

# Strength of brain connectivity varies with fitness level in older adults

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Beckman Institute for Advanced Science and Technology director Arthur Kramer and his colleagues found a relationship between cardiorespiratory fitness and brain connectivity in older adults that was independent of their physical activity levels. Credit: L. Brian Stauffer

A new study shows that age-related differences in brain health - specifically the strength of connections between different regions of the brain - vary with fitness level in older adults. The findings suggest that greater cardiorespiratory fitness - a measure of aerobic endurance - relates to stronger brain connections and likely improves long-term brain function in aging populations.

The study results are reported in the journal *NeuroImage*.

Michelle Voss led the study while a postdoctoral researcher at the University of Illinois with Beckman Institute director Arthur Kramer and kinesiology and community health professor Edward McAuley. Voss now is an assistant professor at the University of Iowa.

"Our study provides the strongest evidence to date that fitness in an older adult population can have substantial benefits to [brain health](#) in terms of the functional connections of different regions of the brain," Kramer said.

There are many ways to measure brain health across the lifespan. One popular technique measures the strength of connections between different parts of the brain while the person is completing a task or during wakeful rest. The latter is known as resting-state functional connectivity. Research has shown that some of these connections weaken with increasing age and indicate deteriorating brain health.

Using functional magnetic resonance imaging, Voss and colleagues measured the strength of these connections throughout the brain in younger and older adults at rest. As expected, the team confirmed that most connections were weaker for older adults when compared with younger adults.

Building on these findings, the researchers examined the role of [cardiorespiratory fitness](#) on resting-brain connectivity in older adults. Fitness is determined by how efficiently someone uses oxygen during [physical activity](#) such as running on a treadmill. Other factors aside from habitual physical activity may alter how fitness affects brain health. For example, a person's genetic makeup can influence his or her fitness and general brain health.

The researchers found a relationship between fitness and the strength of the connections between certain brain regions in [older adults](#) at rest that was independent of their level of physical activity.

"An encouraging pattern in the data from our study and others is that the benefits of fitness seem to occur within the low-to-moderate range of endurance, suggesting that the benefits of fitness for the brain may not depend on being extremely

fit," Voss said.

The study concludes that there is a positive role of cardiorespiratory fitness, beyond habitual physical activity, on brain health as people age.

"The idea that fitness could be related to brain health regardless of one's physical activity levels is intriguing because it suggests there could be clues in how the body adapts for some people more than others from regular activity. This will help our understanding of how [fitness](#) protects against age-related cognitive decline and dementia," Voss said.

**More information:** "Fitness, but not physical activity, is related to functional integrity of brain networks associated with aging"

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