



Association pour la santé environnementale du Québec  
Environmental Health Association of Québec

## ECO-JOURNAL

June 2021

*Bhavini Patel*

# The Brain & Pollution: Effects on Infants, Children, and Adolescents Part 1

It is now widely known that pollution constitutes a threat to human and animal health. Environmental pollutants can affect biological functioning in various ways. The following article will focus on how the nervous system (i.e., the brain) is affected. Specifically, it will explore the effects of pollution on the early years of life, starting with the fetus and ending with the adolescent.

### **Exposure to Pollutants during Pregnancy: The Prenatal Brain**

Pollutants can have harmful effects on the developing fetus by crossing the placental barrier. A study conducted by Klepac (2018) and colleagues showed a strong positive correlation between high levels of air pollutants (e.g., particulate matter, nitrous dioxide, ozone, and carbon monoxide) and the risk of pre-term births. This is particularly alarming as pre-term birth is associated with lower brain volumes in certain regions of the cerebral cortex often leading to neurodevelopmental, cognitive, and behavioural impairments throughout the lifespan (Boardman et al., 2020).

In the early stages of fetal development, the fetal brain is primarily, if not strictly, affected by the functioning of the surrounding placenta. One study examined the effects of household air pollution (HAP) between three groups of pregnant women (high HAP, moderate HAP, and low HAP) and found that higher exposures correlated significantly with chronic placental hypoxia (Dutta et al., 2018), a condition that deprives the fetus of a proper supply of oxygen and is often a common occurrence in smoking mothers.



514-332-4320



bureau@aseq-ehaq.ca  
office@aseq-ehaq.ca

## **Exposure to Pollutants during Young Infancy and Childhood**

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In Mexico City, a team of researchers discovered cognitive deficits in a group of healthy children with no prior neurological risks and linked them to high levels of ambient pollution (Calderón-Garcidueñas et al., 2008). The deficits were primarily located in the prefrontal cortex, a region important for thought process, reasoning, logic, etc. Neuroinflammation was reported to be the main mechanism through which these outcomes precipitated themselves.

A closer look at this process revealed that neuroinflammation was an immune response triggered by pollutants. More alarmingly, this inflammatory process shares a large number of similarities with what is observed in patients with neurodegenerative diseases like Alzheimer's or Parkinson's (Calderón-Garcidueñas et al., 2015).

The neural effects of pollution vary per individual, but there seems to be a trend that a group of researchers in Japan found in a representative sample of children who had prenatal exposure to pollutants. Essentially, they noticed delays in many important milestones like speech acquisition, fine motor development, impulse control, and emotional expression (Yorifuji et al., 2016).

The previous finding exemplifies the cumulative effects of pollution. In simpler terms, this means that toxins may accumulate in brain tissues over long periods causing:

- Continuous effects and/or delayed effects on the brain,
- Effects that last for long periods and/or worsen with additional exposures.

This puts children at risk for developing problems in the next important stage of life: adolescence.

## **Exposure to Pollutants during Adolescence**

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During adolescence, the brain is still developing and preserves a particular sensitivity to external factors like toxins. One study found an interesting link between the amount of exposure to nitrogen oxides and particulate matter and the number of psychotic



experiences in adolescents (Newbury et al., 2019). Psychotic experiences include paranoia, hallucinations, and symptoms common with schizophrenia. Research shows that it is likely that exposure to pollutants may be especially harmful to youth that is already at risk for abnormal psychology.

## Summary

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As you might have concluded from the previous sections, pollution may lead to changes in the brain that can create a wide variety of neurological malfunctions/disorders. Here is the gist of what the previous sections covered:

- Prenatal exposure to pollutants increases the risk of pre-term birth.
- Prenatal exposure to pollutants can lead to complications in brain development which have lasting effects across later stages of life.
- Exposure to pollutants in childhood can slow down normal brain development causing delays in the acquisition of important skills like language learning, memory, and thought processing.
- In adolescence, exposure to pollutants can trigger the early onset of psychological and neurodegenerative disorders.
- Pollutants mainly affect the brain through neuroinflammation, which can be acute (sudden) or chronic (continuous).

## How to Reduce Exposure to Pollutants

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The first few stages of life lay the foundations on which one's future well-being depends. Any interruptions during this period can have life-long impacts on the body. This stresses the importance of intervening as early as possible. Below is a list of a few actions one can take to reduce their exposure to pollutants (Laumbach et al., 2015):

- **Diminish your contribution to outdoor air pollution.** Reduce travel by car and opt for public transportations, bicycling, or walking whenever possible.
- **Keep indoor air clean.** Make sure your house is properly sealed to prevent outdoor pollutants to enter the indoor environment. Install air filters that help clean indoor air.



- **Avoid exercising in polluted areas.** For example, opt for jogging at a park as opposed to urban areas near ongoing traffic.
  - Keep an eye out for air quality. According to research, air pollution is worse on hot, sunny days, and around rush hour when there are many vehicles on the road (“Exercise and Air Quality: 10 Top Tips”, 2015).
- **Choose electric stoves instead of coal, wood, or gas.**
- **Avoid buying products with volatile organic compounds (VOCs).** These can include aerosol sprays, cleaning products, air fresheners, repellent sprays, paint, solvents, and more.

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