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REDUCTION

# **EXERCISE AND ITS EFFECT ON COGNITION: GET MOVING FOR BRAIN HEALTH**

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](https://alz.org/riskreduction)**

# EXERCISE AND ITS EFFECT ON COGNITION

## WHAT IS ALREADY KNOWN

The United States Department of Health and Human Services recommends that all adults get at least 150 minutes of moderate-intensity exercise or 75 minutes of vigorous-intensity exercise, or an equivalent combination, per week to maintain overall health and function, and reduce the risk of a number of chronic diseases. It has become clear that high-intensity aerobic exercise improves not just the function of the body but also function of the brain. The World Health Organization included physical activity as a top priority in its review of 12 nonpharmacological interventions with the potential to reduce the risk of cognitive decline and dementia. Regular exercise as a means to enhance or protect cognitive health is gaining momentum not just among health policy experts but also in messaging to the public.



## BACKGROUND AND EVIDENCE BASE

More than three decades of research in both animal and human studies provides strong support that aerobic exercise benefits the brain. Exercise is associated with increased neurorepair, increased clearance of hyperphosphorylated tau, improved glucose metabolism, reduced inflammation, reduced  $\beta$ -amyloid plaques in the brain, and reduced oxidative stress. In rodents, aerobic exercise leads to hippocampal neurogenesis (a key brain structure for memory), increased levels of brain-derived neurotrophic factor, improved endothelial function and blood flow, slowing of atrophy, physiological stress reduction, and improved cognition. Observational studies in humans report that aerobic exercise results in

improved cognitive function and a reduced risk of cognitive decline and Alzheimer's disease, and it has positive effects on brain volume and Alzheimer's disease biomarkers.

A growing number of clinical trials provide evidence that aerobic exercise increases brain volumes and blood flow to the brain and improves cognitive functions. A recent meta-analysis of 19 studies that examined the effects of physical activity on mild cognitive impairment in older adults at risk of developing dementia (17 of which were randomized controlled trials) concluded that exercise improves cognition. The effect size was 1.3-fold higher when the analysis examined only the effects of aerobic exercise (excluding light physical activity). Thus it is clear that interventions involving high-intensity aerobic exercise substantially benefit cognitive health; however, both moderate-level and lower-intensity exercise may slow cognitive decline among older adults with mild cognitive impairment.

Some studies, such as the recently reported Exercise in Adults with Mild Memory Problems (EXERT) trial, show that even among once-sedentary adults with mild cognitive impairment exercise interventions can be feasibly and sustainably delivered in the community and by community partners even among once-sedentary adults with mild cognitive impairment. One important lesson learned is that older adults must have ongoing support and guidance as they carry out a prescribed exercise program. The EXERT trial's study success can likely be attributed to the trainer support that participants received on a weekly basis throughout their participation in the trial. This support is especially important for older adults who are not regular exercisers before starting an exercise program, and for older adults with mild cognitive impairment who consequently face daily challenges. Without support, such interventions that are designed to protect cognitive function in older adults will not likely succeed.

Combining exercise with other lifestyle behaviors such as balanced nutrition, cognitive stimulation, and monitoring and managing clinical markers such as blood pressure and blood glucose may enhance cognitive benefits and promote overall brain health. Increased physical activity was included in the Alzheimer's Association U.S. POINTER clinical trial as a component of two multidomain lifestyle interventions that also aimed to enhance nutrition, cognitive and social challenge, and health monitoring. The two interventions differed in structure, intensity, and accountability. Both interventions



# GET MOVING FOR BRAIN HEALTH

resulted in clinically significant improvements in cognitive test scores, with greater improvements among participants receiving the more intensive intervention.

## IMPLICATIONS FOR PUBLIC HEALTH

Growing evidence for a relationship between physical activity and long-term preservation of cognitive function underscores the importance of efforts to promote exercise, including creation of and participation in structured community exercise programs. Assessment and implementation of new avenues for exercise participation in diverse communities and across all age groups will strengthen the message that exercise is a helpful pathway for reducing the burden of cognitive decline and dementia. However, the success of intervention strategies will depend on access and sustainability of delivery within the community.

### *The role of social determinants of health*

There are numerous social and cultural factors that may impact an individual's ability to engage in physical activity. Individuals with higher social economic status are more likely to be physically active than others, possibly as a result of having greater access to exercise facilities and safe spaces to exercise. Women are less likely to engage in regular physical activity than men, which may be attributable to cultural norms, gender roles, and lack of social support. Overall, a broad range of societal factors may contribute to differences in physical activity, including one's residence, race and ethnicity, occupation, gender, religion, education, social capital, and local governmental policies. Collectively, these offer many opportunities to decrease barriers to engaging in physical activity and to increase exercise levels to reduce risks of cognitive decline.

## DISCUSSION

Despite the generally positive research findings that exercise improves cognitive function in both healthy adults and adults with varying stages of cognitive decline, results are not always consistent. This inconsistency is likely related to differences in study design, such as the use of supervised versus unsupervised home-based exercise interventions, and differences in the intensity, weekly frequency, and overall duration of interventions. Health-restoring effects of exercise take time; trials with interventions lasting fewer than six months rarely show cognitive benefits. Longer trials more commonly show benefits on executive function, but

those with interventions lasting fewer than 12 months rarely show benefits on memory. Thus, it can be concluded that interventions need to be of an appropriate intensity and an appropriate duration for individuals to experience benefits. Research continues on the exact amount, frequency, and duration to provide the best benefit for brain health.

A long-term commitment to an intense exercise regimen may cause some individuals to wonder whether the potential benefits are worth the challenges and discomfort that can be associated with beginning and adhering to such an exercise program. Thus, public health interventions need to provide ongoing support (coaching) to enable participants to continue exercising at appropriate levels of intensity for an appropriate period of time so that they can experience the full therapeutic benefit. There is a need for sustainable community-based programs that can be delivered by the community, using community-based infrastructure and resources. Health care providers should also be incentivized to promote “exercise as medicine” interventions to their patients, and to provide appropriate referrals to evidence-based community programs that can properly and effectively assist and support the patient. Public health messaging could also support a step-wise approach to exercise – starting small and gradually increasing intensity and frequency over time. Additional challenges with respect to recommendations arise because many trials have historically enrolled populations that are not demographically representative of the overall population, and studies are time and resource limited resulting in programs ending when the funding ends.



# EXERCISE AND ITS EFFECT ON COGNITION

In conclusion, there is increasing evidence that physical exercise, and aerobic training in particular, has favorable effects on multiple health outcomes, including protection against cognitive decline and the development of Alzheimer's disease. Although the success of intervention strategies will depend on the ultimate sustainability of their delivery within the community, it is clear that adults should be encouraged to participate in vigorous aerobic activity in line with the United States Department of Health and Human Services guidelines.



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