0.80 and specificity of 0.89.	Free (original version) https://psychscenehub.com/wp-content/uploads/2021/03/FInal-Free-Cog-Tool-1.pdf
Telephone Interview for Cognitive Status (TICS) **Brandt et al. 1988**	A test of cognitive functioning that was developed for use in situations where in-person cognitive screening is impractical or inefficient.	A derivation of the Folstein Mini-Mental State Examination (MMSE) There are 11 items, assessing orientation to time and place, attention, short-term memory, sentence repetition, immediate recall, naming to verbal description, word opposites, and praxis. Possible scores range from 0-41. A cut-off of 28 has been shown to identify individuals with post-stroke VCI, with a sensitivity of 88% and a specificity of 85% (Barber & Scott 2004). Takes approximately 10 minutes to administer	Available for purchase https://www.parinc.com/Products/Pkey/445
Telephone Interview for Cognitive Status – Modified (TICS-M) **Welsh et al. 1993**	See above	A modification of the TICS. There are 12 items (one additional item-delayed recall of 10 words), with possible scores ranging from 0-50. A cut-off of 30/31 identified elderly individuals with VCI, living in a care home, with a sensitivity of 85% and a specificity of 83%, when using in-person neuropsychological testing as reference standard. Takes approximately 10-20 minutes to administer.	
Tele-MMSE (26-item version) **Newkirk et al. 2004**	Alternative method to in-person clinic visits to screen for VCI	A 26-point adaptation of the older, 22-item ALFI-MMSE (Roccaforte et al, 2002), which contains the additions of a 3-step command: "Say hello, tap the mouthpiece of the phone 3 times, then say I'm back". It also contains a new question that requests that the individual with VCI give the interviewer a phone number where they can usually be reached. A Tele MMSE score of 20 is equivalent to an MMSE score of 23 (cut-ff for possible cognitive impairment). Takes approximately 5-10 minutes to administer.	
Assessment Tools for Vascular Cognitive Impairment and Dementia			

Assessment Tool	Purpose	Items and Administration	Availability
NINDS-CSN Harmonization VCI Neuropsychology Protocols **Hachinski et al. 2006**	Designed to measure vascular cognitive impairment in stroke patients	Three different versions exist: 60 Minute - composed of four domains, within which there are several individual tests of executive/activation function (e.g., animal naming), visuospatial, language/lexical retrieval, memory and learning, and neuropsychiatric/depressive symptoms. 30 Minute - semantic and phonemic fluency, Digit Symbol-Coding, revised Hopkins Verbal Learning Test, CES-D, and Neuropsychiatric Inventory. 5 Minute - subtests from the Montreal Cognitive Assessment, including a 5-word immediate and delayed memory test, a 6-item orientation task and a 1-letter phonemic fluency test (F).	-
Cambridge Cognition Examination (CAMCOG) **Roth et al. 1986**	Designed to be a standardized assessment instrument for diagnosis and grading of VCI	CAMCOG consists of 67 items, divided into 8 subscales: orientation, language (comprehension and expression), memory (remote, recent and learning), attention, praxis, calculation, abstraction and perception. Total score ranges from 0 to 106. Scores lower than 80 are considered indicative of VCI. Among the 67 items, 39 are scored as 'right' or 'wrong'; 11 are scored on a 3-point scale with 'wrong', 'right to a certain degree' or 'completely right' as response options; 9 items encompass questions or commands, and the score for each item is the sum of the correct answers; and 8 items are not scored. Five of the non-scored items are from the MMSE and they are not included in the total score because they are assessed in more detail by other CAMCOG items. The remaining 3 items are optional. The CAMCOG takes 60 minutes to administer.	The CAMCOG can be obtained by purchasing the entire CAMDEX and CAMDEX-DS II through Amazon or Cambridge University Press.
Cognitive- Functional Independence Measure (Cognitive-FIM) **Keith et al. 1987**	Designed to offer a uniform system of measurement for disability based on the International Classification of Impairment, Disabilities and Handicaps.	5 cognitive items including communication (2 items) and social cognition (3 items) are contained with the broader FIM instrument (18 items in total) Comprehension, expression, social interaction, problem solving, and memory. The level of an individual with VCI's disability indicates the burden of caring for them and items are scored based on how much assistance is required for the individual to carry out activities of daily living. Each item on the FIM is scored on a 7-point Likert scale, indicating the amount of assistance required to perform each item (1=total assistance in all areas, 7=total independence in all areas). The ratings are based on performance by observation. For the cognitive domain, possible scores range from 5 to 35. FIM must be administered by trained	FIM is proprietary. https://www.udsmr.org/products/the-fim-system-snf-subacute https://www.udsmr.org/products/inpatient-rehab

Assessment Tool	Purpose	Items and Administration	Availability
		evaluator(s) and takes approximately 30-45 minutes to complete.	
Frontal Assessment Battery (FAB) **Dubois et al. 2000**	Designed to be a brief tool to be used at the bedside or in a clinic setting to discriminate between dementias with a frontal dysexecutive phenotype and Dementia of Alzheimer's Type (DAT).	6 items 1. Conceptualization (similarities) possible score of 0-3 2. Lexical fluency (mental flexibility) possible scores of 0-3 3. Motor series "Luria" test (programming) possible scores of 0-3 4. Conflicting instructions (sensitivity to interference) possible scores of 0-3. 5. Go–No Go (inhibitory control) possible scores of 0-3. 6. Prehension behaviour (environmental autonomy) possible scores of 0-3 A cut off score of 12 has a sensitivity of 77% and specificity of 87% in differentiating between frontal dysexecutive type dementias and DAT. The test can be completed in approximately 10 minutes.	Free https://psychscenehub.com/wp-content/uploads/2018/07/Frontal_FAB_Scale.pdf
Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) **Randolph et al. 1998**	Designed to be a brief neurocognitive battery with four alternate forms	5 items Immediate memory (list learning, story memory) Visuospatial/Constructional (figure copy/line orientation) Language (picture naming/semantic fluency) Attention (digit span/coding) Delayed memory (list recall/list recognition/story recall/figure recall) The RBANS uses standard scores (mean= 100, standard deviation=15) Raw scores in each domain are converted to index scores. The results are compared with normative data. The test takes approximately 30 minutes to complete.	Available for purchase https://www.pearsonassessments.com/

REFERENCES FOR APPENDIX FOUR: SUMMARY OF SELECTED SCREENING AND INITIAL ASSESSMENT TOOLS FOR VASCULAR COGNITIVE IMPAIRMENT

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APPENDIX FIVE: THE LIVED EXPERIENCE OF VASCULAR COGNITIVE IMPAIRMENT JOURNEY MAP (SWARTZ ET AL. 2025)

	Symptom onset	Pre-diagnosis	Diagnosis				Management	Living with VCI
Symptoms	Pre-existing, sudden experience, evolving, accumulative and/or increasing symptoms of vascular condition	Identification (by self, family and/or caregiver) of cognitive changes	Experiencing a significant event leading to seeking healthcare involvement	Access to diagnostic testing	Confirmation of diagnosis, explanation of cognitive changes and management	Need for follow up, management plan, goals, next steps		Ongoing adaptations to changing needs
Navigating care		Lack of awareness of when, where and how to access care	Limited access to HCPs and services	Need recognition from HCPs about cognitive changes/concerns	Long process with multiple referrals and investigations	Access to rehabilitation, community resources and living accommodations	Lack of appropriate services and information (e.g. life stage, current abilities & goals, age)	Education and information on "what to expect" for the person and their family	Peer support for the person, family and/or caregiver
Managing daily activities	Challenges with managing daily activities and roles / Attributing changes to lifestyle factors (e.g., aging, hearing loss, stress)	Limiting challenges by using compensation		Developing and using strategies to manage daily activities	Accommodations and guidance on returning to work, school and community participation		Support for returning to leisure activities	Financial considerations and support / Maintaining or re-establishing person-hood and identity
Emotions and mental health	Uncertainty	Grieving losses and changes				Need for mental health support (e.g., depression)	Developing and using coping strategies to support mental health (for the person, family and caregivers)	Finding meaning, purpose and quality of life for the person, family and/or caregiver
Relationship to self and others		Changes to roles and relationships, assistance from family	Diagnosis has impact on identity, consent and autonomy	Family support and advocacy	Begin to discuss wishes and plan for future		Relationships with HCPs and client-centered care	Establishing a supportive network to promote self-management and advocacy

Each journey is unique to the person (person living with VCI, family or caregiver). This Journey Map has been created to support people living with VCI, families, caregivers and healthcare providers (HCP) in understanding elements of the experience of living with VCI. A person's journey may be impacted by many intersecting factors such as: life stage, current abilities, goals, geographic location, sex, gender, sexual orientation, race, indigeneity, culture, age and other social determinants of health. While this journey map is an example of an experience of VCI, individuals may experience any of these elements at multiple times or throughout their personal journey. There also may be other important elements within a person's journey that are not included on this map which should be respected, using a person centred approach. The journey map was developed in consultation with a Heart & Stroke Community Consultation and Review Panel, as well as extensive consultation with external stakeholders including but not limited to: people with lived experience of VCI, caregivers, researchers and healthcare providers.

Appendix Six: References

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