



A Child's Unique "Web of Exposures" Can Affect Lung Health

Naturally, aspects of a person's environment are connected, but until recently, scientists lacked the tools to visualize this complex web. The "exposome" concept maps environmental exposures and shows how they can affect a person's health.

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What is this research about?

This is the first study to apply the exposome concept to look at early life lung health in Canadian children.

The exposome is made up of all the exposures a person encounters over his or her lifetime, from conception onward. From broad external exposures, including social, economic and neighborhood factors like stress or air pollution, to more personal exposures determined by diet, lifestyle and an individual's unique characteristics, the exposome represents the environmental counterpart to our genetic blueprint: it is the "nurture" in the nature (genes) and nurture mix that makes us who we are.

Scientists know the environment plays an important role in the development of allergic diseases, such as asthma. However, before this study, the exposome concept had never been applied to the study of respiratory health in early life.

What did the researchers do?

Researchers in Kingston, Ontario, examined data from 560 women involved in the Kingston Allergy Birth Cohort, a study that tracks children from before birth to see how various factors influence health over time.

The women completed an environmental questionnaire asking about their homes (single-family house, multi-family house or apartment/condo) and their exposures to smoke, mould, and air fresheners during pregnancy.

After the babies were born, the researchers asked the mothers to complete follow-up environmental questionnaires, which captured additional details about the child's birth, siblings, and breastmilk consumption. Finally, the researchers asked parents about the respiratory health of their children, including symptoms such as wheezing (whistling, noisy breathing), or coughing not associated with a cold.

The researchers used the survey data to create "exposome globes" for each child, for both the pre-birth period and the birth-to-age-two period. The globes made the invisible visible by revealing not only the environmental exposures surrounding the children, but the intricate web of connections between those exposures.

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What did the researchers do? *cont.*

For example, the globes revealed that children living in the country were more likely to be exposed to farms, dogs, and wood burning, but less likely to live near a major road or a parking lot.

Next, the researchers analyzed the interactions among the environmental exposures to determine which combinations might be closely related to childhood respiratory health.

What did the researchers find?

The type of home, its location (city or country), and the socioeconomic status of the neighborhood were the exposures most connected to other factors. When the researchers looked at the impacts of these variables on a child's respiratory health, they found both positive and negative influences.

Breastfeeding, the presence of siblings, and a higher gestational age had positive influences on respiratory health in childhood. Based on previous studies, the researchers believe that some of the positive effects of breastfeeding may be related to the contribution of breastmilk to the establishment of a healthy mix of microorganisms in the baby's digestive tract, and that the interactions between a baby and its siblings may contribute in a similar way.

The positive effect of a higher gestational age may have a different cause. Gestational age is a measure of how long the baby spends developing in the mother's womb: if that time is less than 37 weeks, a newborn is classified as "premature." The lungs are one of the last organs to develop, and they can be dangerously underdeveloped in premature babies. Excluding premature babies from their analysis, the researchers found that extra time in the womb was beneficial for lung development even for full-term babies born between 37 and 40 weeks. The exposome globe also revealed that a lower gestational age within term babies was related to a caesarean-section birth.

Exposure during pregnancy to cigarette smoke, and exposure to mould and air fresheners in the early-life home environment had negative effects on a child's respiratory health. While smoking and mould have previously been associated with asthma in children, much less is known about the role of air fresheners.

The exposome globe also helped to visualize other meaningful connections. For example, the globes revealed that smoke exposure was related to housing type and age of the home, while mould exposure was related to the financial status of the neighborhood. Air freshener use was associated with smoking, the use of candles indoors and financial status, illustrating how interconnected home exposures can be.

How can this research be used?

The study's findings can be used to support breastfeeding efforts, and to caution against unnecessary caesarean section deliveries, as even small decreases in gestational age may affect childhood lung health.

The findings also suggest that policy efforts to improve the housing and financial situations of parents—factors that are associated with exposure to smoke and mould—may improve the lung health of the next generation.



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