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Poorer lung health leads to age-related changes in brain function

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Keeping the lungs healthy could be an important way to retain thinking functions that relate to problem-solving and processing speed in one's later years, new research suggests.

While these two types of "fluid" cognitive functions were influenced by reduced pulmonary function, a drop in lung health did not appear to impair memory or lead to any significant loss of stored knowledge, the study showed.

Researchers used data from a Swedish study of aging that tracked participants' health measures for almost two decades. An analysis of the data with statistical models designed to show the patterns of change over time determined that reduced pulmonary function can lead to cognitive losses, but problems with cognition do not affect lung health.

"The logical conclusion from this is that anything you could do to maintain lung function should be of benefit to fluid cognitive performance as well," said Charles Emery, professor of psychology at Ohio State University and lead author of the study. "Maintaining an exercise routine and stopping smoking would be two primary methods. Nutritional factors and minimizing environmental exposure to pollutants also come into play."

Emery said the analysis also offers insights into the process of human aging. While one theory of aging holds that all functions that slow down do so at the same rate, this study suggests that some aspects of functional

decline contribute to a change in the rate of other areas of decline.

"In this case, pulmonary functioning may be contributing to other aspects of functioning," he said. "It starts to speak to the bigger question: What are the processes involved in aging?"

The study is published in the current issue of the journal Psychological Science.

The study sample consisted of 832 participants between ages 50 and 85 who were assessed in up to seven waves of testing across 19 years as part of the Swedish Adoption/Twin Study of Aging. Emery and colleagues used data from pulmonary and cognitive tests conducted in the Swedish study.

Lung function was measured in two ways: forced expiratory volume, or how much air a person can push out of the lungs in one second, and forced vital capacity, the volume of air that is blown out after a deep inhalation.

The Swedish participants also were tested in four cognitive domains that measured verbal abilities associated with stored knowledge, memory, spatial abilities related to problem-solving and processing speed – which included the ability to write correct responses quickly.

The researchers entered the data into structural equation models that allow for interaction between the components being compared – in this case, lung function and cognitive function – as well as the trajectory of the changes over time. These dual-change-score models can be likened to a horse race, Emery said.

"We were looking for effects in both directions. We had previously looked in simpler models and found that pulmonary function did predict

cognitive function, but there are some studies that show the opposite direction. It was important for us to go into this with an open mind and use this modeling to test both directions," he said.

This kind of statistical analysis did not quantify the effects, but showed clear trends between a decline in lung function and steeper losses in the two types of "fluid" cognitive function. A small effect was seen on verbal tasks, as well. Pulmonary function change had no influence on memory performance.

The study also showed that changes in cognitive function did not predict lung outcomes.

"In these models the relationship is consistently moving from pulmonary function to cognitive function and not the other way," said Emery, also a professor of internal medicine and an investigator in Ohio State's Institute for Behavioral Medicine Research.

The declines seen in this study are expected with age, he noted. And the elements of cognitive function that were not influenced by lung function – memory and retrieval of stored knowledge – are not typically associated with normal aging.

"We know, for example, that the speed at which people can perform the processing task does decline with age. But now we have data that suggests pulmonary function actually predicts that decline," he said.

Though this study does not explain what a loss of pulmonary function does to the brain, the researchers speculated that reduced lung health could lower the availability of oxygen in the blood that could in turn affect chemicals that transmit signals between brain cells.

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