

RESEARCH ARTICLE

Canadian Stroke Best Practice Recommendations: Vascular cognitive impairment, 7th edition practice guidelines update, 2024

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Abstract

The Canadian Stroke Best Practice Recommendations (CSBR) 7th edition includes this new module on the diagnosis and management of vascular cognitive impairment (VCI) with or without neurodegenerative disease. An expert writing group and people with VCI lived experience (PWLE) reviewed current evidence. Existing recommendations were reviewed and revised, and new recommendations added. Sections include definitions, signs and symptoms, screening, assessment, diagnosis, pharmacological and non-pharmacological management, secondary prevention, rehabilitation, and end-of-life care. PWLE were actively involved in all aspects of the development, ensuring their experiences are integrated. A unique VCI journey map, developed by PWLE, is included, and helped to motivate and anchor the recommendations. We encourage it to be displayed across healthcare settings to raise awareness and support persons with VCI. These VCI CSBRs emphasize the need for integrated multidisciplinary care across the continuum. Evidence for the diagnosis and management of VCI continues to emerge and gaps in knowledge should drive future research.

KEYWORDS

cognitive dysfunction, dementia, management of VCI, practice guidelines, stroke, vascular cognitive impairment

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Highlights

- This Canadian Stroke Best Practice Recommendations module focuses specifically on VCI using a structured framework and validated methodology.
- A comprehensive set of evidence-based recommendations is presented that addresses the continuum from symptom onset to diagnosis, management, and end of life.
- The recommendations consider individuals who experience VCI because of stroke or because of other vascular pathologies such as atrial fibrillation or heart failure.
- A journey map of an individual's experience with VCI has been developed by individuals with lived experience. It is a valuable guide to inform educational content, approaches to caring for individuals and families with VCI, and systems planning.

1 | INTRODUCTION

Poststroke vascular cognitive impairment (VCI) is highly prevalent,^{1–4} and is associated with poorer recovery⁵ and an increased risk of institutionalization, death, and disability.⁶ In stroke populations, the prevalence of cognitive impairment is about 20% after a first stroke, and over one-third with more than one stroke.^{1,4} Independent predictors of significant cognitive impairment include increasing age, stroke severity, and stroke recurrence.⁴ However, VCI occurs outside of overt stroke as well. Covert cerebrovascular disease, including infarction and cerebral small vessel disease (CSVD), is often detected in the brains of older individuals with cognitive decline. Many individuals also harbor neurodegenerative diseases such as Alzheimer's disease.⁷ Cardiovascular or systemic surgeries can result in new cognitive changes, and other vascular conditions such as heart failure, congenital heart disease, and atrial fibrillation have higher rates of VCI associated with them.^{8–10} VCI represents a major economic burden to the healthcare system, to society, and untold suffering for individuals with VCI and their families; therefore, strategies and healthcare policies for prevention, early detection, and aggressive management of this condition are essential.

VCI is often underreported, under-assessed, and under-treated, for numerous reasons including stigma, logistical barriers, lack of awareness, and therapeutic nihilism.¹¹ Individuals with lived experience highlight delays in diagnosis, lack of access to information and supports, and challenges navigating the health system as major gaps and sources of frustration.¹² Given that age is a major contributor to both vascular and neurodegenerative disease risk, and that vascular risk factors increase overt (symptomatic) and covert (presenting without sudden obvious neurological deficits) strokes, as well as small vessel disease and neurodegenerative pathologies,^{13,14} it is not surprising that mixed disease—vascular contributions plus effects of neurodegenerative diseases—is the most common cause of cognitive impairment. There is an urgent need for better recognition, diagnosis, individual and family education, and coordination and integrated management across specialties. Further, there is a need to consider sex and gender factors in the presentation and manifestation of VCI. Whether in primary care, stroke, general or cognitive neurology, cardiology, geriatric,

endocrinology or general medical clinics, inpatient or outpatient rehabilitation centers, care homes, or communities, VCI is present and must be addressed. These recommendations are intended to assist clinicians across a broad range of specialties and practice locations to effectively and efficiently identify, assess, and manage VCI and its consequences, working as a team with the individual and their family.

1.1 | Definition of VCI

In this module, VCI refers to a range of new or worsening cognitive deficits attributed to or accelerated by cerebrovascular injury.¹⁵ 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. 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). Refer to online [Supplemental Material A1](#) for additional definitions.

2 | FRAMEWORK FOR ASSESSING AND DIAGNOSING VCI

There are multiple terms used in clinical and research literature, 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), VCI and dementia (VCID),¹⁶ vascular

dementia (VaD), vascular mild cognitive impairment (vMCI), VCI no dementia (vCIND), poststroke 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), and CSVD causing cognitive impairment.¹⁷

VCI is therefore heterogeneous in scope, severity, and impact. As we have defined it, the definition of VCI requires the presence of both cognitive impairment and cerebrovascular pathology. Diagnosis of VCI should thus include three main components, which are addressed in the recommendations that are included below:

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 a rehabilitation setting (Section 1.2).

The diagnosis of VCI 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. Individuals with VCI can present in diverse ways (Figure 1). An individual with the commonly considered "poststroke cognitive impairment" or "poststroke dementia" presents with an overt stroke event and is found to have cognitive consequences. In contrast, some people present with cognitive impairment and are only found to have cerebrovascular pathology if imaged, and yet others may have high-risk features for both cerebrovascular disease and cognitive impairment (eg, those with multiple vascular risk factors, or heart failure or cardiac surgery) and may only be identified if both imaging and cognitive screening are undertaken.

The 7th update of the Canadian Stroke Best Practice Recommendations (CSBPR) has elevated VCI to its own stand-alone module to emphasize the importance of this condition across the cardiovascular spectrum. Previously, this topic had been covered in the Mood, Cognition and Fatigue module, published in 2020.¹⁸ The new and expanded module contains recommendations that focus on recognizing the signs and symptoms of VCI, screening, assessment, diagnosis, pharmacological and non-pharmacological management, secondary prevention of VCI, rehabilitation, and end-of-life planning and care. This module is targeted at managing individuals who are already exhibiting VCI signs and symptoms, both with and without overt stroke, and for those with VCI secondary to other vascular conditions such as heart failure, atrial fibrillation, or hypertension, with or without neurodegenerative disease. The CSBPR are intended to provide up-to-date evidence-based guidelines for the prevention and management of stroke, and to promote optimal recovery and reintegration for individuals who have experienced stroke and major vascular events including the individual, their family, and informal caregivers. The goal of disseminating and implementing these recommendations is to increase the uptake and

RESEARCH IN CONTEXT

1. **Systematic review:** Comprehensive literature searches were conducted to identify peer-reviewed studies examining a broad range of topics associated with vascular cognitive impairment (VCI), arising as a consequence of stroke, or secondary to other vascular conditions.
2. **Interpretation:** Using a standardized, previously used methodology, a comprehensive series of evidence-based recommendations are presented pertaining to all aspects of clinical management of VCI (identification of signs and symptoms, screening and assessment, diagnosis, pharmacological and non-pharmacological management, secondary prevention, rehabilitation and end-of-life planning and care). These recommendations will help to standardize care processes across all regions of Canada and are globally applicable, while ensuring a person- and family-centered approach to care.
3. **Future directions:** These guidelines will be updated every 3 to 5 years, incorporating new research as it becomes available. New areas of focus may include the use of technology and artificial intelligence, which have the potential to impact healthcare policy and practice.

implementation of evidence-based stroke care, reduce practice variations in care delivery, and narrow the gap between current knowledge and clinical practice.

3 | THE LIVED EXPERIENCE OF THE VCI JOURNEY MAP

These guidelines are unique in that their development included interactive and meaningful input from individuals living with VCI and their families throughout the process. This publication includes an experiential journey map (Figure 2) developed by this group to assist clinicians, other individuals with a diagnosis of VCI and their families, and system leaders to anticipate and understand the journey forward, leverage enablers, and mitigate barriers (refer to Online [Supplemental Material A2](#) for VCI Journey Map development methodology).¹² Persons with lived experience were consulted regularly, and the journey map evolved with the review process and discussions. The people with VCI lived experience (PWLE) input guided the expansion of these guidelines to address more of the issues they raised in the journey map. The journey map highlights the importance of, and difficulties encountered with, navigating care, managing daily activities, addressing emotional and mental health, and managing interpersonal relationships. Challenges in identifying symptoms, obtaining a timely diagnosis and treatment plan, and navigating silos within healthcare come through clearly, and it is hoped that these guidelines will help clinicians, families,

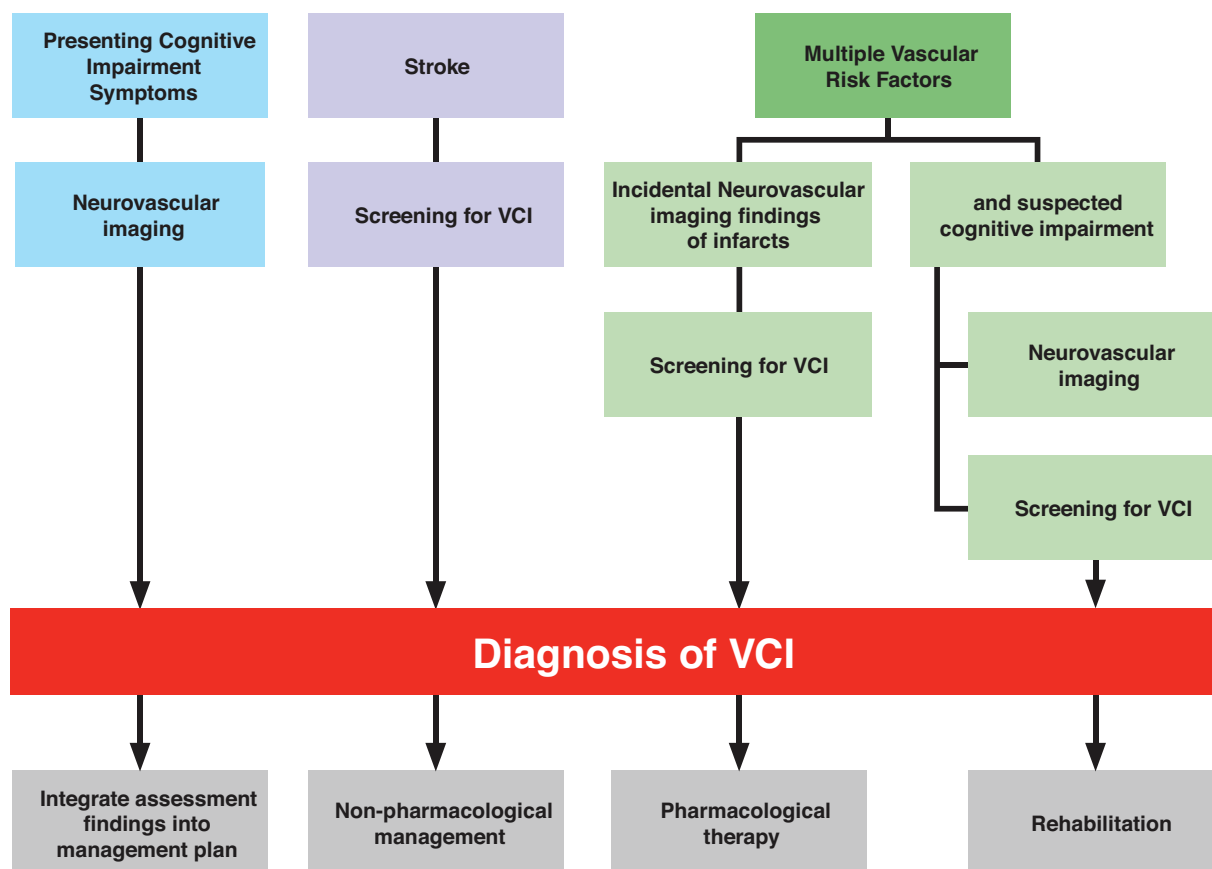


FIGURE 1 Multiple clinical presentations can lead to VCI, with the main components of clinical pathways covered in these recommendations. VCI, vascular cognitive impairment.

and individuals with VCI in addressing existing gaps in both knowledge and care.

4 | GUIDELINE DEVELOPMENT METHODOLOGY

The CSBPR development and update process follows a rigorous framework^{19,20} and addresses all criteria defined within the AGREE Trust model.²¹ The methodology for development and updates to the CSBPR has previously been published²² and detailed methodology can be found on the Canadian Stroke Best Practices website at www.strokebestpractices.ca. A broad interdisciplinary group of experts was convened and participated in reviewing, drafting, revising, and voting on all recommendation statements. A group of individuals having lived experience with VCI also actively participated in the review and update process in a parallel review process through our Community Consultation and Review Panel (CCRP).²³

Experienced personnel conducted searches to identify peer-reviewed literature that examined each topic area addressed in the current module. Systematic reviews, meta-analyses, randomized controlled trials, and observational studies were included, as available. The literature for this module was current to May 2024. Following a standardized abstraction format, evidence tables were

constructed including content from selected studies, and provided to the writing group for review. The writing group discussed and debated the strength, importance, clinical relevance, and applicability of the evidence, risks, benefits, and harms. The values and preferences of individuals with VCI were explored by the CCRP and shared with the scientific writing group for consideration. Through consensus, the group developed a draft set of proposed recommendations. Throughout, additional literature may have been identified and added to the evidence tables if it contributed to the final set of recommendations. Evidence levels were assigned based on the quality of available evidence, using the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) system^{24–26} where appropriate and feasible. Expert opinion, presented as clinical considerations, was used to formulate recommendations and guidance in the absence of evidence. These guidelines have undergone extensive internal and external review, and consensus was achieved for all content. Input from people with lived experience was incorporated throughout the recommendations and [Supporting Materials](#). For additional details of the methodology and additional materials to support these recommendations, including rationales, system implications, performance measures, knowledge translation and implementation tools, evidence tables, and an extended summary of the evidence, please visit the Canadian Stroke Best Practices website.²⁷

	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.



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FIGURE 2 The lived experience of VCI journey map. HCP, healthcare provider; VCI, vascular cognitive impairment.

5 | Best Practice Recommendations for VCI

5.1 | Section 1: Screening, assessment, and diagnosis

Screening, assessment, and diagnosis of VCI has three major components (Figure 1): understanding the presence and severity of neurovascular burden (neuroimaging); the presence, severity, and impact of cognitive impairment; and the impact of cognitive impairment on daily function. Neuroimaging is essential to establish the nature and severity of vascular brain injury following stroke. While computed tomography (CT) is widely available and can be used to approximate parameters such as infarct volume, brain volume, preexisting infarcts, and severity of white matter changes, magnetic resonance imaging (MRI) is generally considered to have greater sensitivity detecting these abnormalities (refer to Section 1.3 for recommendations).²⁸ Neuroimaging is also vital to highlight additional pathologies that could contribute to cognitive impairment, for example, cortical atrophy patterns in neurodegenerative diseases like Alzheimer's disease (medial temporal) or frontal-temporal lobar degeneration, or other structural changes such as meningiomas, vascular malformations, or cerebral micro- or macro-bleeding from hypertension or amyloid angiopathy.

Screening for cognitive impairment is especially important in patients who have had a mild stroke and whose cognitive deficits may be initially undetected, given that unaddressed cognition can worsen

over time. There are multiple validated screening and assessment tools for VCI (refer to Table 1, and Online Supplemental Material A3). The most commonly used office tests for the screening of cognitive function poststroke are the Montreal Cognitive Assessment test (MoCA) and the Mini-Mental State Examination (MMSE), which can be used to quickly screen global cognitive status by brief evaluations of attention, language, memory, and visuospatial/executive functions. The overall sensitivity and specificity of the MoCA are higher than the MMSE (MoCA: 84% and 71%, respectively, vs MMSE: 73% and 70%).²⁹ For VCI, the MoCA is even more sensitive compared to the MMSE, particularly when mild deficits are present.^{30–33} When potential cognitive impairment is identified on screening tests, more detailed neuropsychological assessments may be appropriate. These may include adding a single task at the bedside (such as digit symbol substitution,³⁴ testing a single domain (eg, frontal assessment battery),³⁵ or a more detailed battery (eg, National Institute of Neurological Disorders and Stroke—Canadian Stroke Network Vascular Cognitive Impairment Harmonized battery).³⁶ Emerging screening and diagnostic tests include options that may help reduce the burden on clinical staff for some patients. For example, self-administered online tests (eg, Cogniciti,³⁷ Croyos³⁸) may be useful for individuals with good technology literacy and access. Emerging AI-based clinical biomarkers such as automated analyses of speech and language function or eye movements are in development that may be less dependent on technological literacy, but these are not yet validated or approved for routine clinical practice.

TABLE 1 List of selected screening and initial assessment tools for VCI.

Selected screening and initial assessment tools for VCI

Quick screening tools (≤ 5 min to administer)

- 6-CIT³⁹
- SIS⁴⁰
- CDT⁴¹
- DOC Screen⁴²
- Eight-item Informant Interview to Differentiate AD⁸⁴³
- GPCOG⁴⁴
- MIS⁴⁵
- Mini ACE⁴⁶
- Mini Cog⁴⁷

Screening tools (≥ 5 min to administer)

- ACE⁴⁸
- Free Cog⁴⁹
- Short IQCODE⁵⁰
- MMSE⁵¹
- MoCA⁵²
- MMQ⁵³
- RUDAS⁵⁴
- TYM⁵⁵

Screening tools for remote use

- Tele-Free-Cog⁵⁶
- TICS¹⁴¹
- TICS-M⁵⁷
- Tele-MMSE (26-item version)⁵⁸

Assessment tools for VCI

- CAMCOG⁵⁹
- Cognitive-FIM⁶⁰
- FAB³⁵
- NINDS-CSN Harmonization VCI Neuropsychology Protocols³⁶
- RBANS⁶¹

Note: Free Cog (just a description: novel hybrid scale for use in clinical practice which integrate measures of cognition and executive abilities); Mini Cog also does not seem to have any longer form.

Abbreviations: 6-CIT, 6-item cognitive impairment test; ACE, Addenbrooke's Cognitive Examination; AD8, aging and dementia; CAMCOG, Cambridge Cognition Examination; CDT, clock drawing test; DOC, depression, obstructive sleep apnea, and cognitive impairment; Cognitive-FIM, Cognitive-Functional Independence Measure; FAB, frontal assessment battery; GPCOG, the general practitioner assessment of cognition; Mini-ACE, Mini Addenbrooke's Cognitive Examination; MIS, memory impairment screen; MMSE, Mini-Mental State Examination; MMQ, Multifactorial Memory Questionnaire; MoCA, Montreal Cognitive Assessment; NINDS-CSN, National Institute of Neurological Disorders and Stroke and the Canadian Stroke Network; RBANS, repeatable battery for the assessment of neuropsychological status; RUDAS, Rowland Universal Dementia Assessment Scale; Short IQCODE, informant questionnaire on cognitive decline in the elderly; SIS, 6-item screener; TICS, Telephone Interview for Cognitive Status; TICS-M, Telephone Interview for Cognitive Status—Modified; TYM, Test Your Memory; VCI, vascular cognitive impairment.

1. Screening, assessment, and diagnosis 2024

1.0 Diagnosis of VCI

- All individuals with clinically evident stroke, transient ischemic attack (TIA), or covert stroke present on brain imaging without a history of symptomatic stroke, overt

cardiovascular disease, or significant vascular risk factors should be considered at higher risk for VCI [Strong recommendation; Moderate quality of evidence]. Refer to definitions of VCI and Figure 1 for additional information.

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

Refer to Table 2 for additional information on the presenting signs and symptoms of VCI.

1.1 Screening for VCI

- 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 that changes can be reported by the individual, family members, caregivers, or clinicians. Refer to Table 2 for more information on the presenting signs and symptoms of VCI.
 - Timing: Individuals who have experienced a stroke or TIA** should be screened for cognitive impairment before discharge from acute care and inpatient rehabilitation setting [Strong recommendation; Moderate quality of evidence].
- Ongoing screening should also take place at transition points and follow-up visits with healthcare professionals (eg, outpatient and community-based healthcare settings) [Strong recommendation; Moderate quality of evidence].
- Individuals who have **significant risk factors for VCI** (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 VCI [Strong recommendation; Moderate quality of evidence].
 - Screening should also be considered when a decline in functional abilities is reported or clinically evident [Strong recommendation; Low quality of evidence].
 - Screening may be initiated by asking the individual and informant (if available) about cognitive or functional changes that could indicate a cognitive decline, such as missing medication doses, forgetting medical appointments, or other changes in basic activities of daily living (ADL) or instrumental ADL (IADL). This should be followed by cognitive and functional assessments as clinically indicated [Strong recommendation; Low quality of evidence].
- When screening for cognition and function, validated screening tools should be used [Strong recommendation; Moderate quality of evidence]. Refer to Table 1 and the online Supplemental Material A3 for more information on validated screening and assessment tools.
- When screening results are insufficiently informative, inconsistent with functional skills, or indicate antic-

ipated safety risks, then referral for formal cognitive, language, and/or functional assessments should be considered [Strong recommendation; Low quality of evidence]. Refer to item #2 of Section 1.1 Clinical considerations, below, 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 judgment, or general loss of independence.
3. Individuals may not be aware of their 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 VCI

- (i) Individuals with VCI who demonstrate any cognitive impairments (either clinically, by history, by the 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 health-

care professionals with the appropriate expertise in neurocognitive assessment and VCI [Strong recommendation; Moderate quality of evidence]. Refer to Table 2 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 ADL, driving, IADL, social, leisure, financial, vocational, and/or academic functioning [Strong recommendation; Low quality of evidence]. Refer to Table 1 and the online Supplemental Material A3 for more information on validated screening and assessment tools.
 - a. These assessments should be undertaken before the individual returns 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 the *Rehabilitation, Recovery, and Community Participation* module for additional information on poststroke depression, and sleep disorders.¹⁸ See Section 1.2 Clinical considerations, below, for additional information.
- (iv) The results of these assessments should be considered to guide the selection and implementation of appropriate remedial, compensatory, and/or adaptive intervention strategies according to person-centered 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 (eg, lability, depression, apathy, and anxiety), other medical conditions (eg, pain, infections) or medications, as well as sociodemographic and individual factors (eg, 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, and 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 poststroke 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-centered goals, which may differ by life stages (eg, school, work, driving, independent living).
4. **Personalization:** Individuals with VCI should have personalized management and rehabilitation plans that include a person-centered 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 (amnesic 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, memory, 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 (Cognitive Impairments Poststroke).⁶²*

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 are 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 (eg, 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 noncognitive neurological deficits—including visual field deficits and motor deficits—need to be considered when performing cognitive assessments and understanding the basis

of changes in ADL. Additionally, assessing nonlanguage 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 judgment. 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 MRI or 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].⁶³
- (ii) Laboratory testing for stroke risk and possible contributing factors to cognitive impairment should include complete blood count (CBC), thyroid-stimulating hormone (TSH), B12, calcium, electrolytes, creatinine, alanine transaminase (ALT), lipid panel, and hemoglobin A1c (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 CSVD 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), fluid-attenuated inversion recovery (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 1 to 2 weeks after stroke symptoms or sudden change in cognition or behavior.
 - 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 Standards for Reporting Vascular Changes on Neuroimaging (STRIVE).⁶⁴
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 2900 poststroke 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.^{65,66}

*Refer to the CCCDTD5–VCI guidance for details on imaging procedures for additional information.*⁶³

1.4 Diagnostic criteria for VCI

- (i) As defined in these guidelines (see above), VCI 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 VCI [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, 5th edition [DSM-5]; Vascular Impairment of Cognition Classification Consensus Study (VICCS); or the American Heart Association (AHA) consensus statement [Strong recommendation; Low quality of evidence].⁶³

5.2 | Section 2: Management of VCI

5.2.1 | Prevention

Vascular risk factors, such as hypertension, diabetes, dyslipidemia, and smoking at midlife are each associated with a 20% to 40% increased risk of VCI,⁶⁷ underscoring the importance of early and long-term achievement of vascular targets. Hypertension has the strongest evidence of association with poor cognitive performance,^{68,69} and hypertension treatment has the strongest evidence supporting prevention of later cognitive impairment. SPRINT MIND⁷⁰ showed that among individuals aged 50 years or older, without stroke but with systolic blood pressure (SBP) > 130 mmHg and at least one additional risk factor, the risk of MCI was significantly lower in the intensive therapy group (goal of <120/<80) after a median of 5.11 years. Subsequent meta-analyses have confirmed the benefit of intensive hypertension treatment for reducing cognitive impairment and dementia, with an absolute risk reduction of about 0.4% to 0.7% per year,⁷¹ with a linear relationship between lower blood pressure and lower VCI risk (ie, lower is better) down to at least 100/70.⁷² Canadian guidelines recommend intensive BP control (goal of SBP < 120 mmHG) in people over 50 with blood pressure > 130 to reduce mortality, cardio/cerebrovascular risk, and dementia/cognitive impairment.⁷³ However, the effects of intensive control, to a target of <120/<80, have not yet been trialed in patients with stroke.

Diabetes has also been associated with cognitive decline. In a recent systematic review examining risk factors for poststroke cognitive impairment (PSCI) and poststroke VCI, including 89 studies (160,783 participants with acute stroke), baseline diabetes was one of the strongest treatable predictors of PSCI (relative risk [RR] = 1.29, 95% confidence interval [CI]: 1.14 to 1.45) and poststroke VCI (RR = 1.38, 95% CI: 1.10 to 1.72).⁷⁴ In a randomized controlled trial, subcutaneous dulaglutide, compared with placebo, caused less decline in cognitive function.⁷⁵ Otherwise, specific diabetes treatments have not been shown to prevent cognitive impairment in randomized controlled trials, but epidemiological studies suggest that SGLT2 inhibitors may be associated with a lower risk of subsequent VCI and possible severe dementia compared to DDP-4 inhibitor use^{76,77} and large-scale clinical trials are needed.

There is growing literature highlighting the cognitive consequences of conditions such as heart failure, atrial fibrillation, cardiac surgery, and other conditions involving cerebrovascular compromise.^{8,9,78–81} It is important that cognition be assessed in these populations and included in management plans.

The risk of cognitive impairment is increased in individuals who consume heavy amounts of alcohol, defined as >14 units/week.⁸² Smoking has also been shown to increase the risk of VCI by up to 40%.⁸³

Lifestyle factors associated with a decreased risk of cognitive impairment include regular physical activity^{84–86} and adherence to a Mediterranean or Mediterranean-DASH diet Intervention for Neurodegeneration Delay (MIND) diet.⁸⁷

5.2.2 | Medical management

Cholinergic agents, including donepezil, rivastigmine, and galantamine have been used in the treatment of dementia of the Alzheimer's type and VaD. The usefulness of these agents has also been investigated in the treatment of poststroke cognitive deficits. In a network meta-analysis,⁸⁸ using the results from seven trials, 10 mg donepezil ranked first in terms of benefit for improving cognition but also had the most side effects. Galantamine ranked second in terms of both, while Rivastigmine had the lowest impact (both positive effects and side effects). The use of the N-methyl-D-aspartate (NMDA) receptor antagonist, memantine, has also been associated with small improvements in measures of cognitive function in individuals with VaD.⁸⁹

5.2.3 | Neuropsychiatric comorbidities

Mood disorders, including depression, anxiety, and apathy are common in individuals with VCI.^{90–92} Psychological interventions such as cognitive behavioral therapies (CBTs) have been shown to improve mood, increase the odds of depression remission, and improve ADL performance and quality of life for individuals with VCI.⁹³ Physical activity has also been shown to reduce depressive symptoms in people with MCI.⁹⁴ Behavioral disturbances, which can be difficult to manage, are common in people with severe VCI or dementia. Simulated presence therapy (SPT), using audio or video recordings prepared by family members or surrogates and including positive experiences from the participant's past life, can reduce symptoms of agitation in individuals with severe dementia living in nursing homes.⁹⁵ Massage therapy, animal-assisted interventions, personally tailored interventions, and even pet robot interventions have been shown to help agitation.⁹⁴

Both typical and atypical antipsychotics can also reduce agitation and psychosis in individuals with Alzheimer's disease or VaD with neuropsychiatric symptoms, but have been discouraged⁹⁶ and should be used with caution because they increase the risk of death, probably from cardiac toxicities.^{97,98} In individuals with VCI and depression, treatment with antidepressants (serotonergic, tricyclic, monoamine oxidase inhibitor [MAOI], and selective serotonin reuptake inhibitor [SSRI]) did not improve symptoms of depression at 6 to 13 weeks but did increase the odds of remission.⁹⁹ Serotonergic antidepressants significantly improved overall neuropsychiatric symptoms, agitation, and depression in individuals with VCI, both with and without a major depressive disorder at baseline. Hence SSRIs are considered first-line treatments for agitation.⁹⁸ In subgroup analysis, SSRIs as a class were found to significantly reduce overall neuropsychiatric symptoms, but non-SSRIs did not, while both drug classes reduced agitation.

5.2.4 | Physical activity

Engaging in regular physical activity can help to preserve cognitive function and reduce the risk of vascular-related cognitive decline later

TABLE 2 Signs and symptoms of VCI.

	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: - sustaining attention - speed of information processing - forming verbal &/or nonverbal concepts - verbal &/or nonverbal reasoning - 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 (eg, serial 7's, go, no-go) or bedside screening (eg, clock drawing, Trails B) Does not initiate tasks, conversations Poor judgment: does not appreciate the 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 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 - new information - recent activities - to turn off the stove - to turn off the tap - to take medications - to pay bills - how to get to familiar places Impairments in learning & retrieval of information (verbal/non-verbal) Poor 3- or 5-word recall	Changes misattributed to 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 healthcare providers Develop & use strategies to manage daily activities Living accommodation Limited access to healthcare 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	Patient is - easily distracted - can only focus on one thing at a time - tires easily on tasks requiring cognitive effort - does not take initiative - slow to think/speak - irritable, 'short fuse' - repetitive Disagrees with others about what can do independently or safely Would the individual with VCI or their family or caregivers feel comfortable letting the individual; with VCI drive a young child or loved one by themselves?	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 return to work Grieve losses Impact on identity & self-determination Uncertainty Discuss plan for future

Abbreviation: PWLE, people with VCI lived experience; VCI, vascular cognitive impairment.

in life.⁸⁴ Physical activity interventions including home-based exercises, group exercise programs, strength and balance exercises, and Tai Chi have been shown to significantly reduce the incidence of falls (incidence rate ratio = 0.70, 95% CI: 0.52 to 0.95) compared to the usual care in individuals with mild to moderate VCI, living in the community.¹⁰⁰ In the Canadian Study of Health & Aging, 6434 participants, without dementia, ≥65 years, were recruited from the community. After 5 years, individuals who engaged in moderate to high levels of physical activity had a significantly lower risk of developing VCI (without dementia) compared to those with low physical activity (odds ratio [OR] = 0.59, 95% CI: 0.40 to 0.88).⁸⁶

Safety items, such as a grab rail, a sensor night light, an electronic bracelet, and a tele-assistance support center also helped to reduce the number of people who fell (RR = 0.50, 95% CI: 0.32 to 0.78) compared with individuals who received usual care.¹⁰¹

5.2.5 | 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.¹⁰² The included trials 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 orientation to time and space, improving leisure activities, and improving communication, the results were mixed.

5.2.6 | Driving

In a systematic review of 53 studies including individuals with VCI,¹⁰³ the effects of severity and type of VCI on driving fitness were reviewed. The results indicated that drivers with VCI are more likely to exhibit severe driving difficulties. Individuals with multi-infarct VCI show poorer on-road driving skills than older people with diabetes, healthy older people, or healthy young drivers. Driving scores were inversely associated with cognitive skills, number of collisions, and violations per 1000 miles driven. About 70% of drivers with very mild and mild VCI fail an on-road driving test, compared to 11% of healthy seniors.

2. Management of VCI 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-centered perspectives, and systems approaches to improve care navigation and continuity.

2.1 Principles of VCI management

- (i) Individuals with VCI should have a personalized management plan that includes a person-centered 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 (eg, 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 the 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.^{73, 104} Refer to Box 5.0, "ACP and palliative care 2024" below, Section 5.2 Palliative and end-of-life care, 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 Figure 2, 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 VCI and the continuum of care.

2. The approach to the 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 Box 5.0, "ACP and palliative care 2024" below, Section 5.2 Palliative and end-of-life care, for additional information.

2.2 Non-pharmacological management of VCI

- (i) Individuals with VCI should be assessed for medical (eg, hypertension, diabetes, lipids, atrial fibrillation, sleep disorders) and lifestyle vascular risk factors (eg, diet, sodium intake, cholesterol, exercise, weight, alcohol intake, smoking) [Strong recommendations; 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 recommendations; 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 (eg, dysphagia) where required [Strong recommendations; Moderate quality of evidence].
- (iv) Individuals with VCI may require additional support (eg, 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 module¹⁰⁴ for additional information. Refer to Sections 2.6–2.9 below for additional information on specific non-pharmacological strategies.

2.3 Pharmacological management of VCI

- (i) Cholinesterase inhibitors (donepezil, rivastigmine and galantamine)* and the 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 (below), items #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 VCI. Many dementias include both Alzheimer's disease and VaD (ie, mixed) pathology.*

Refer below to Section 2.4 Anti-thrombotic agents, for recommendations on anti-thrombotic use, and Section 2.5 Management of hypertension. Also, refer to CSBPR for Secondary Prevention of Ischemic Stroke for general guidance on stroke prevention.¹⁰⁴

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. The 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 (eg, 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].^{22, 104, 105}
- (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 VaD who have covert brain infarcts detected on neuroimaging **without** a 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].⁶³

Refer to CSBPR Secondary Prevention of Stroke module¹⁰⁴ and CSBPR ASA for Prevention of Vascular Events module for additional information.¹⁰⁶

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 BP consistently ≥ 90 mmHg, or for individuals with an average SBP consistently ≥ 140 mmHg [Strong recommendation; Moderate quality of evidence]. Refer to the CSBPR Secondary Prevention of Stroke module,¹⁰⁴ Hypertension Canada,¹⁰⁷ and C-CHANGE guidelines⁷³ 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,¹⁰⁴ Hypertension Canada,¹⁰⁷ and C-CHANGE guidelines⁷³ for additional information.

2.6 Management of mood in VCI

- (i) Healthcare providers should monitor individuals with VCI for changes in mood and behavior, 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.¹⁸
- (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.¹⁸
- (iii) For patients with mild VCI it is reasonable to consider either CBT, interpersonal therapy, or behavioral 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 the quality of life, and to reduce behavioral and psychological symptoms, should

be considered. Such approaches can include environmental management and behavioral 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 [eg, memory, executive functions] may be important in determining the feasibility of a specific intervention or appropriate goals.
2. CBT 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 behavior 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 behavioral consequences of VCI and may be appropriately addressed through behavioral 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 VCI.
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.¹⁸

2.7 Behavior management

- (i) Individuals with known or suspected VCI should be screened for behavior 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 behavioral changes, investigating and treating potential underlying causes should be undertaken (eg, 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 behavior 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].¹⁰⁸
- (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 (ie, 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 behavioral management can have potential harm. The involvement of specialists in adult behavior 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 (eg, 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-behavior-consequences (ABC) charting approach can be used for behavioral 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 behavioral management strategies.

3. For individuals with mild VCI living in less structured environments (eg, 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 (eg, rural vs urban communities).
6. If pharmacological treatment of behavior is required (which is not the first line), most evidence comes from the treatment of behavioral 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 recommendations 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.⁹⁸

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].
- (ii) Assessment of individuals for potential safety risks may include an understanding of the relationship between the individual's cognitive status (eg, insight, memory, planning) and the following attributes of the individual's:
 - a. autonomy and decision-making capacity [Strong recommendation; Low quality of evidence];
 - b. behavioral status (eg, 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 (eg, ADL, IADL, 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 fall risk, refer to CSBPR Rehabilitation and Recovery following Stroke.*¹⁰⁹

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 (eg, family, and care providers). This information may include cognitive functioning, life demands, setting familiarity, potential impact on the 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 the following:
 - a. identifying personal supports (eg, family/caregivers to observe, check-in, and/or support health and/or financial decision-making);
 - b. technological supports (eg, personal alarm systems);
 - c. environmental changes/supports (eg, 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 Table 3 for additional information on the impact of VCI on ADL.*
- (ii) The use of assistive technologies (eg, automatic prompting for ADL, automatic lighting) should be considered to aid functional skills, such as during mealtime, hygiene and self-care (eg, handwashing, dental care, dressing, and toileting), and orientation to time [Strong recommendation; Low quality of evidence].
- (iii) The use of cues (eg, 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 (eg, music, lighting,

personal photographs), and leisure activities (eg, 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 (eg, 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 those with an open concept);
 - c. homelike atmosphere (eg, 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 (eg, home vs congregate setting) given that there may be variability in supports in a shared space, availability of supports (eg, 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.

5.3 | Section 3: Cognitive rehabilitation

In a Cochrane review,¹¹⁰ which included data from 33 randomized controlled trials (RCTs) of individuals with mild to moderate VCI (without stroke), multi- and single-domain cognitive interventions were associated with significant improvements in the composite measure of global cognition, when assessed immediately after the intervention (standardized mean difference [SMD] = 0.42, 95% CI: 0.23 to 0.62) and at 3- to 12-month follow-up (SMD = 0.65, 95% CI: 0.11 to 1.2), compared with active or passive control interventions. A

TABLE 3 Examples of activities of daily living impacted by cognitive changes.**The impact of VCI on ADL and IADL**

The following activities are examples of ADL and IADL that may be impacted by VCI. This box provides examples of ADL and IADL that may need to be considered or adapted as part of a safety plan.^a

- ADL
- Bathing/personal hygiene
- Dressing/selecting appropriate clothing
- Feeding (eg, swallowing, food handling, healthy dietary choices)
- Toileting
- Household mobility and transfers (including fall risk)
- IADL
- Driving
- Parenting and caring for others
- Community mobility
- Shopping (including purchase choice)
- Cleaning
- Kitchen safety (eg, meal preparation, discarding spoiled foods, fire safety)
- Medication safety and adherence
- Healthcare decisions
- Financial decisions
- Home safety
- Living alone or spending time home alone

Abbreviations: ADL, activities of daily living; IADL, instrumental activities of daily living; VCI, vascular cognitive impairment.

^aNote that this is not a comprehensive list. Rather it represents more common and frequent areas of concern.

multi-domain internet-based adaptive training program resulted in significantly increased mean MoCA scores from baseline, compared with an active intervention control group at 7 weeks in individuals with complaints of cognitive impairment involving memory or other domains lasting ≥ 3 months, but without dementia (mean change of 3.36 vs -0.85 , $p = 0.013$), in the Cog-VACCINE trial.¹¹¹

Following stroke, 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 to 0.48) have been reported in systematic reviews including individuals with stroke who received cognitive rehabilitation.^{112, 113} 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,¹¹⁴ including 4005 individuals with/without cognitive impairment following stroke, 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 versus wait list control (memory).

3. Cognitive rehabilitation 2024**Notes**

- This section addresses specific elements of rehabilitation for individuals with VCI, regardless of the underlying cause.
- Additional recommendations and information related to cognitive rehabilitation can be found in the CSBPR Rehabilitation, Recovery, and Community Participation modules.^{109, 115}
- Evidence supporting rehabilitation of cognitive challenges related to VCI 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 the 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 the best available evidence, and have the long-term aim to facilitate resumption or continued safe participation of desired activities (eg, 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 (eg, attention, memory, executive function) and global strategies (eg, physical activity and exercise) [Strong recommendation; High quality of evidence]. Refer to the CSBPR Rehabilitation, Recovery and Community Participation module for additional information.^{109, 115}

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 of 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-centered approach to optimize function.
5. In addition to interventions tailored for specific cognitive domains, other approaches that directly impact brain function or health (eg, noninvasive brain stimulation, and physical activity) have received growing attention as modulators of cognition.
6. Multimodal approaches (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.^{109, 115}

5.4 | Section 4: Support for individuals with VCI, their families, and caregivers

Education and training are essential to enhance the engagement of caregivers of individuals with VCI or VaD. In a narrative review¹¹⁶ including 56 studies examining interventions aimed at supporting carers of individuals with dementia, educational interventions increased confidence in caring, reduced burden, increased competence, and improved mental health. The authors concluded that support interventions were more likely to be effective if multiple supports were offered, educational interventions provided the opportunity for active learning, and the interventions were simple. A systematic review of educational interventions for caregivers of individuals with VCI living in the community included seven RCTs with 764 participants.¹¹⁷ Educational programs aimed at teaching skills relevant to VCI caring were associated with a reduction in carer burden compared with usual care (SMD = -0.52, 95% CI: -0.79 to -0.26) and possibly carer depression (SMD = -0.37, 95% CI: -0.65 to -0.09).

Interventions to support caregivers including psychoeducation, problem-solving, mindfulness-based stress reduction (MBSR), and multicomponent interventions have been shown to decrease depression and reduce caregiver burden.¹¹⁸⁻¹²¹ 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.¹¹⁸ 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.¹¹⁹ A Cochrane review¹²⁰ including five RCTs of 201 unpaid carers of individuals with any type of VCI examined 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).

4.0. Support for individuals with VCI, their families and caregivers 2024

Notes

- When someone experiences VCI, their family and informal caregivers play a pivotal role and are also personally affected along this journey. Understanding the caregivers' circumstances, abilities, and concerns is important when providing comprehensive person- and family-centered care.
- Support for families and caregivers may address the following domains: education, training, counseling, development of a support structure, and financial assistance (based on AHA stroke rehabilitation and recovery guidelines).¹²²
- Consent: Refer to Section 5 Clinical considerations (in Box 5.0, "ACP and palliative care 2024" below) for more information on consent.
- For more in-depth recommendations and information, refer to the CSBPR Rehabilitation, Recovery, and Community Participation following Stroke module.^{109, 115}

4.1 Education related to VCI

- (i) Clinicians should assess the needs of individuals with VCI, their family, and caregivers 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 the 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 the 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 (eg, 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 (eg, caregivers, family, friends) for individuals with VCI and their caregivers to help personalize treatment.
- 2. Consider services that can enhance, or supplement, care provided by family and caregivers—for example, respite care, day programming, and 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 individuals with VCI and their caregivers view the condition and options for care, based on their knowledge, experience, and cultural beliefs, to encourage health-seeking behaviors and uptake of care and services.¹⁰⁸

- 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.¹⁰⁸
- 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.

5.5 | Section 5: Palliative and end-of-life care

Elements to consider in advance care planning (ACP) include the individual's prognosis, treatment options, goals of care, and the identification and documentation of end-of-life wishes. There is little direct evidence specifically for VCI. A review of reviews of people with dementia or cognitive impairment and their carers¹²³ found that ACP interventions were associated with decreased hospitalizations, increased concordance between care received and prior wishes, and increased completion of ACP documents. 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 VCI and their families.¹²⁴ A recent Cochrane review¹²⁵ included the results of nine 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.

5.0 ACP and palliative care 2024

5.1 Advance Care Planning

- (i) Individuals with VCI, as well as their families and informal caregivers, should be informed about ACP options as early as possible following diagnosis due to the progressive nature of VCI [Strong recommendation; Low quality of evidence].
- (ii) Respectful and empathetic ACP 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 Section 5 Clinical considerations (below) for more information regarding consent in VCI.

- (iii) ACP discussions should be documented and reassessed regularly with the individual with VCI, the healthcare team, and the 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 VaD, 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 with substitute decision-makers regarding the individual's goals of care that include consideration of the individual's capacity, diagnosis, prognosis, values, wishes (ACPs), 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 counseling, 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 ACP discussions, what it involves, why it is important, and the benefits of establishing an ACP. These 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 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 center can be considered if further discussions are required.
5. Consent: In the field of VCI, the issue of the agency to provide consent often arises. Throughout these recommendations, there is a 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.

6 | DISCUSSION: CHALLENGES AND FUTURE DIRECTIONS

Globally, VCI, heart disease, and stroke are all increasing. The number of people (in millions) living with VCI is predicted to rise from 46.8 (2015) to 74.7 in 2030, with corresponding increases in stroke and heart disease from 95.9 to 122.4 and from 121.4 to 156.8,

respectively.¹²⁶ Data from Canadian health surveys also suggest that the age-standardized prevalence of (any) VCI has been increasing among noninstitutionalized adults over the past 30 years^{127–129} and is generally higher among women. More disturbingly, the prevalence of individuals with VCI and another vascular comorbidity (stroke or heart conditions) has also been increasing in the previous 6 years.¹²⁹ Meanwhile, the costs of caring for people with VCI and VaD increase. Using data from the 2014 National Population Health Study of Neurological Conditions, the total costs (Canadian healthcare system costs and out-of-pocket caregiver costs) in 2016 for all-cause dementia, including VaD as well as other causes, were \$10.4 billion and are projected to increase to \$16.6 billion in 2031.¹³⁰ Generally, costs for people with VCI are estimated to be five-and-a-half times greater compared with those without VCI.¹³⁰

Aggressive measures will be required to reverse these trends, with primary and secondary prevention playing key roles. Multidomain interventions targeting diet and a healthy lifestyle (maintaining a normal weight, abstinence from smoking, engaging in regular physical activity, and maintaining cholesterol, blood pressure, and fasting glucose within normal ranges) beginning at younger ages will be pivotal. Building on previous multidomain lifestyle modification trials such as FINGER,¹³¹ preDIVA,¹³² and MAPT,¹³³ the results from several trials in progress are anticipated. Some examples of these include the SINGER trial¹³⁴ (NCT05007353), CAN THUMBS UP,¹³⁵ and SMARRT¹³⁶ (NCT03683394). In primary prevention, the SPRINT¹³⁷ and SPRINT-MIND⁷⁰ studies, and subsequent meta-analyses of intensive blood pressure control trials, have provided key evidence that aggressive blood pressure control in at-risk people over 50 years without stroke can reduce subsequent heart attacks, deaths, and VCI. Intensive hypertension control after stroke may be an achievable secondary prevention strategy to reduce VCI, but large randomized trials are needed to understand the efficacy and safety of this approach. Other emerging treatments for vascular risk factors, such as SGLT-2 inhibitors and GLP-1 agonists for diabetes, may also hold promise to prevent or delay CSVD and associated VCI, but long-term studies are also needed. The contributions from additional, lesser-known lifestyle risk factors (sleep disturbance, stress), medical conditions (cancer, carotid atherosclerosis, arthritis), pharmacological agents (statins), and environmental factors (pesticides, air pollution) are yet to be fully elucidated.¹³⁸ A more complete understanding of the adverse effects associated with the timing and duration of risk factor(s) exposure is also essential for interventions to be effective.

The impact of sex and gender on the incidence, clinical presentation, testing, and trajectory of VCI is still poorly understood. Available evidence suggests little difference in rates of VCI between men and women; however, signs and symptoms of VCI may manifest differently between sexes.^{39,40,139,140} Exalto et al.³⁹ report that women more often had impairment in the domains of attention, executive functioning, and language, whereas men more often had impairment in verbal memory. Women seem to be more likely to experience cognitive impairment after stroke,⁴¹ but differences are attenuated after adjustment for baseline characteristics.⁴¹ Volgman et al.¹³⁹ identify several factors that may increase the risk of VCID in women,

such as increased burden or severity of vascular risk factors, hypertensive disorders of pregnancy, increased longevity and older age at stroke onset, and undertreatment with anticoagulants. Women are also more likely to experience delayed diagnosis due to better verbal skills and limited sensitivity to routinely used tests such as the MMSE. Further research into sex and gender differences in all aspects of assessment, diagnosis, and management of VCI is urgently needed.

In the future, the use of technology and artificial intelligence for the management of individuals with VCI will likely increase, potentially helping to aid screening and diagnosis, decrease the burden on the healthcare system, and reduce some of the barriers to diagnoses and treatment identified by patients and families. Potential applications include those that can aid in the assessment and diagnosis of VCID (such as the use of touch screens for administering cognitive assessment batteries and machine learning for the interpretation of MRI and positron emission tomography [PET] scans)⁴² and technologies that enable individuals to continue living in their own homes using smart home devices with sensors that can detect gas and water leaks, and wearable devices with motion sensors that can detect falls and nighttime wandering. These developments, among others, have the potential to change practice and healthcare policies in the next decade.

7 | SUMMARY

The 7th update of the CSBPR Vascular Cognitive Impairment module provides a detailed series of recommendations applicable to the care of all adult Canadians who have experienced a stroke or other vascular condition that impacts cognition. These recommendations, guided by the experiences and concerns identified by people with lived experience, are comprehensive and span the spectrum of care from symptom onset through the early rehabilitation period using a standardized framework. The focus throughout has been on building an integrated system to provide seamless care to the individual with vascular risk factors and multimorbidity, and to their family. Such an approach requires coordinated systems to be in place in all regions of Canada, a challenge given its vast geographical area with many smaller isolated communities. Further, improved data collection, standardization, and data sharing to support continuity of care, research, and systems planning is essential to drive improvements in outcomes for individuals with VCI and reduce overall burden.

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CONSENT STATEMENT

Consent was not required for this clinical practice guideline.

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