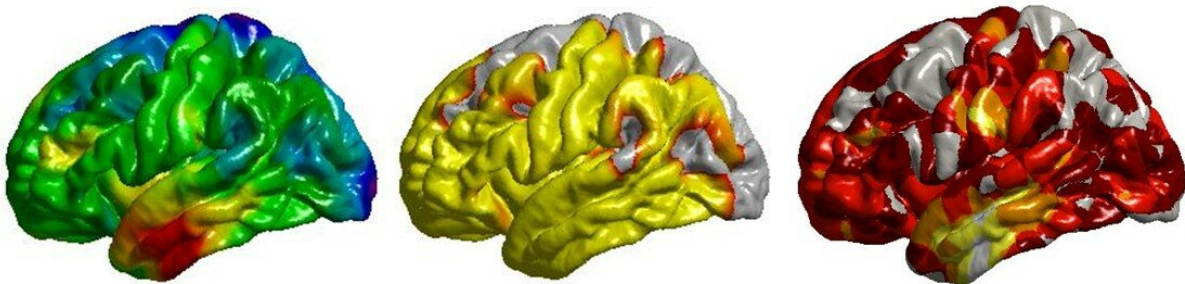


Smoking, high blood pressure, diabetes and obesity each linked to unhealthy brains

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'Having a larger number of vascular risk factors is linked to having less grey matter volume in the brain's cortex. Left panel shows areas where the effects are strongest (hotter colors), center panel shows the extent of detectable effects (yellow and red), and the right panel shows how each individual risk factor overlaps with all others (again, hotter colors show more overlap). Grey colors indicate areas that appeared unaffected.' Credit: Dr. Simon Cox, University of Edinburgh

Factors that influence the health of our blood vessels, such as smoking, high blood and pulse pressures, obesity and diabetes, are linked to less healthy brains, according to research published in the *European Heart Journal* today.

The study examined the associations between seven vascular risk factors and differences in the structures of parts of the brain. The strongest links

were with areas of the brain known to be responsible for our more complex thinking skills, and which deteriorate during the development of Alzheimer's disease and dementia.

The researchers, led by Dr. Simon Cox, a senior research associate at the Centre for Cognitive Ageing and Cognitive Epidemiology at the University of Edinburgh (UK), examined MRI scans of the brains of 9,772 people, aged between 44 and 79, who were enrolled in the UK Biobank study—one of the largest groups of people from the general population to have data available on brain imaging as well as general health and medical information. All had been scanned by a single scanner in Cheadle, Manchester, and most of the participants were from the north-west of England. This is the world's largest single-scanner study of multiple vascular risk factors and structural brain imaging.

The researchers looked for associations between brain structure and one or more vascular risk factors, which included smoking, [high blood pressure](#), high pulse pressure, diabetes, high cholesterol levels, and obesity as measured by body mass index (BMI) and waist-hip ratio. These have all been linked to complications with the blood supply to the brain, potentially leading to reduced blood flow and the abnormal changes seen in Alzheimer's disease.

They found that, with the exception of high cholesterol levels, all of the other vascular risk factors were linked to greater brain shrinkage, less [grey matter](#) (tissue found mainly on the surface of the brain) and less healthy white matter (tissue in deeper parts of the brain). The more vascular risk factors a person had, the poorer was their brain health.

Dr. Cox said: "The large UK Biobank sample allowed us to take a comprehensive look at how each factor was related to many aspects of brain structure. We found that higher vascular risk is linked to worse brain structure, even in adults who were otherwise healthy. These links

were just as strong for people in middle-age as they were for those in later life, and the addition of each risk factor increased the size of the association with worse brain health.

"Importantly, the associations between risk factors and brain health and structure were not evenly spread across the whole brain; rather, the areas affected were mainly those known to be linked to our more complex thinking skills and to those areas that show changes in dementia and 'typical' Alzheimer's disease. Although the differences in brain structure were generally quite small, these are only a few possible factors of a potentially huge number of things that might affect brain ageing."

Smoking, high blood pressure and diabetes were the three vascular risk factors that showed the most consistent associations across all types of brain tissue types measured. High cholesterol levels were not associated with any differences in the MRI scans.

To quantify the size of the differences they observed, Dr. Cox explained: "We compared people with the most vascular risk factors with those who had none, matching them for head size, age and sex. We found that, on average, those with the highest vascular risk had around 18ml, or nearly 3%, less volume of grey matter, and one-and-a-half times the damage to their white matter—the brain's connective tissue—compared to people who had the lowest risk; 18ml is slightly more than a large tablespoon-full, or a bit less than a small, travel-sized toothpaste tube."

He said that the findings showed the potential of making lifestyle changes to improve brain and [cognitive ageing](#).

"Lifestyle factors are much easier to change than things like your genetic code—both of which seem to affect susceptibility to worse brain and cognitive ageing. Because we found the associations were just as strong in mid-life as they were in later life, it suggests that addressing these

factors early might mitigate future negative effects. These findings might provide an additional motivation to improve vascular health beyond respiratory and cardiovascular benefits."

Limitations of the study include the fact that it does not include people over the age of 79 and that UK Biobank participants tend to live in less deprived areas, which may restrict how the findings can be generalised to other populations. As the researchers were measuring brain structures only, and were not carrying out functional brain imaging or tests of thinking skills, they cannot show in this study how the changes in [brain structure](#) might impact cognitive function, but other studies have shown the relationship between increased numbers of vascular risk factors and worse or declining thinking skills, and dementia.

Now the researchers plan to measure the links between vascular risk factors and thinking skills in the UK Biobank participants and in other groups too. In addition, they are following older people, and carrying out multiple scans and tests of thinking skills. They hope this will tell them more about the role that [vascular risk factors](#) play in the decline of different types of thinking skills and which areas of the brain are implicated. They also hope that the findings will motivate future work to understand the biological mechanisms through which different sources of vascular risk might be related to different [brain](#) areas and tissues.

More information: Simon R Cox et al, Associations between vascular risk factors and brain MRI indices in UK Biobank, *European Heart Journal* (2019). [DOI: 10.1093/eurheartj/ehz100](https://doi.org/10.1093/eurheartj/ehz100)

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