

Study suggests a variety of factors beyond age influence reaction time

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Reaction time, as a measure of brain health, is influenced by aging and a variety of other factors, including education, sex, smoking, dizziness, the number of daily medications, family medical history, and even whether one favors using their right or left hand.

In a study published in *npj Aging and Mechanisms of Disease*, researchers at the Translational Genomics Research Institute (TGen), an affiliate of City of Hope, looked at data collected from more than 159,000 participants in TGen's online cognitive test called MindCrowd

(and augmented with data from an additional 500,000 individuals from a biomedical research resource in the United Kingdom known as the UK Biobank) to illustrate how reaction [time](#) can be used to measure brain health.

"Our findings have begun to pull back the curtain on the intricate network connecting processing speed and cognition to more accurately describe the comparisons of healthy, versus pathological, brain aging," said Matt Huentelman, Ph.D., TGen Professor of Neurogenomics, a MindCrowd founder, and the study's senior author.

Reaction time is a product of processing speed, or efficiency, in the central nervous system and is an essential factor in higher cognitive functions. Age is the main factor known to influence reaction time, with processing speed a limiting factor for most aspects of cognition during aging, especially memory.

The findings collectively suggest that reaction time performance is a valuable index of age-related cognitive decline, healthy brain aging, and neurodevelopment.

The key variable observed in 75,666 MindCrowd participants was simple visual reaction time (svRT) as measured in milliseconds: participants logged a keystroke whenever a pink sphere appeared at random intervals on the computer screen. The researchers also assessed participants through a word pair memory test. The results showed that both processing speed and memory declined from younger to older ages.

Sample size and diversity matter

In contrast to earlier studies, this work includes over 200,000 participants representing a wide range of factors associated with cognitive performance and Alzheimer's disease risk.

"We need a deeper understanding of the normal variation of reaction time and the genetic and environmental factors associated with reaction time performance," said Joshua Talboom, Ph.D., a postdoctoral fellow in Dr. Huentelman's lab and the lead author of the study. "We used both the MindCrowd and UK Biobank data, comprising over 233,000 combined participants, to model reaction time as a function of demographic, health, medical and lifestyle factors."

MindCrowd data showed that average reaction time slowed by 7 milliseconds per year. Besides age, factors that also slowed reaction time included smoking, dizziness, the number of daily medications, and a family history of Alzheimer's disease.

Other findings include: men, on average, being 34 milliseconds faster than women; the more education one attained, the faster the reaction time; and those age 20-40 with a left-hand preference posted a higher reaction time than their right-handed counterparts, though individuals 40-60 years old showed no difference whichever hand they preferred.

Although the differences were measured in milliseconds, they were validated by the sheer number of participants. In addition, data from the UK Biobank further validated the findings among those in the MindCrowd study.

"This study's large participant numbers, as well as broad age and surveyed data range, lends it to be a substantial evaluation of [reaction time](#) across the aging spectrum," said Dr. Talboom, who suggests that the findings are important because they will help develop a valid model of healthy brain aging.

Potential savings could reach billions of dollars

"Many things in our study linked to brain health during aging, like

biological sex, are not our choice. However, not smoking is an example of a choice we can make to have a healthier brain during aging. Mitigating age- or disease-related cognitive decline, allowing maintenance of independence by even a few years, would have many benefits," said Dr. Huentelman, "including saving billions of dollars in healthcare costs and lost productivity of caregivers, while improving the quality of life for the aging population. Part of our overall goal is to enable the cognitive healthspan to better match the human lifespan."

He added, "With MindCrowd recruitment ever-increasing, we aim to continue to refine the knowledge necessary to optimize cognitive performance throughout life."

More information: J. S. Talboom et al, Two separate, large cohorts reveal potential modifiers of age-associated variation in visual reaction time performance, *npj Aging and Mechanisms of Disease* (2021). [DOI: 10.1038/s41514-021-00067-6](https://doi.org/10.1038/s41514-021-00067-6)

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