

Study links child behavior problems to prenatal tobacco smoke and traffic density

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Credit: Cottonbro/Pexels.

A pregnant woman's exposure to tobacco smoke and pollution from road traffic can influence the development of behavioral outcomes in early childhood. This is the conclusion of a recent study led by a team from the Barcelona Institute for Global Health (ISGlobal), a center supported by the "la Caixa" Foundation. The study, published in *Environmental International*, is the first to investigate the impact of the exposome—i.e. the set of all environmental exposures, both chemical and non-chemical, during the prenatal and postnatal stages—on child behavior. Previous research had assessed the impact of environmental exposures separately but not as a whole.

Childhood is a critical time for people's mental health and well-being, as it is the period when brain development accelerates. Although the causes of behavioral problems are not yet well understood, we do know that the limited genetic component involved in behavioral disorders interacts with multiple social and physical exposures, particularly during the sensitive prenatal and [early childhood](#) periods.

The study was based on data from the large European Human Early-Life Exposome (HELIX) project. The study population consisted of six

longitudinal birth cohorts from six European countries. A total of 1,287 children between 6 and 11 years of age underwent follow-up to characterize their exposures and assess behavioral problems. The researchers assessed 88 pregnancy exposures and 123 childhood exposures, encompassing the outdoor, indoor, chemical, lifestyle and social domains of the exposome.

Maternal smoking and road traffic

During pregnancy, smoking and traffic were the factors most strongly associated with behavioral problems.

"We found that maternal tobacco smoke exposure during pregnancy was the most important prenatal exposure associated with emotional and behavioral problems in children," explained Léa Maitre, postdoctoral researcher at ISGlobal and lead author of the study. Maternal tobacco smoke exposure "is closely linked to other co-exposures, such as parental psychopathology symptoms, socioeconomic factors, the father's smoking habits and the [home environment](#), in particular the quality of the attachment, support and stimulation that the child is exposed to at home," added Maitre. "This may account for a large part of the effect of maternal smoking during pregnancy on child behavior."

The study also found that increased residential traffic density on the nearest road during pregnancy was associated with increased externalizing symptoms (i.e. aggressive and rule-breaking behaviors) and a higher attention deficit hyperactivity disorder (ADHD) index. A biological explanation is plausible, although the exact mechanisms remain elusive.

Postnatal exposure to [tobacco smoke](#) and car traffic density were not as strongly associated with child behavior as prenatal exposures. This finding suggests that pregnancy may be the period most

sensitive to the harmful effects of these exposures, due in part to the rapid development of the nervous system during this time window, but also because of exposures that occur in utero, among other hypotheses.

Good sleep, healthy diet and social contact

The study also found that children aged 6-12 years who got more hours of sleep, ate a healthy (Mediterranean) diet, and whose parents had [strong family](#) and social ties had fewer internalizing symptoms, i.e. withdrawal (e.g. not talking), somatization (headaches), and anxiety or depression (nervousness).

In contrast, greater exposure to lead and copper, [indoor air pollution](#) and unhealthy diet were associated with increased behavioral problems.

In particular, a diet of readymade food, sweets and caffeinated beverages was associated with an increased risk of ADHD symptoms, although impulsivity traits in children with ADHD can also lead to poor dietary choices and emotional eating.

One of the strongest associations with ADHD was in relation to the social and family ties of the parents (especially the mother): children whose parents had contact with family or friends less than once a week were 31% more likely to have ADHD symptoms.

Indoor air pollution in the home and levels of copper and lead in the blood were associated with increased behavioral problems in children.

"Our findings confirm the harmful role of maternal smoking and traffic exposure during pregnancy in childhood behavioral disorders, but they also underscore the potential protective role of a healthy family lifestyle during childhood, in particular diet, sleep and regular [social contact](#)," commented Martine Vrijheid, head of the Childhood and Environment Programme at ISGlobal and last author of the study. "Early promotion of healthy family habits and regulation of air quality and lead exposure could help to prevent the future development of mental health disorders."

The second author of the study, Jordi Julvez, a neuropsychologist and researcher at the Pere Virgili Institute of Health Research (IISPV-CERCA), underscored the importance of the study: "For the first time, human behavioral studies are taking into account a wide variety of environmental determinants and lifestyles in a single analysis, from the perspective of child psychological development. This is the closest we have come so far in adjusting our studies to the multifaceted reality of human psychological development."

More information: Léa Maitre et al, Early-life environmental exposure determinants of child behavior in Europe: A longitudinal, population-based study, *Environment International* (2021). [DOI: 10.1016/j.envint.2021.106523](https://doi.org/10.1016/j.envint.2021.106523)

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