

Risk gene for Alzheimer's may aggravate neurological effects of air pollution in children

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Participants at the BREATHE project in Barcelona (Spain) take computerised tests Credit: Barcelona Institute for Global Health (ISGlobal)

There is growing evidence that exposure to air pollution adversely affects cognitive and behavioural development in children. However, the mechanisms underlying this association are, as yet, unknown. Now, the findings of a new study from the [Barcelona Institute for Global Health \(ISGlobal\)](#), an institute supported by the "la Caixa" Banking Foundation, suggest that the $\epsilon 4$ variant of the APOE gene may play a significant role in this process. The study has been published in the journal *Environmental Health Perspectives*.

Previous studies carried out within the framework of the BREATHE project have linked childhood exposure to [air pollution](#) with diminished cognitive development, increased [behavioural problems](#), and even structural differences in the brains of the children studied.

In the new study, which analysed data from over 1,600 children attending 39 schools in Barcelona, scientists observed that the association between exposure to traffic-related pollution and adverse effects on neurodevelopment was more marked in the children who carried the $\epsilon 4$ allele of the APOE gene. Carriers of this genetic variant had higher behaviour problem scores and their attention capacity developed more slowly. Moreover, the volume of the caudate nucleus, an anatomical brain structure, tended to be smaller in that population.

"These findings suggest that children who carry this allele could be more vulnerable to the detrimental effects that air pollution has on important aspects of their neurodevelopment," explained Silvia Alemany, ISGlobal researcher and lead author of the study

Neurodegenerative Diseases

"Systemic inflammation and oxidative stress are two of the most well-established mechanisms underlying the [adverse health effects](#) of air pollution. Interestingly, both these mechanisms are also involved in the

pathogenesis of dementia. In fact, research has demonstrated an association between exposure to air pollution and cognitive impairment in older people. All these considerations, and the fact that APOE ϵ 4 is the most important known genetic risk factor for Alzheimer's disease, led us to wonder whether the allele might also have a relationship with the [adverse effects](#) air pollution has on brain function in children," says Silvia Alemany.

Genetic data were available for all of the participants. Tests were carried out to evaluate cognitive functions, behavioural problems and possible symptoms of attention deficit hyperactivity disorder. Traffic-related [air pollution levels](#) were calculated on the basis of actual measurements. Magnetic resonance imaging data were available for 163 of the study participants.

"More research will be needed in other populations to replicate these results and we need to establish whether this possible genetic vulnerability also applies to exposure to air pollution during earlier stages of development, for example, in the prenatal period," warns ISGlobal researcher Jordi Sunyer, director of the BREATHE project. "In any case, once again the findings are clear: it is essential to implement measures to reduce traffic in the urban environment and, particularly, in places where children are present, such as the areas around schools."

More information: Silvia Alemany et al, Traffic-Related Air Pollution, APOE ϵ 4 Status, and Neurodevelopmental Outcomes among School Children Enrolled in the BREATHE Project (Catalonia, Spain), *Environmental Health Perspectives* (2018). [DOI: 10.1289/EHP2246](https://doi.org/10.1289/EHP2246)

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