Exposure to tobacco smoke in early life is associated with accelerated biological ageing

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Accelerated biological aging is associated with exposure to tobacco smoke during pregnancy and early childhood, as well as with indoor exposure to black carbon. These are the conclusions of an analysis led by

the Barcelona Institute for Global Health (ISGlobal), an institution supported by the "la Caixa" Foundation, the first to evaluate associations between a large number of early-life environmental exposures and epigenetic age in children. The analysis was published in *Environment International*.

Exposure to environmental factors during pregnancy and early childhood can significantly—and sometimes irreversibly—alter our metabolism and physiology, thereby determining our health status later in life. It can also accelerate the process of biological aging, which has been associated with a higher risk of metabolic, cardiovascular or neurodegenerative diseases. At the cellular level, aging is a continuous process that starts early in life, and which can be measured thanks to of epigenetic clocks. Epigenetic clocks use the levels of DNA methylation in certain regions of the genome to infer biological aging of a person.

"The epigenetic clock allows us to assess whether someone's biological age is older or younger than his or her chronological age," explains Mariona Bustamante, ISGlobal researcher and last author of the study. Several studies have shown an association between an acceleration in epigenetic aging and certain environmental exposures, but most were performed in adults and focusing on single exposures. In this study, the team led by Bustamante investigated for the first time the association between the early-life exposome (83 prenatal exposures and 103 in early childhood) and the epigenetic age of 1,173 children between 6 and 11 years of age from the Human Early Life Exposome (HELIX) project, based on six birth cohorts in six European countries, including Spain, and coordinated by ISGlobal researcher Martine Vrijheid.

After selecting the best suited epigenetic clock for the study and adjusting for multiple factors, the research team found that exposure to maternal tobacco smoke during pregnancy was associated with an acceleration in epigenetic aging. Regarding the postnatal exposome, the

analysis showed association with two exposures: parental smoking and indoors levels of black carbon, an air pollutant which results from the incomplete combustion of fuels (and is indirectly measured by particulate matter absorbance or PM_{abs}).

Intriguingly, two other variables were associated with a slowing in biological aging: the organic pesticide DMDTP and a persistent organic pollutant (polychlorinated biphenyl-138). "Further research is needed to explain these results, but the former could be due to a higher intake of fruits and vegetables while the latter could be explained by its correlation with body mass index," says Paula de Prado-Bert, first author of the study.

"The positive association between epigenetic age acceleration and exposure to tobacco smoke during pregnancy and early childhood go in line with previous results obtained in the adult population," says Bustamante. The epigenetic modifications could affect pathways involved in inflammation, toxin elimination, and cell cycle, with a subsequent impact on health.

Admittedly, these associations do not prove a causality, but this and future early life exposome studies will help guide health policies to reduce certain environmental exposures and promote a "healthy aging" from early life stages.

More information: Paula de Prado-Bert et al, The early-life exposome and epigenetic age acceleration in children, *Environment International* (2021). DOI: 10.1016/j.envint.2021.106683

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