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CENTER OF
EXCELLENCE**

ALZHEIMER'S ASSOCIATION

DEMENTIA RISK
REDUCTION

HYPERTENSION AND COGNITION: WHAT'S GOOD FOR THE HEART IS GOOD FOR THE BRAIN

The Public Health Center of Excellence on Dementia Risk Reduction coordinates risk reduction efforts and helps public health agencies share best practices. The Center translates the latest science on dementia risk reduction into actionable tools, materials and messaging that public health agencies can use to reduce dementia risk for all people — including those in diverse, underserved and higher-risk communities.

Find the summaries of science and additional tools, resources and data at: alz.org/riskreduction

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HYPERTENSION AND COGNITION

WHAT IS ALREADY KNOWN

High blood pressure is strongly linked to poorer brain health, including increased risk for cognitive decline and dementia. Up to 80% of individuals with Alzheimer's disease show evidence of vascular damage in the brain, such as small vessel disease, microinfarcts, or blood-brain barrier disruption, for which hypertension is a leading risk factor. Over 50% of adults have hypertension by age 50. The evidence for hypertension's role in cognitive decline is consistent across cultures and races and spans the translational spectrum from basic biology to epidemiologic and clinical trial science.

BACKGROUND AND EVIDENCE BASE

Evidence from population studies

There is substantial evidence that chronic hypertension over the lifespan is the most prevalent risk factor for cognitive impairment in aging, with midlife hypertension strongly associated with later cognitive deficits.

- Midlife vascular factors, particularly hypertension, were associated with 25-year incident dementia in the diverse Atherosclerosis Risk in Communities (ARIC) observational cohort.
- The AGES-Rejyavik Study documented the joint importance of mid- and late-life blood pressure on subsequent cognitive decline.
- The Harvard Aging Brain Study reported interactive associations among vascular risk, beta-amyloid burden, and cognitive decline in clinically normal older adults.
- In a British birth cohort study, Insight 46, vascular risk across adulthood was associated with late-life brain pathology.
- In the Coronary Artery Risk Development in Young Adults (CARDIA) study, cumulative blood pressure exposure over time, beginning in young adulthood, was associated with mobility and cognitive function in midlife.
- Most recently, a study used UK Biobank data from more than 200,000 participants to determine the relative causal contributions to dementia of individual biological and lifestyle factors that tend to cluster together in midlife. The results showed that, of the biological factors (i.e., systolic blood pressure, LDL cholesterol level, and hemoglobin A1c level), only systolic blood pressure in midlife was an independent predictor of incident dementia later in life.



Biological evidence

Cerebrovascular disease, a condition affecting the blood vessels in the brain and a complication of hypertension, is a major contributor to cognitive decline and dementia. Vascular brain changes frequently co-occur with Alzheimer's disease-related pathology, including β -amyloid and tau accumulation. Hypertension is the primary risk factor for small-vessel ischemic disease, a type of cerebrovascular disease, and cortical white matter abnormalities in the brain, both of which are highly predictive of cognitive decline and dementia. Observational studies and clinical trials suggest that better control of hypertension reduces risk for Alzheimer's and other dementias, with the strongest association for blood pressure (BP) lowering in middle age. These data support intensive BP treatment (target systolic blood pressure <130 mm Hg) as an important strategy for the prevention of cognitive impairment and suggest that benefits of intensive BP control on prevention of cognitive impairment continue even with only a few years of intensive treatment.

There is evidence for a synergistic interaction between the accumulation of A β and vascular damage in the brain. However, it is unclear whether vascular decline precedes amyloid accumulation or vice versa.

Another mechanism that could explain the link between hypertension, vascular health, and cognitive health is arterial stiffness. The brain, heart, and kidneys are especially vulnerable to arterial stiffness, and all three organs show age-related changes in physiology associated with organ system failure. Arterial stiffness increases

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pulse wave velocity, and the increased transmission of a larger forward wave may expose fragile peripheral small arteries and micro-vessels to damaging levels of pulsatility, particularly in the brain. Such damage may contribute to the microvascular disorders that are common in aging in these organs.

Evidence supporting hypertension treatment to reduce the risk of dementia

The most recent evidence that reduction of a cardiovascular (CVD) risk factor could minimize the risk for clinically significant cognitive decline comes from the Systolic Blood Pressure Intervention Trial–Memory and Cognition in Decreased Hypertension (SPRINT-MIND). Participants were randomized to either a standard blood pressure management goal (systolic blood pressure <140 mm Hg) or to an intensive blood pressure management goal (systolic blood pressure <120 mm Hg). After only 3.2 years of treatment, participants assigned to the lower systolic blood pressure goal had a 19% lower risk for developing mild cognitive impairment (MCI), a precursor stage of dementia, compared with those assigned to the systolic blood pressure goal of <140 mm Hg. Participants also had a 17% lower risk for developing dementia, but this reduction was not statistically significant as fewer cases of dementia than of MCI developed during the follow-up period. Participants assigned to the lower blood pressure goal also had reduced development of abnormal white matter lesions in their brains, indicating a possible mechanism for the observed preservation of cognitive function. This statistically positive impact on reducing the risk for cognitive impairment or dementia persisted for at least 7 years and benefited people in their 80s. Finally, a large study in China, the China Rural Hypertension Control Project, showed a 15% reduction in dementia for those treated to a systolic blood pressure goal of 120 mm Hg for 48 months.

IMPLICATIONS FOR PUBLIC HEALTH

There is a vascular component in most cases of dementia, with increasing evidence that hypertension in mid- and later life is strongly associated with dementia and should thus be a focus of prevention strategies. Public health efforts should reach populations with the highest rates of uncontrolled hypertension: older adults, especially those living in poverty, Black Americans, and American Indian and Alaska Native people. There is substantial epidemiologic evidence for a link between long term hypertension and dementia incidence, and therefore an

additional population of focus for prevention should be middle-aged adults.

Nearly six million people in the United States aged 75 years or older met the criteria for inclusion in the SPRINT trial. This age group is rapidly growing and at the greatest risk for cognitive decline and dementia and would therefore be a prominent subgroup to target for meeting blood pressure goals as a way to reduce the risk of cognitive dysfunction quickly and safely.

The role of social determinants of health

Barriers to accessing healthy foods and safe environments for exercise can further exacerbate hypertension and other vascular risk factors for dementia. Diet and poor access to healthy dietary components have been linked to both dementia and hypertension. Access to healthy foods including vegetables, leafy greens, berries, whole-grain, and fish is important to reducing risk for hypertension and its complications.

Finally, a person's living environment substantially influences their risk for development of hypertension and their ability to manage it. Air pollution and limited access to safe outdoor spaces for physical activity disproportionately affect communities with lower socioeconomic status, many of which have high prevalence of Black, Hispanic, and other people of color.



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DISCUSSION

Evidence shows that vascular health and cognitive health are closely related. Chronic hypertension is the most prevalent risk factor for cognitive impairment in aging, and the incidence of high blood pressure increases with age; by age 75, up to 80% of individuals will have been diagnosed with and/or treated for hypertension. Prevention is always the most effective way to change the course of a disease, and the scientific evidence is strong for treating hypertension as an effective means to reduce the risk of cognitive dysfunction in older age. Importantly, there are many existing treatments for doing so. However, despite the wide availability of hypertension treatments, access to those treatments is a major concern for underrepresented populations, many of which have higher rates of hypertension and dementia. Public health programs should reach these populations with hypertension prevention and treatment strategies to reduce the risk of, or delay the development of, cognitive decline in later life.



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Selected References

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