

Air pollution, green space and built environment characteristics may influence body mass index

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Exposure to higher air pollution levels and greater population density during the early months of life may be associated with an increase in

children's body mass index (BMI). By contrast, living in areas with greater exposure to green space and a more favorable land use mix (a measure of the variety of building types and services in an area) could be associated with the opposite effect. These are two conclusions reached by a study undertaken by the Barcelona Institute for Global Health (ISGlobal), a center supported by the 'la Caixa' Foundation, in which data from nearly 80,000 children living in urban environments in Catalonia was, for the first time, analyzed to explore relationships between BMI growth trajectories and multiple urban exposures.

There is a growing body of evidence that environmental urban exposures, such as [air pollution](#), green space and the built environment, may be linked to effects on growth and obesity in children. These effects may begin at a very early stage, during pregnancy and the first few years of life. "Urban environments are characterized by multiple exposures that may influence the BMI, but the results of research to date have been inconsistent and earlier studies did not assess simultaneous exposures," explains the first author of the study, Jeroen de Bont, researcher at ISGlobal and the IDIAPJGol Foundation.

The most notable innovation of this new large scale longitudinal study, funded by the La Marató de TV3 Foundation and published in the journal *Environmental Pollution*, was that multiple exposures were evaluated simultaneously. The data analyzed was extracted from a database of primary care medical records in Catalonia, which included 79,992 children born between 2011 and 2012 in urban areas, who were followed up until they reached five years of age. BMI growth curves were calculated based on routine measurements of weight and height. At the same time, the authors estimated various urban exposures at the level of the census tracts where the children live. These included air pollution (nitrogen dioxides [NO₂] and particulate matter [PM₁₀ and PM_{2.5}], green spaces and several characteristics of the built environment (population density, street connectivity, land use, and walkability).

"Our results suggest that the population density in urban areas and exposure to higher levels of air pollution may be associated with a small increase in BMI in children up to five years of age and that greater exposure to green spaces and a more favorable land use mix may be associated with a small decrease in BMI," says de Bont. "The fact that these associations were strongest during the first two months of life," he adds, "could be explained by the effects of exposure during pregnancy, which would persist over time."

According to study coordinator and ISGlobal researcher Martine Vrijheid, earlier findings indicated that the relationship between BMI and air pollution might be explained by the fact that the pollution "could affect fetal growth through various factors, such as oxidative stress and inflammation, and lead to alterations in the basal metabolism of infants, thereby increasing the risk of obesity by inducing insulin resistance and hormonal alterations."

"On the other hand," Vrijheid goes on to explain, "the possible relationship between a lower BMI and exposure to [green space](#) could be explained by the fact that such spaces are a valuable resource favoring physical activity on the part of both mother and child and result in a beneficial effect on the development of the fetus and later on that of the child."

A different hypothesis is that the association could be explained by another possible mediating factor—the lower levels of air pollution observed in the greener areas in the study.

In the case of the characteristics of the built environment, Vrijheid goes on to explain that higher population density may be associated with a higher BMI "owing to higher levels of air [pollution](#) and because traffic levels in the more populated areas in Spain may give rise to a perceived lack of safety and disincentivise active modes of travel (walking and

cycling), thereby increasing childhood obesity."

While there is no clear consensus on how the land use mix affects BMI, the chief hypothesis is that a more varied land use mix decreases the distance between housing, work and services and therefore favors walking and cycling, which in turn increases levels of physical activity.

"For children, the early years of life are a time of great sensitivity; they represent a window of special vulnerability to environmental exposures that can permanently affect the structure, physiology and metabolism of the child's body. Future studies should take into account multiple exposures in the urban setting instead of analyzing exposure one by one, as encouraged by the exposome concept, which studies many different exposures a person faces altogether," Vrijheid concludes.

More information: Jeroen de Bont et al, Early life exposure to air pollution, green spaces and built environment, and body mass index growth trajectories during the first 5 years of life: A large longitudinal study, *Environmental Pollution* (2020). [DOI: 10.1016/j.envpol.2020.115266](https://doi.org/10.1016/j.envpol.2020.115266)

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