Received: 1 February 2023 | Accepted: 9 April 2023

DOI: 10.1002/agm2.12253

REVIEW ARTICLE

Aging Medicine Open Access WILEY

Exploring what progress is being made in the development of health promotion material for vascular dementia: A systematic review of the evidence

Rachel S. Price

Manchester Metropolitan University, Manchester, UK

Correspondence
Rachel S. Price, Manchester Metropolitan University, Brooks Building, Birley Fields Campus 53 Bonsall Street, Manchester M15 6GX, UK.
Email: r.price@mmu.ac.uk

Abstract

A systematic review conducted by Price and Keady (Journal of Nursing and Healthcare of Chronic Illness, 2, 88 and 2010) demonstrated that there was a dearth of health-promoting literature available for people diagnosed with vascular dementia. The correlation between health behavior and the onset of cardiovascular change that can lead to vascular dementia had demonstrated a need for health education and health-promoting information to be made accessible to vulnerable populations to ameliorate the risk of cognitive decline because of cardiovascular disease. Dementia is a progressive and life-limiting condition and with limited treatment options and a lack of progress in identifying a way to delay onset or even cure the condition. Focus must be targeted towards risk reduction strategies that serve to reduce onset and decline and limit the global burden on not only the individual with the condition and their carers but also to the health and social care economy. To identify the progress that has been made in developing health-promoting literature and patient education guidance since 2010 a systematic literature review was undertaken. Using thematic analysis, *CINAHL*, *MEDLINE*, and *psych INFO* databases were accessed and following *PRISMA* guidelines an inclusion and exclusion criteria was developed in order to locate peer-reviewed articles. Titles and abstracts were reviewed to identify a match with key terms, and from 133 screened abstracts eight studies met the inclusion requirements. From the eight studies, thematic analysis was implemented to identify shared understanding of experiences relating to health promotion in vascular dementia. The methodology for the study was replicated from the authors' previous systematic review in 2010. Five key themes were identified in the literature (*Healthy heart healthy brain; Risk factors; Risk reduction/modification; Interventions; Absence of targeted health promotion*). From what little evidence was available to review the thematic analysis has demonstrated developments in knowledge into the link between the onset of cognitive impairment and vascular dementia because of compromised cardiovascular health. Modifying health behavior has become essential in ameliorating the risk of vascular cognitive decline. With these developments the synthesis of the literature demonstrates that even with

these insights there continues to be a lack of targeted material that individuals can access to understand the link between cardiovascular health and cognitive decline. It is recognized that maximizing cardiovascular health has the potential to lessen the risk of vascular cognitive impairment and vascular dementia developing and progressing yet targeted health promoting material remains lacking. With the developments in understanding the causal links between poor cardiovascular health, vascular cognitive impairment, and vascular dementia progress now needs to be made in developing targeted health promotion material for individuals to access to share this knowledge to reduce the potential onset and subsequent burden of dementia.

KEYWORDS
brain health, health promotion, modifiable and nonmodifiable risk factors, vascular cognitive impairment, vascular dementia, vascular health promotion

1 | INTRODUCTION

Vascular dementia is the second most common form of dementia; however, it has become widely recognized that there is vascular pathology present with other dementia syndromes such as Alzheimer's disease. Developments in research and understanding of vascular dementia over the last decade have led to a better understanding of the relationship between cardiovascular disease and the onset on structural brain change leading to cognitive decline.

Further developments within the last decade have also highlighted that vascular events do not automatically preclude the onset of vascular dementia. The development of a cognitive impairment through vascular events are recognized to be on a continuum[1] that encompasses a range of disorders that originate from vascular brain changes that may not inevitably lead to the individual being diagnosed with vascular dementia.

Use of the term vascular cognitive impairment has developed to encompass individuals who are experiencing impaired cognitive function considered to be outside of the expected normal aging process when age-related vascular pathology occurs.[2] Evidence indicates vascular pathology contributes to cognitive impairment and dementia, rather than vascular dementia being a common singular pathological construct.[3] This suggests that vascular dementia is a rarer condition than originally suggested.[4]

There is no cure for dementia and, although research into the disease has made progress within the last few decades, there are still very limited options available to those living with the condition to receive treatment to manage the symptoms and no curative developments have yet made a breakthrough. Consequently, focus is placed on preventative strategies and risk amelioration interventions to underpin dementia care.

With dementia being one of the leading causes of death globally and being a condition that accounts for 28.3 million disability adjusted life years,[5] there is a growing demand for strategies to address not only the prevention of the disease but also to reduce the progression for people already diagnosed with dementia. Learning strategies to live well for longer is a global challenge; however, implementing strategies to reduce disease progression will not only limit individual and carer burden but also has the potential to lessen the impact dementia has on health and social care services.

Strategies for enhancing well-being and implementing preventative and health promoting measures are significant and increasingly important determinants in providing quality dementia services.[6] The primary prevention of dementia remains challenging, with substantial barriers yet to overcome. These barriers include training and education of the workforce, availability of evidence-based resources to underpin effective health promotion in dementia, resource and financial limitations to research and service development in dementia, and poor service integration and organization.[7]

Following on from a previous systematic review conducted by Price and Keady,[6] this paper undertakes a systematic review of the literature published between from January 2012 to December 2022 to explore the developments in health promotion for people at risk of developing vascular cognitive impairment and vascular dementia.

1.1 | Review question

What progress has been made in the past decade in the development of health promoting material available for people living with or at risk of developing vascular cognitive impairment and vascular dementia?

2 | BACKGROUND

2.1 | Vascular cognitive impairment and vascular dementia

Vascular dementia accounts for one-third of all dementias and is the second most common subtype of dementia after Alzheimer's disease (Wolters and Ikram, 2019).[8] It accounts for around 15%–20% of all

dementia diagnoses in Europe and North America[9] and around 30% in Asian countries.[10]

Traditionally used as an umbrella term, vascular dementia identifies a diagnostic subset of conditions that ultimately cause cell death within the brain, leading to cognitive and functional decline. There may be several reasons why vascular dementia develops from an etiological perspective, but there are three recognized contributing factors relating to onset.

2.1.1 | Stroke

Stroke arises from the cessation of blood flow to the brain. This may occur following blockage by a clot or other matter such as fatty deposits (ischemic stroke), or from a burst blood vessel, causing oxygenated blood to leak (hemorrhagic stroke). Both events reduce the supply of oxygenated blood to essential parts of the brain, resulting in cell death.

2.1.2 | Small vessel disease

Small vessel disease refers to the process by which small arteries, venules, arterioles, and capillaries within the brain become damaged.[11] Consequently, the flow of oxygenated blood to the brain is impaired, elimination of waste becomes less effective, and affected parts of the brain do not receive adequate oxygenation to prevent cell death.

2.1.3 | Transient ischaemic attack/Mini strokes

A transient ischaemic attack (TIA) or mini stroke arises when the blood vessels in the brain become blocked and then spontaneously clear without any intervention. Although the TIA and associated symptoms tend to resolve within 24 hours, the etiology of such an event is a medical emergency; there is a need for clinical evaluation to confirm changes in the ischaemic mechanisms within the brain to initiate a tailored therapy to reduce the risk of further vascular events.[12] Evidence highlights that the TIA event may be abrupt in onset and resolve rapidly (i.e. <24 h); it has been reported that 60% of individuals recover in <1 h and 71% within 2 h.[13]

2.2 | The vascular continuum

Vascular events and vascular disease influence the cognitive function of the brain because of the reduction in oxygen perfusion.[14] However, these vascular events are no longer anticipated to preclude vascular dementia from the outset, and it is proposed that there is a spectrum of cognitive alterations caused by vascular factors.[15] The development of a cognitive impairment through vascular events are recognized to be on a continuum[1] rather than a single defined entity that deteriorates in a stepwise manner. VCI encompasses a range of disorders that originate from vascular brain changes that may not inevitably lead to the individual being diagnosed with vascular dementia.

Vascular dementia represents the latter stage of the vascular cognitive impairment continuum[16] where there has been widespread injury, particularly in the subcortical structures of the brain.

Use of the term vascular cognitive impairment has developed to encompass individuals who are experiencing impaired cognitive function considered to be outside of the expected normal aging process when age-related vascular pathology occurs.[2] Evidence indicates vascular pathology contributes to cognitive impairment and dementia, rather than vascular dementia being a common singular pathological construct.[3] This suggests that vascular dementia is a rarer condition than originally suggested.[4]

The vascular cognitive impairment continuum and Alzheimer's disease have been viewed historically as two very distinct and separate conditions and differentiating between the two is becoming increasingly difficult[17] as there is a recognized vascular component to the onset and progression of AD.[6,18,19]

The continuum of vascular cognitive impairment represents a heterogeneous set of disorders that have a broad range of pathologies and clinical manifestations.[20] Milder presentations may include experiences of change in executive function where working memory is slower and information processing becomes impaired. However, it is important to recognize that vascular brain damage may exist without overt evidence of cognitive decline.[20]

At the latter end of the continuum, the level of cognitive decline transitions from mild to severe and is accompanied by a marked deterioration in memory, executive function, social function, and significant changes to the ability to undertake and complete daily activities. It is valuable to acknowledge that the impact of cognitive change will depend on a range of factors, including the location of the vascular event(s), the number of vascular events, the individual's pre-morbid level of function, current physical health status, and available social support network.

2.3 | Health promotion

The prevention of disease and relief of ill health in those who are sick or have disease are core aspects of health promotion, yet this process also incorporates an understanding that improvements in quality of life are essential.[6] Health promotion includes elements of sociology, education, economics, epidemiology, and psychology. Therefore, the focus transitions from sickness and disease to a more biographical understanding of the individual that incorporates a whole person approach underpinned by individual understanding of identity, culture, and wider society.[6]

Health promotion is an activity that works towards seeking change in health activity and behavior to enable transformation. The health promotion process facilitates a move from engaging in ill health–encouraging activity to adopting strategies that maximize

health outcomes, ameliorate the risk of disease and illness, and maximize quality of life.

Laverack[21] suggests that, fundamentally, people do not seek to resist change but do resist when being changed. Therefore, it is essential that health-promoting strategies do not instruct, or dictate, but focus on activities that are inclusive, guiding, and that consider the whole person. If health activities are controlling or agenda driven and do not meet the needs of the population, then they are unlikely to succeed.

Empowerment underpins effective health promotion practice.[22,23] Developing a sense of participation and connectivity, as opposed to a hierarchal and control model of health promotion, enhances the empowerment of individuals[24] to take greater control over the decisions and actions that influence their health.[25]

A growing understanding of disease epidemiology, together with increasing numbers of the population living longer, often with comorbid physical health problems, requires health promotion and public health to continually develop, undertake, and disseminate research and develop a body of knowledge that supports populations to maintain, recover, and adapt to health changes.

Health promotion can be achieved through a variety of interventions that may support individuals to change health behaviors and adopt a healthy lifestyle; encourage individuals to access services and be involved with health decisions, including the promotion of environments where healthy choices become the norm and more widely accepted; and to educate self and others about keeping healthy.[26]

2.4 | Vascular health promotion

Turco et al.[27] highlight that there are three pathways that are critical in vascular health promotion: primordial prevention, to prevent the development of vascular risk factors; primary prevention, to specifically prevent vascular change in individuals at high risk of vascular disease; and secondary prevention, to minimize the recurrence of vascular events and further complications associated with vascular disease.

Risk factors for vascular disease are either modifiable, where alterations to lifestyle and the implementation of clinical interventions can be adopted to reduce risk or nonmodifiable, where there is limited capacity to change or alter risk factors.[6] A common theme in the literature demonstrates that if the modifiable risk factors for vascular change are addressed through improving health outcomes, health promotion, and health education, then there is an opportunity to influence vascular risk and ultimately reduce the potential damaging impact of vascular disease and illness.[6,28,29]

Focusing on behavior change to reduce the impact of modifiable risk factors has the potential to reduce the incidence of vascular disease in the population and to potentially improve health outcomes.[30] Therefore, health-promoting activity should aim not only to be inclusive and person centered,[21] but should also encompass prevention strategies that are geared towards the specific level of vascular support required by the individual.

Developing knowledge and insights into the importance of vascular health has enabled the focus of patient care to move away from symptom management to a more proactive and preventative approach; minimizing the primordial risk factors associated with vascular disease and ameliorating the risk of vascular cognitive impairment. However, despite these positive steps to maximize the vascular health of the population, the incidence of vascular cognitive impairment and vascular dementia continues to rise within the United Kingdom and worldwide. These disorders are a major and increasing cause of disability yet remain under researched.[31]

The clinical development of medications to prevent the onset of vascular cognitive impairment and vascular dementia is limited;[6] many potential therapeutic agents that showed promise in early clinical trials did not progress further than the phase III setting due to lack of benefit.[31] This underlines the need for effective prevention and risk amelioration strategies, especially in individuals with accumulative nonmodifiable cardiovascular risk factors to prevent vascular disease arising in the first instance or reduce further vascular damage.

Early identification and management of cardiovascular risk factors, including diseases such as diabetes, hypercholesterolaemia, and hypertension, is associated with improved outcomes and a lower incidence of dementia.[6,32,33] However, maximizing brain health is also as important as preventing stroke or vascular disease as a way of inhibiting the onset of a vascular cognitive impairment and potential progression to vascular dementia.

The preservation of cognitive function is an essential element of vascular health promotion as this has the potential to mitigate the impact of vascular cognitive impairment and vascular dementia, thus minimizing the impact on individuals, their carers, and health and social care resources. Cognitive function is often overlooked as an important element of healthy aging,[34] yet cognitive impairment is a strong predictor of institutionalization and is associated with reduced quality of life and increased dependence.[35]

Vascular health promotion has traditionally focused on targeting modifiable risk factors as a primordial or primary prevention strategy, often providing advice for ameliorating the risk of specific conditions, such as diabetes and cardiovascular disease (NHS England, 2019).[30,36–38]

Delivering health-promoting activity in vascular health is based on two potential activity types: targeted prevention and universal prevention. Universal health promotion interventions apply to whole populations and are structured to deliver health education and health-promoting activity regardless of any qualifiers that may relate to social status, race, income, or education.[39] In contrast, targeted health promotion is specifically for a group within a population that is vulnerable because of certain indicators or risk factors.[40]

3 | METHODS

Three electronic databases were used (CINAHL, Medline, and Psych INFO). Searches were conducted in December 2021 and updated in October 2022. Primary terms search terms were used with the Boolean operator *"and"* in combination with secondary search terms

(See Table 1). In addition to the electronic databases the author felt it was judicious to also include a review of journals including *"Health Promotion Practice,"* *"The Journal of Health Promotion"*; *"International Journal of Health Promotion and Education; The Journal of Prevention and Health Promotion"*; *"Dementia: The International Journal of Social Research and Practice," and "Alzheimer's and Dementia: Diagnosis, Assessment and Disease Monitoring."* The scoping exercise completed prior to the development of the systematic review also included "grey material" and this was obtained through looking at material published through organizations such as "The Dementia Knowledge Centre" (https://www.alzheimers.org.uk/dementia-professionals/resources-professionals/dementia-knowledge-centre), "The Global Heart Hub" (https://globalhearthub.org), "The Global dementia Observatory" GlobalDementiaObservatory(GDO)(who.int), in addition to the "World Dementia Council" (www.worlddementiacouncil.org).

Following the development and application of the inclusion and exclusion criteria (see Table 2) each article retrieved was subjected to a review using narrative synthesis suggested by Popay et al.[41] The use of narrative synthesis enables findings from the included studies to be explored rather than make suggestions or draw conclusions about a single or isolated intervention. In this case the author felt that the broad nature of the subject under investigation would benefit from an expansive narrative approach, which in turn could be followed by the application of thematic analysis. The thematic analysis would provide a plotted exploration of the potential patterns that the literature yields. A deductive approach was taken to develop the thematic analysis on the grounds the aim of the review was to compare key themes identified in a previous systematic review by the author (Price, 2009[6]). In using this approach insights gained from the previous publication could be used to identify comparative themes and new concepts relating to health promotion strategies relating to vascular cognitive impairment and vascular dementia.

Using PRISMA[42] as guidance to obtain literature it became evident that there is a scarcity of literature in the subject area specifically focusing on the role of health promotion in vascular cognitive impairment and vascular dementia (see Figure 1) The systematic search of the literature yielded eight papers from a range of countries as sources of evidence suitable for review following the implementation of the inclusion and exclusion criteria (see Table 3). Each piece of literature was read in full to ascertain concordance the subject area of vascular cognitive impairment, vascular dementia, and health promotion to ensure relevant material could be identified in the main body of the article, and reference lists were also scrutinized to see if any literature could be identified that had been omitted from the initial search.

The papers were then read in full and key themes identified; decisions about what constituted a key theme were guided by the review question and through identifying the occurrence of the primary and secondary search terms developed for this review in the papers selected.

TABLE 1 Search terms.

Primary Search Term	Boolean Operator	Secondary Search Term
Vascular Dementia		Health Promotion
		Health Education
	"AND"	Health Improvement
Vascular Cognitive Impairment		Disease Prevention
		Modifiable Risk
		Healthy Lifestyle

4 | RESULTS

4.1 | Theme 1. – Healthy heart, healthy brain

Kivipelto et al.[50] recognizes the robust evidence supporting the link between vascular health and brain health and that maintaining vascular health reduces the risk of cognitive change and dementia. There is acknowledgement that more evidence is needed to understand what specific interventions would be optimal and a recognition that these interventions need to be tailored to different populations at different stages in their life.

Vicario and Cerezo[45] support the heart-brain interaction as being indisputable and that connections between cardiovascular

TABLE 2 Study inclusion and exclusion criteria.

Inclusion	Exclusion
Literature from 2010	Literature pre-2010
Literature published in English	Literature requiring translation into English
Literature including key terms in title and abstract	Literature focused on other subtypes of dementia
Literature including health promotion	Literature focused on interventions and treatments not associated with health promotion
Primary topic of vascular cognitive impairment and/or vascular dementia.	Comparative epidemiological literature that contrasts vascular dementia with other types of dementia and comorbid conditions
Peer reviewed and published articles	Commentary/opinion pieces, newspaper articles, information retrieved from website/internet

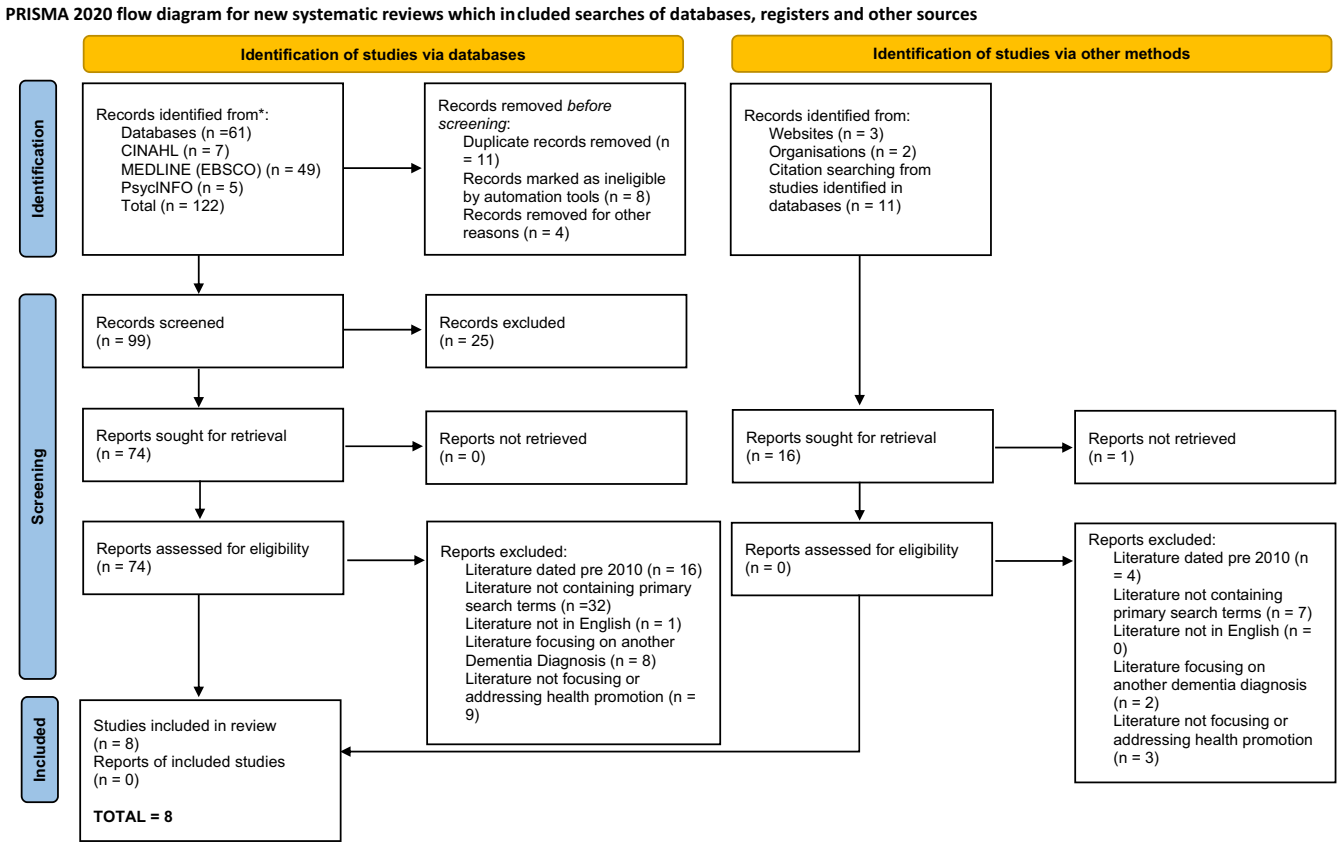

FIGURE 1 Prisma.

disease, cognitive impairment, and dementia are well established to the extent that health policy should be implemented to ensure populations maintain healthy brain aging and the preservation of cognitive function. The indisputable link between heart and brain health is supported by Gottesman and Seshadri[49] with acknowledgement that the progressive developments in neuroimaging has enabled a better understanding of this relationship.

The prevention of adverse brain change requires the consideration of multiple lifestyle and risk factors[49] and the threats to brain health arise because of impairment to cardiovascular function. Gardner et al.[44] suggest that primordial prevention of cardiovascular disease from early adulthood impacts later life cognitive function, identifying that the longer individuals live with "ideal" cardiovascular health the more likely cognitive performance is maintained.

Kaufman and Perales-Puchalt[47] recognize poor cardiac health is associated with a range of brain pathologies and that evidence is clear that the heart-brain connection is increasingly linked to dementia when heart health is compromised.

The consensus shared in all the papers recognizes the direct correlation between maintaining positive heart health to ameliorate the risk of vascular cognitive decline; however, what is not shared is an agreement on which interventions or combination of interventions are likely to enhance or maintain the healthy heart-brain relationship and at what age and to whom these should be targeted using health-promoting interventions.

4.2 | Theme 2. – Risk factors

Previous research by the author (Price, 2008, 2009[6,51,52]) detailed vascular risk factors that are associated with the onset of vascular cognitive decline and these included hypercholesterolemia, diabetes, hypertension, previous incidence of stroke, age, gender, lifestyle choices, race, and ethnicity. The risk factors relating to lifestyle choice included health-depreciating behaviors such as poor diet, smoking, lack of exercise, alcohol consumption, and obesity.

Gottesman and Seshadri[53] suggest in addition to these risk factors there are novel risk factors that can be added to this list. These include later life air pollution exposure, traumatic brain injury, and sleep disturbances. Gardner et al.[46] also recognize sleep as a contributing risk factor to changes in heart-brain health and additionally present novel risk factors of migraine, chronic kidney disease, inflammation, and infectious burden.

Metabolic syndrome (a combination of diabetes, hypertension, and obesity) is recognized to be a significant contributor to vascular change and places the heart-brain relationship at significant risk when present in populations. Metabolic pathophysiology is cited by Gardner et al.,[46] Kaufman and Perales-Puchalt,[49] and Vicario and Cerezo[45] as a combination that is more likely to impact on vascular health and cognitive impairment, yet the other authors report these factors singularly as contributors.

TABLE 3 Overview of papers included.

Author(s) and Date	Article Title	Methodology	Summary
Dichgans & Zietemann[43]	Prevention of vascular cognitive impairment	Literature review	The prevention of vascular brain damage is an important goal. Preventing vascular disease is important in reducing the prevalence of VaD and VCi. A demand for large properly designed trials is evident.
Gardner et al.[44]	Brain health and shared risk factors for dementia and stroke	Literature review	Vascular risk factors contribute to brain health and effective preventative interventions to improve heart health are required to reduce the onset of dementia and vascular cognitive impairment.
Vicario & Cerezo[45]	At the heart of brain disorders: preventing cognitive decline and dementia	Literature review	Dementia is incurable yet evidence highlights vascular disease prevention may delay the onset of the condition. Vascular risk detection, preventative measures and identification of therapeutic targets may represent an effective strategy to prevent or delay cognitive decline.
Tariq & Barber[46]	Dementia risk and prevention by targeting modifiable risk factors	Literature review	Public health efforts need to promote healthier lifestyles. Dementia prevention strategies are more likely to succeed if early risk assessment is targeted at those manifesting vascular disease. Further clinical trials are required to target modifiable risk factors in high-risk groups.
Kaufman & Perales-Puchalt[47]	Cardiovascular contributions to dementia: beyond individual risk factors	Commentary	Poor cardiac health associated with a range of brain pathologies, maintaining cardiac health may prevent or delay the onset of dementia, further interventions are required to be developed to improve cardiovascular health.
Chen & Rundek[48]	Vascular brain health	Literature review	Maintaining vascular brain health is critical for healthy life. Vascular risk factor reduction and the promotion of healthy lifestyle will assure successful aging and brain health.
Gottesman & Seshadri[49]	Risk factors, lifestyle behaviors, and vascular brain health	Literature review	Identification of traditional vascular risk factors, lifestyle behaviors, and other factors that impact on cognition. Further clinical trials and observational data are required to support developing recommendations for impacting dementia incidence and improving brain health.
Kivipelto et al.[50]	Trials and treatments for vascular brain health: risk factor modification and cognitive outcomes	Evidence reporting from trials	Vascular risk factors are the major preventable and treatable component of dementia. Vascular and metabolic risk factors contribute to later life cognitive impairment and dementia. Evidence on the efficacy of risk reducing interventions is not yet conclusive.

Developing the theme of novel risk factors, Gottesman and Seshadri[49] identify the composition of the microbiomes in the gut as essential for reducing the risk of cognitive impairment with suggestions that the production of butyrate, which promotes cognitive function, can be impaired by stroke and lifestyle factors. Other papers included in this review have not provided any additional insight; however, reviewing the evidence referred to by Gottesman and Seshadri,[49] published by Bourassa et al.,[53] the research indicates that both dietary and pharmacological butyrate (a chemical found in the gut) has an impact on the gut brain axis and maintaining a fiber-rich diet can improve cognitive function. Unfortunately, the focus of this research was predominantly on children with autism and although valuable was not able to establish a link between gut microbiomes and vascular cognitive impairment and dementia.

Recognizing the vascular component to the onset and progression of Alzheimer's disease (Weinstein, 2018[6,18,54]), Tariq and Barber[46] suggest there is a considerable interaction between cardiovascular disease (CVD) and Alzheimer's disease with hallmarks of CVD not being specific just to vascular dementia. The apolipoprotein E gene (APOE4) is the most significant genetic risk factor for the development of Alzheimer's disease, and Kaufman and Perales-Puchalt[47] recognize that not everyone with this gene will go on to develop dementia; however, poor cardiovascular health in individuals with the APOE4 gene and particularly the incidence of stroke have a combined effect of increasing the onset of dementia.

TABLE 4 Risk factors.

Risk Factor	Modifiable/ Nonmodifiable	Supporting Evidence
Stroke	Nonmodifiable	Gottesman and Seshadri[49]; Chen and Rundek[48]; Kaufman and Perales-Puchalt[47]; Tariq and Barber[46]; Gardener et al.[44]; Vicario and Cerezo[45]; Dichgans, & Zietemann,[43]
Age	Nonmodifiable	Gottesman and Seshadri[49]; Chen and Rundek[48]; Tariq and Barber[46]; Vicario and Cerezo[45]; Dichgans & Zietemann[43]
APOE4 gene/genetics	Nonmodifiable	Gottesman and Seshadri[49]; Chen and Rundek[48]; Kaufman and Perales-Puchalt[47]; Tariq and Barber[46]; Vicario and Cerezo[45]; Dichgans & Zietemann[43]
Traumatic brain injury	Nonmodifiable	Gottesman and Seshadri[49]
Race and ethnicity	Nonmodifiable	Gottesman and Seshadri[49]
Gender	Nonmodifiable	Gottesman and Seshadri[49]
Hypertension	Modifiable	Gottesman and Seshadri[49]; Kivipelto et al.[50]; Chen and Rundek[48]; Kaufman and Perales-Puchalt[47]; Tariq and Barber[46]; Gardener et al.[44]; Vicario and Cerezo[45]; Dichgans and Zietemann[43]
Diabetes	Modifiable	Gottesman and Seshadri[49]; Kivipelto et al.[50]; Kaufman and Perales-Puchalt[47]; Tariq and Barber[46]; Gardener et al.[44]; Vicario and Cerezo[45]; Dichgans and Zietemann[43]
Obesity	Modifiable	Gottesman and Seshadri[49]; Chen and Rundek[48]; Kaufman and Perales-Puchalt[47]; Tariq and Barber[46]; Gardener et al.[44]; Vicario and Cerezo[45]; Dichgans and Zietemann[43]
Hypercholesterolemia	Modifiable	Gottesman and Seshadri[49]; Kivipelto et al.[50]; Chen and Rundek[48]; Tariq and Barber[46]; Gardener et al.[44]; Vicario and Cerezo[45]; Dichgans and Zietemann[43]
Smoking	Modifiable	Gottesman and Seshadri[49]; Chen and Rundek[48]; Kaufman and Perales-Puchalt[47]; Tariq and Barber[46]; Gardener et al.[44]; Vicario and Cerezo[45]; Dichgans and Zietemann[43]
Diet	Modifiable	Gottesman and Seshadri[49]; Tariq and Barber[46]; Gardener et al.[44]; Dichgans & Zietemann[43]
Physical activity	Modifiable	Gottesman and Seshadri[49]; Chen and Rundek[48]; Kaufman and Perales-Puchalt[47]; Tariq and Barber[46]; Gardener et al.[44]; Vicario and Cerezo[45]; Dichgans and Zietemann[43]
Sleep	Modifiable	Gottesman and Seshadri[49]; Gardener et al.[44]
Metabolic disease	Modifiable	Kaufman and Perales-Puchalt[47]; Gardener et al.[44]; Vicario and Cerezo[45]
Alcohol consumption	Modifiable	Gardener et al.[44]
Inflammation and infectious Burden	Modifiable	Gardener et al.[44]; Dichgans & Zietemann[43]
Gut health	Modifiable	Gottesman and Seshadri[49]
Migraine	Modifiable	Gardener et al.[44]
Chronic kidney disease	Modifiable	Gardener et al.[44]; Dichgans & Zietemann[43]
Social activity/psychosocial factors	Modifiable	Tariq and Barber[46]
Education	Modifiable	Chen and Rundek[48]; Kaufman and Perales-Puchalt[47]; Dichgans and Zietemann[43]
Homocysteine	Modifiable	Dichgans & Zietemann[43]
Pollution	Modifiable	Kivipelto et al.[50]
Cognitive reserve and resilience	Modifiable	Chen and Rundek[48]
Depression	Modifiable	Kaufman and Perales-Puchalt[47]

Gottesman and Seshadri[49] expand further by suggesting that having the APOE4 gene has the potential to modify the brain and its resilience to vascular risk and this is exacerbated further when lifestyle behaviors that impact on cardiovascular health are present.

4.3 | Theme 3. – Risk reduction/modification

The literature widely recognizes modifiable and nonmodifiable factors that contribute to an increased risk of the development cognitive impairment and dementia. Table 4 summarizes the papers reviewed and their findings.

4.4 | Theme 4. – Interventions

Kivipelto et al.[50] recognize that several trials have been undertaken to attempt to modify vascular risk factors and they have included interventions to minimize the impact of hypertension, diabetes, and hypercholesterolemia; however, the conclusion drawn is that

although beneficial these trials fail to recognize the intricate and often multifactorial underlying causes of vascular dementia.

Chen and Rundek[48] report that managing cardiovascular risk should focus specifically on maximizing brain health and this should include measuring body mass index (BMI), levels of physical activity, smoking behaviors, diet, blood pressure, total cholesterol, and fasting glucose. This suggestion is adopted from the American Health Association's[55] goal for improving the cardiovascular health of Americans and is referred to as "life's simple 7"; however, there are shortcomings to this in that there is a limited recognition of genetic factors that may influence heart health.

Kaufman and Perales-Puchalt[47] had previously recognized the need for genetic risk factors to be considered in future research into interventions that may ameliorate the risk of dementia because of cardiovascular disease.

Gottesman and Seshadri[49] also recognized the importance of improving brain health to optimize cardiovascular outcomes and refer to the value of the "life's simple 7"[55]; however, there is a suggestion that the benefits to this are more likely to occur if the strategy is implemented in middle age. Tariq and Barber[46] agree with the importance of targeting interventions at midlife and report that doing so will provide the optimal opportunity for effective treatment.

Promoting brain health is suggested to be an important public health message and campaigns need to be developed like those that already exist to promote cardiovascular health.[44] It is not, however, made apparent as to how specifically these interventions should be developed or implemented particularly in relation to preventing or reducing the impact of cognitive vascular impairment and vascular dementia.

4.5 | Theme 5 – Health promotion for vascular cognitive impairment/vascular dementia

Thematic analysis of the literature not only identifies commonalities but has an additional benefit of highlighting gaps in the evidence base. The papers reviewed highlighted a key link between maintaining vascular health and the potential to prevent or delay the onset of cognitive impairment; however, it is evident that this knowledge has not been widely developed further to recognize specific health-promoting resources or material for individuals at risk of developing cognitive problems. Understanding the risk factors for vascular change and providing measures for behavior modification is a valuable contribution to primordial and primary health promotion; however, the literature has yet to recognize how this knowledge can be brought together to provide education linked specifically to the development of vascular cognitive impairment and vascular dementia.

There is wide recognition that further research is needed (Kaufman et al., 2019)[43–46,50] to specifically develop health-promoting and preventative measures to maximize brain health to reduce the risk of dementia.

Vicario and Cerezo[45] suggest that health promotion activity should inspire populations to make changes in their lifestyles and behaviors in addition to raising the knowledge of physicians in understanding cardiovascular risk factors as a precursor to changes in brain health; however, specific strategies about how primary prevention should be implemented are not discussed.

5 | DISCUSSION

Health promotion activities for people with existing vascular cognitive impairment and vascular dementia can be challenging as primary prevention is no longer an option and this population require engagement in risk reduction activity to attempt to reduce further vascular events.

Health promotion in vascular cognitive impairment and vascular dementia should be viewed, like the disease, on a continuum; primordial and primary universal measures should be provided a better understanding of how vascular cognitive impairments develop and to provide general information about activity that can prevent vascular brain changes based on modifiable vascular risk factors. As the disease progresses then the implementation of health-promoting activity should also adapt to address secondary and even tertiary health promotion strategies.

The onset of vascular cognitive impairment and vascular dementia should signify a change in approach in implementing targeted strategies to ameliorate the risk of further cognitive decline in a directed way and health and social care providers are required to gain a better understanding of the vascular cognitive impairment continuum and health-promoting strategies. However, to achieve this there needs to be further research and development into targeted health-promoting interventions, specifically for individuals who already present on the vascular cognitive impairment and vascular dementia continuum.

Price (2008) and Price and Keady[6,56] established that there is a lack of targeted health-promoting literature and resources for individuals with vascular cognitive impairment and especially for those at the latter end of the continuum who have been diagnosed with a vascular dementia. In the last decade more evidence has emerged to help better understand the modifiable risk factors associated with cardiovascular disease.[28,29,57,58] However, there has been a lack of evidence that supports the development of specific health-promoting interventions for these populations.

A better understanding of factors that contribute to the cognitive decline of people experiencing cardiovascular disease has developed over the last decade and there is a wider recognition that health promotion and preventative activity has the potential to reduce the risk of dementia and impaired brain health. What needs to be developed further is a clear evidence base that supports specific activity that focuses on health promotion in reducing cardiovascular disease. The link between heart health and brain health is becoming more widely appreciated and it is recognized that early cardiovascular intervention in midlife has the potential to improve

outcomes in relation to maintaining brain health, yet to date there is limited consensus available to support how interventions for the modifiable and nonmodifiable risk factors for vascular cognitive impairment and vascular dementia should be implemented and how primary prevention strategies are targeted towards vulnerable populations.

The dearth of health promotion literature and evidence to support strategies that can ameliorate the risk of vascular dementia and vascular cognitive impairment developing remains problematic. Enhancing brain health and providing vulnerable populations with health education and health-promoting guidance is a priority to ensure the burden of dementia not only on individuals and their carers but on health and social care economies is reduced.

6 | CONCLUSION

Treatments and the possibility of a cure for people living with dementia remains elusive, yet the evidence is highlighting a greater understanding of the vascular risk factors associated with the development and deterioration of vascular cognitive impairment. Between the study published by Price and Keady[6] and the literature review undertaken for this paper it is evident there remains a dearth of actual health-promoting literature that can be shared with individuals living with a risk of developing vascular cognitive impairment or for those already symptomatic. Clearly the knowledge about contributing vascular factors is growing but what needs further development is a clear and precise health promotion and health education program that is tailored directly for those at the greatest risk. Knowledge and understanding are essential in disease prevention, but when that knowledge is not disseminated to individuals at risk or already showing the signs of vascular decline (physically and mentally) then meeting global targets to reduce the incidence and impact of dementia may remain unfulfilled.

There is a clear need for health-promoting literature to be developed from these findings that can be shared widely with the public and people developing cognitive impairment attributable to a cardiovascular cause.

AUTHOR CONTRIBUTIONS

The author confirms sole responsibility for the following: study conception, study design, data collection, result analysis and interpretation, and manuscript preparation.

ACKNOWLEDGMENTS

None declared.

FUNDING INFORMATION

None declared.

CONFLICT OF INTEREST STATEMENT

None.

ORCID

Rachel S. Price https://orcid.org/0000-0003-3885-7002

REFERENCES

1. Graff-Radford J. Vascular cognitive impairment. *Continuum*. 2019;25(1)(Dementia):147-164. doi:10.1212/CON.0000000000000684
2. Harrison SL, Tang EY, Keage HA, et al. A systematic review of the definitions of vascular cognitive impairment, No dementia in cohort studies. *Dement Geriatr Cogn Disord*. 2016;42(1–2):69-79. doi:10.1159/000448213
3. Munoz DG, Weishaupt N. Chapter 5 – Vascular Dementia. In: Cechetto DF, Weishaupt N, eds. *The Cerebral Cortex in Neurodegenerative and Neuropsychiatric Disorders*. Academic Press; 2017. doi:10.1016/B978-0-12-801942-9.00005-7
4. Lambert C, Zeestraten E, Williams O, et al. Identifying preclinical vascular dementia in symptomatic small vessel disease using MRI. *Neuro Clin*. 2018;19:925-938. doi:10.1016/j.nicl.2018.06.023
5. World Health Organisation (WHO). *Dementia*. WHO; 2023. https://www.who.int/news-room/fact-sheets/detail/dementia
6. Price RS, Keady J. Systematic review: role of health promotion in vascular dementia. *J Nurs Healthc Chronic Illn*. 2010;2:88-101. doi:10.1111/j.1752-9824.2010.01053.x
7. Wittenberg R, Knapp M, Hu B, et al. The costs of dementia in England. *Int J Geriatr Psychiatry*. 2019;34(7):1095-1103. doi:10.1002/gps.5113
8. Wolters FJ, Ikram MA. Epidemiology of vascular dementia. *Arterioscler Thromb Vasc Biol*. 2019;39(8):1542-1549. doi:10.1161/ATVBAHA.119.311908
9. Rizzi L, Rosset I, Roriz-Cruz M. Global epidemiology of dementia: Alzheimer's and vascular types. *Biomed Res Int*. 2014;2014:908915. doi:10.1155/2014/908915
10. Chan KY, Wang W, Wu JJ, et al. Epidemiology of Alzheimer's disease and other forms of dementia in China, 1990-2010: a systematic review and analysis. *Lancet*. 2013;381(9882):2016-2023. doi:10.1016/S0140-6736(13)60221-4
11. Hakim AM. Small Vessel Disease. *Front Neurol*. 2019;10:1-6. doi:10.3389/fneur.2019.01020
12. Cereda CW, Olivot J-M. Emergency department (ED) triage for transient ischemic attack (TIA). *Curr Atheroscler Rep*. 2018;20:56. doi:10.1007/s11883-018-0755-5
13. Panagos PD. Transient ischemic attack (TIA): the initial diagnostic and therapeutic dilemma. *Am J Emerg Med*. 2011;30(5):749-799. doi:10.1016/j.ajem.2011.03.004
14. Wolters FJ, Zonneveld HI, Hofman A, Van der Lugt A, Koudstaal PJ, et al. Cerebral perfusion and the risk of dementia. *Circulation*. 2017;136:719-728. doi:10.1161/CIRCULATIONAHA.117.027448
15. Iadecola C, Duering M, Hachinski V, et al. Vascular cognitive impairment and dementia: JACC scientific expert panel. *J Am Coll Cardiol*. 2019;73(25):3326-3344. doi:10.1016/j.jacc.2019.04.034
16. Dichgans M, Leys D. Vascular cognitive impairment. *Circ Res*. 2017;120:573-591. doi:10.1161/CIRCRESAHA.116.308426
17. Renata FL. Brain oxygen extraction is differentially altered by Alzheimer's and vascular diseases. *J Magn Reson Imaging*. 2020;52(6):1838-1839. doi:10.1002/jmri.27281
18. Sweeney MD, Montagne A, Sagare AP, et al. Vascular dysfunction—the disregarded partner of Alzheimer's disease. *Alzheimer's Dementia*. 2019;15(1):158-167. doi:10.1016/j.jalz.2018.07.222
19. Weinstein J. A new direction for Alzheimer's research. *Neural Regen Res*. 2018;13(2):190-193. doi:10.4103/1673-5374.226381
20. Sachdev P, Kalaria R, O'Brien J, et al. Diagnostic criteria for vascular cognitive disorders: a VASCOG statement. *Alzheimer Dis Assoc Disord*. 2014;28(3):206-218. doi:10.1097/WAD.0000000000000034

21. Laverack G. The challenge of behaviour change and health promotion. *Challenges*. 2017;8(2):25. doi:10.3390/challe8020025
22. Giné March A, Bacigalupe A, Morteruel M, Martín U. Multi-level strategy to promote equity through empowerment and participation. *Int J Integr Care*. 2019;19(4):523. doi:10.5334/ijic.s3523
23. World Health Organisation (WHO). *WHO Framework on Integrated People-Centred Health Services, A report by the Secretariat*. WHO; 2016. https://apps.who.int/gb/ebwha/pdf_files/WHA69/A69_39-en.pdf
24. Jacobs G. "Take control or lean Back?" barriers to practicing empowerment in health promotion. *Health Promot Pract*. 2011;12(1):94-101. doi:10.1177/1524839909353739
25. World Health Organisation (WHO). *The Ottawa Charter for Health Promotion*. WHO; 1986. https://www.who.int/teams/health-promotion/enhanced-wellbeing/first-global-conference
26. Naidoo J, Wills J. *Foundations for Health Promotion*. 4th ed. Bailliere Tindall; 2016.
27. Turco JV, Inal-Veith A, Fuster V. Cardiovascular health promotion: an issue that can no longer wait. *J Am Coll Cardiol*. 2018;72(8):908-913. doi:10.1016/j.jacc.2018.07.007
28. Hope K. Role of nurses in addressing modifiable risk factors for early Alzheimer's disease and mild cognitive impairment. *Br J Nurs*. 2020;29(8):460-469. doi:10.12968/bjon.2020.29.8.460
29. Yusuf S, Joseph P, Rangarajan S, et al. Modifiable risk factors, cardiovascular disease, and mortality in 155 722 individuals from 21 high-income, middle-income, and low-income countries (PURE): a prospective cohort study. *Lancet*. 2020;395(10226):795-808. doi:10.1016/S0140-6736(19)32008-2
30. National Institute for Health and Care Excellence (NICE). *NICE Impact: Cardiovascular Disease Prevention*. NICE; 2018a. https://www.nice.org.uk/guidance/ph25
31. McFall A, Hietamies TM, Bernard A, et al. UK consensus on pre-clinical vascular cognitive impairment functional outcomes assessment: questionnaire and workshop proceedings. *J Cereb Blood Flow Metab*. 2020;40(7):1402-1414. doi:10.1177/0271678X20910552
32. McFarlane O, Kędziora-Kornatowska K. Cholesterol and dementia: a long and complicated relationship. *Curr Aging Sci*. 2020;13(1):42-51. doi:10.2174/1874609812666190917155400
33. Srikanth V, Sinclair AJ, Hill-Briggs F, Moran C, Biessels GJ. Type 2 diabetes and cognitive dysfunction—towards effective management of both comorbidities. *Lancet Diabetes Endocrinol*. 2020;8(6):535-545. doi:10.1016/S2213-8587(20)30118-2
34. Gorelick PB, Scuteri A, Black SE, et al. Vascular contributions to cognitive impairment and dementia: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2019;42(9):2672-2713. doi:10.1161/STR.0b013e3182299496
35. Hussenoeder FS, Conrad I, Roehr S, et al. Mild cognitive impairment and quality of life in the oldest old: a closer look. *Qual Life Res*. 2020;29:1675-1683. doi:10.1007/s11136-020-02425-5
36. National Institute for Health and Care Excellence (NICE). *Type 2 Diabetes Prevention: Population and Community-Level Interventions*. Public Health Guideline [PH35]. NICE; 2011. https://www.nice.org.uk/guidance/ph35
37. National Institute for Health and Care Excellence (NICE). *NICE Impact: Diabetes in Adults*. NICE; 2018b. https://www.nice.org.uk/guidance/ng28
38. NHS England. *The NHS long term plan*. NHS England; 2019. www.longtermplan.nhs.uk
39. Moffatt H, Fish K, Schwenger S, Sankaran S. *Let's Talk: Universal and Targeted Approaches to Health Equity*. St. Francis Xavier University. National Collaborating Centre for Determinants of Health; 2013. https://nccdh.ca/images/uploads/Approaches_EN_Final.pdf
40. McLaren L, Petit R. Universal and targeted policy to achieve health equity: a critical analysis of the example of community water fluoridation cessation in Calgary, Canada in 2011. *Crit Public Health*. 2017;28(2):153-164. doi:10.1080/09581596.2017.1361015
41. Popay J, Roberts H, Sowden A, et al. *Guidance on the Conduct of Narrative Synthesis in Systematic Reviews: a Product of the ESRC Methods Programme*. Lancaster University; 2006.
42. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Syst Rev*. 2021;10:89. doi:10.1186/s13643-021-01626-4
43. Dichgans M, Zietmann V. Prevention of vascular cognitive impairment. *Stroke*. 2012;43(11):3137-3146. doi:10.1161/STROKEAHA.112.651778
44. Gardener H, Wright CB, Rundek T, Sacco RL. Brain health and shared risk factors for dementia and stroke. *Nat Rev Neurol*. 2015a;11(11):651-657. doi:10.1038/nrneurol.2015.195
45. Vicario A, Cerezo GH. At the heart of brain disorders – preventing cognitive decline and dementia. *Euro Cardiol*. 2015;10(1):60-63. doi:10.15420/ecr.2015.10.01.60
46. Tariq S, Barber PA. Dementia risk and prevention by targeting modifiable vascular risk factors. *J Neurochem*. 2018;144(5):565-581. doi:10.1111/jnc.14132
47. Kaufman CS, Perales-Puchalt J. Cardiovascular contributions to dementia: beyond individual risk factors. *Int Psychogeriatr*. 2019;31(10):1387-1389. doi:10.1017/S1041610219001285
48. Chen CLH, Rundek T. Vascular brain health. *Stroke*. 2021;52(11):3700-3705. doi:10.1161/STROKEAHA.121.033450
49. Gottesman RF, Seshadri S. Risk factors, lifestyle Behaviours, and vascular brain health. *Stroke*. 2022;53(2):394-403. doi:10.1161/STROKEAHA.121.032610
50. Kivipelto M, Palmer K, Hoang T, Yaffe K. Trials and treatments for vascular brain health: risk factor modification and cognitive outcomes. *Stroke*. 2022;53(2):444-456. doi:10.1161/STROKEAHA.121.032614
51. Price RS. *A substantive investigation into vascular dementia and health promotion*. Unpublished MSc Thesis. The University of Manchester; 2008.
52. Price RS, Keady J. Introducing the 4ME cue card for vascular dementia. *J Dementia Care*. 2009;17(4):24-26.
53. Bourassa MW, Alim I, Bultman SJ, Ratan RR. Butyrate, neuroepigenetics and the gut microbiome: can a high fibre diet improve brain health? 2016 CITED IN: Gottesman, RF, And Seshadri, S. (2022). Risk Factors, Lifestyle Behaviours, and Vascular Brain Health. Stroke 53(2), 394–403. doi: 10.1161/STROKEAHA.121.032610
54. Weinstein J. A new direction for Alzheimer's research. *Neural Regen Res*. 2018;13(2):190-193. doi:10.4103/1673-5374
55. American Health Associations (AHA). *Life's Simple 7*. AHA; 2020. https://playbook.heart.org/lifes-simple-7/. CITED IN: Chen, CLH., and Rundek, T. (2021). Vascular Brain Health. Stroke 52(11):3700–3705. doi: 10.1161/STROKEAHA.121.033450.
56. Price RS, Keady J. Introducing the 4ME cue card for vascular dementia. *J Dementia Care*. 2009;17(4):24-26.
57. Adams ML, Grandpre J, Katz DL, Shenson D. The impact of modifiable risk factors on leading chronic conditions. *Prev Med*. 2019;120:113-118. doi:10.1016/j.ypmed.2019.01.006
58. Edwards GA III, Gamez N, Escobedo G Jr, Calderon O, Moreno-Gonzalez I. Modifiable risk factors for Alzheimer's disease. *Front Aging Neurosci*. 2019;361:129-143. doi:10.3389/fnagi.2019.00146

How to cite this article: Price RS. Exploring what progress is being made in the development of health promotion material for vascular dementia: A systematic review of the evidence. *Aging Med*. 2023;00:1-11. doi:10.1002/agm2.12253