

EMBARGOED UNTIL 23 SEPTEMBER**AT 03.00 AM UK TIME****-PRESS RELEASE-**

Study Findings Suggest Association between Exposure to Air Pollution—Particularly in the First 5 Years of Life—And Alterations in Brain Structure

Experts have assessed, for the first time, children's exposure to air pollution from conception to 8.5 years of age on a monthly basis

Barcelona, 23 September 2022 (EMBARGOED). A study published in the journal *Environmental Pollution* has found an association, in children aged 9-12, between exposure to **air pollutants** in the womb and during the first 8.5 years of life and alterations in white matter structural connectivity in the brain. The greater the child's exposure before age 5, the greater the brain structure alteration observed in preadolescence. The study was led by the Barcelona Institute for Global Health (ISGlobal), a research centre supported by the "la Caixa" Foundation.

Tracts or bundles of cerebral white matter ensure structural connectivity by interconnecting the different areas of the brain. Connectivity can be measured by studying the microstructure of this white matter, a marker of typical brain development. Abnormal white matter microstructure has been associated with **psychiatric disorders** (e.g., depressive symptoms, anxiety and autism spectrum disorders).

In addition to the association between air pollution and white matter microstructure, the study also found a link between specific exposure to **fine particulate matter (PM_{2.5})** and the volume of the **putamen**, a brain structure involved in motor function, learning processes and many other functions. As the putamen is a subcortical structure, it has broader and less specialised functions than cortical structures. The study found that the greater the exposure to PM_{2.5}, especially during the first 2 years of life, the greater the volume of the putamen in preadolescence.

"A larger putamen has been associated with certain psychiatric disorders (schizophrenia, autism spectrum disorders, and obsessive-compulsive spectrum disorders)," says **Anne-Claire Binter**, ISGlobal researcher and first author of the study.

"The novel aspect of the present study is that it identified periods of susceptibility to air pollution" **Binter** goes on to explain. "We measured exposure using a finer time scale by analysing the data on a month-by-month basis, unlike previous studies in which data was analysed for trimesters of pregnancy or childhood years. In this study, we analysed the children's exposure to air pollution from conception to 8.5 years of age on a monthly basis."

Effects Observed Even at Pollution Levels Complying With European Union Standards

Another strong point of this study is that the data analysed came from **a large cohort of 3,515 children** enrolled in the [Generation R Study](#) in Rotterdam (Netherlands).

To determine each participant's exposure to air pollution during the study period, the researchers estimated the **daily levels of nitrogen dioxide (NO₂) and particulate matter (PM_{2.5} and PM_{2.5} absorbance)** at their homes during the mother's pregnancy and until they reached 8.5 years of age. When participants were between 9 and 12 years analysed of age they

underwent brain magnetic resonance imaging to examine the structural connectivity and the volumes of various brain structures at that time.

The levels of NO₂ and PM_{2.5} recorded in the present study exceeded the annual thresholds limits specified in the current World Health Organization guidelines (10 µg/m³ and 5 µg/m³, respectively) but met **European Union (EU) standards**, an indication that brain development can be affected by exposure to air pollution at levels lower than the current EU air quality limit values.

“One of the important conclusions of this study” explains Binter “is that the infant’s brain is particularly susceptible to the effects of air pollution **not only during pregnancy**, as has been shown in earlier studies, but also during childhood.”

“We should follow up and continue to measure the same parameters in this cohort to investigate the possible long-term effects on the brain of exposure to air pollution” concludes **Mònica Guxens**, ISGlobal researcher and last author of the study.

Reference

Binter AC, Kusters MSW, van den Dries MA, Alonso L, Lubczyńska MJ, Hoek G, White T, Iñiguez C, Tiemeier H, Guxens M. Air pollution, white matter microstructure, and brain volumes: periods of susceptibility from pregnancy to preadolescence, *Environmental Pollution*, September 2022.

About ISGlobal

The Barcelona Institute for Global Health, ISGlobal, is the fruit of an innovative alliance between the “la Caixa” Foundation and academic and government institutions to contribute to the efforts undertaken by the international community to address the challenges in global health. ISGlobal is a consolidated hub of excellence in research that has grown out of work first started in the world of health care by the Hospital Clínic and the Parc de Salut MAR and in the academic sphere by the University of Barcelona and Pompeu Fabra University. Its working model is based on the generation of scientific knowledge through Research Programmes and Groups, and its translation through the areas of Training and Analysis and Global Development. ISGlobal has been named a Severo Ochoa Centre of Excellence and is a member of the CERCA system of the Generalitat de Catalunya.

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