

'Exergames' may provide cognitive benefit for older adults

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This photo shows a cybercycle demonstration for study participants from the Glen Eddy retirement community in Niskayuna, N.Y. Credit: *American Journal of Preventive Medicine*

Virtual reality-enhanced exercise, or "exergames," combining physical exercise with computer-simulated environments and interactive videogame features, can yield a greater cognitive benefit for older adults than traditional exercise alone, according to a new study published in the February issue of the *American Journal of Preventive Medicine*.

"We found that for older adults, virtual-reality enhanced interactive [exercise](#), or 'cybercycling' two to three times per week for 3 months, yielded greater cognitive benefit, and perhaps added protection against [mild cognitive impairment](#) (MCI), than a similar dose of traditional exercise," explains lead investigator Cay Anderson-Hanley, PhD, from

the [Healthy Aging](#) and Neuropsychology Lab and Department of Psychology at Union College, Schenectady, NY.

Research shows that exercise may prevent or delay dementia and improve [cognitive functioning](#) in normal aging. However, only 14% of adults aged 65-74 years old, and only 7% of those over 75 report regular exercise. Exergames have the potential to increase exercise by shifting attention from aversive aspects toward motivating features such as competition and three-dimensional scenery, leading to greater frequency and intensity, and enhanced [health outcomes](#).



This is a sample screenshot showing scenery and competitors/avatars on an Espresso cybercycle bike tour. Credit: Courtesy of Interactive Fitness Holdings, LLC; *American Journal of Preventive Medicine*

The Cybercycle Study enrolled 101 volunteers, ranging in age from 58 to 99 years, from independent living facilities with indoor access to an [exercise bike](#). 79 participants completed initial evaluations and training, and rode identical recumbent stationary bikes, except the experimental bike was equipped with a virtual reality display. Cybercycle participants experienced 3D tours and raced against a "ghost rider," an avatar based

on their last best ride. 63 adults completed the study, averaging three rides per week. Cognitive assessment to evaluate executive functions such as planning, [working memory](#), attention, and problem solving was conducted at enrollment, 1 month later (pre-intervention) and 3 months after (post-intervention). Blood plasma was tested to measure whether a change in brain-derived neurotrophic growth factor (BDNF) indicated possible neuroplasticity, a mechanism of change that could link exercise to cognition.

The cybercycle riders had significantly better executive function than those who rode a traditional stationary bike, and cybercyclists experienced a 23% reduction in progression to MCI compared to traditional exercisers. Co-principal investigator on the project, Paul Arciero, PhD, professor of health and exercise sciences at Skidmore College, comments, "No difference in exercise frequency, intensity, or duration was found between the two groups, indicating that factors other than effort and fitness were responsible for the cognitive benefit."

"Navigating a 3D landscape, anticipating turns, and competing with others require additional focus, expanded divided attention, and enhanced decision making. These activities depend in part on executive function, which was significantly affected," notes Dr. Anderson-Hanley.

The study also found a significantly greater increase of BDNF in cybercyclists than in traditional riders, suggesting that interactive/combined mental and [physical exercise](#) may lead to cognitive benefits by way of biomarkers linked to neurotrophic effects.

"Further research will be needed to tease apart the contributions of a variety of factors in the cybercycling condition," says Dr. Anderson-Hanley. "Consistency across conditions for goal setting and competition suggests virtual reality imagery and interactive decision-making might be potent factors of the cybercycle." Exit interviews provided anecdotal

evidence of the value of these unique features. Participants commented on their enjoyment of visual stimulation and the challenge of outpacing avatars.

"The implication of our study is that [older adults](#) who choose exergaming with interactive physical and cognitive exercise over traditional exercise may garner added cognitive benefit, and perhaps prevent decline, all for the same exercise effort," concludes Dr. Anderson-Hanley.

More information: The article is "Exergaming and Older Adult Cognition: A Cluster Randomized Clinical Trial," by C. Anderson-Hanley, P.J. Arciero, A.M. Brickman, J.P. Nimon, N. Okuma, S.C. Westen, M.E. Merz, B.D. Pence, J.A. Woods, A.F. Kramer, and E.A. Zimmerman ([doi:10.1016/j.amepre.2011.10.016](https://doi.org/10.1016/j.amepre.2011.10.016)). The article appears in the *American Journal of Preventive Medicine*, Volume 42, Issue 2 (February 2012)

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