Air pollution in Europe and children's health

Stroh, Emilie

2023

Document Version:
Publisher's PDF, also known as Version of record

Air pollution in Europe and children's health

Air pollution in Europe and children's health

About the author: Emilie Stroh,PhD, is a researcher at Lund University, Sweden, focusing on the health effect on children of environmental stressors such as air pollution

Cover Photo: Susanna Stroh

Layout: Sven Ängermark/Monoclick

Language consultant: Malcolm Berry, Seven G Translations, UK

Published in March 2023 by the Air Pollution & Climate Secretariat (Ebba Malmqvist).

Address: AirClim, Första Långgatan 18, 413 28 Göteborg, Sweden.

Phone: +46(0)31 711 45 15

Website: http://www.airclim.org.

The Secretariat is a joint project by Friends of the Earth Sweden, Nature and Youth Sweden, the Swedish Society for Nature Conservation and the World Wide Fund for Nature Sweden. The report is also available in pdf format at www.airclim.org. The views expressed here are those of the authors and not necessarily those of the publisher.

Air pollution in Europe and children's health

Children are unable to choose their environment and cannot link the sensation of illness to a specific exposure or a certain environment, thus they are powerless to remove themselves from harmful exposures. It is therefore up to us as guardians and adults to shelter them from these exposures.

Why children need clean air

Cells are the basic building blocks of our body's organs. For our organs to function, and for children to grow and develop healthily, our cells need three fundamental things:

1. Water
2. Energy – from food
3. Oxygen – from the air we breathe.

Without enough oxygen, our bodies will cease to function optimally. For children, a lack of oxygen means that their organs will not develop properly and grow to their full capacity. Thus, the function of these organs might be chronically reduced. This is alarming, as the functioning of our organs and our ability to oxygenate our bodies is vital to remain healthy throughout our lifespan.

Children's lungs are not yet fully developed at birth. It is not until three years of age that children's lungs and airways will resemble a small version of the adult respiratory system. As children grow, their lungs and airways mature and expand. The lungs continue to grow until a child's early teenage years, but their exact size and volume will vary from child to child. Damage to children's lungs during this period might cause irreversible impairments, and the younger the child, the worse the damage.

Air pollution particles tend to stick to children's lung tissues to a greater extent than they do in adults, with a difference of 10–20 percent per breath. This is of great concern as children also breathe and ingest more air pollution in relation to their body weight than adults. The concentrations of air pollutants in children's bodies and respiratory systems will therefore be much higher than in those of adults.

Inhaling air pollutants will provoke an inflammatory response and, in the case of particles, also congest the lung tissue, which decreases the body's ability to oxygenate. These effects will cause our body's immune system to react.

However, if the concentrations of inhaled air pollution are high and the exposure is persistent, the immune system will not be able overcome these harmful effects. Because they have less-developed and weaker immune systems, children are particularly susceptible. To compensate for a lower concentration of oxygen in our blood, the heart must work harder to circulate a larger amount of blood per minute to our cells. Consequently, air pollution exposure also increases the burden on our cardiovascular system. Children who grow up in areas with constantly elevated levels of air pollutants thus experience a chronic level of bodily stress due to inflammatory responses and decreased ability to oxygenate. This may prevent their organs from developing to full capacity and mean that their future health as grownups could be fundamentally impaired.

Health effects – from the womb to the grave

Exposure to air pollution has been documented to cause an alarming range of health effects among children. These not only affect children when they are young but can also negatively impact their health for the rest of their lives. While the health effects are diverse, the main underlying mechanisms are believed to be the oxidative stress and inflammatory response these pollutants cause throughout the body.

The most direct health effects of air pollution exposure for children include impaired lung function, acute infections in the lower respiratory tract (i.e., the lungs, bronchial tree and trachea) and an increased risk of developing asthma and exacerbated asthma symptoms. However, children already begin suffering from the negative health consequences of air pollution while they are in the womb. There is an increased risk of being born prematurely or with a low birth weight and there is also sufficient evidence that air pollution exposure during pregnancy increases the risk of stillbirth and infant mortality. Ongoing research also indicates that traffic-related air pollution might lead to an increased risk of childhood leukaemia.

There is strong evidence that exposure to air pollutants in the form of small particles will harm children's neurodevelopment and decrease their mental development and motor skills. After being inhaled, these particles are small enough to enter the blood stream through the air-blood barrier (the so-called, alveolar-capillary barrier) in the lung. As a result the particles gain unrestricted access to the rest of the child's body and its organs, including the brain, where they are believed to harm the blood-brain barrier. A growing number of studies note that such exposures may also lead to the development of behavioural disorders such as autism spectrum disorders (ASD) and attention deficit hyperactivity disorder (ADHD).

Air pollution exposure is also suggested to cause childhood obesity due to related metabolic disturbance and insulin resistance. Decreased lung function in children, caused by air pollution exposure, can also affect their physical activity levels since the ability to effectively oxygenate the body is vital to being physically active. Children with decreased lung function therefore have a higher risk of developing childhood obesity.

Apart from these acute health risks, exposure to air pollution during childhood can also impair lung development, causing chronic lung disease and cardiovascular disease in adulthood. In other words immense gains can be made in human health and wellbeing, as well as economic savings, by shielding our children from air pollution exposure.

Children's exposure in Europe

There are huge differences in both the levels and chemical composition of air pollution across the European continent, depending on factors such as air quality policy, urban planning, local emission sources, geography and meteorological conditions. Although air pollutants know no boundaries, exposure levels are generally highest in urban areas. This is because there is a large concentration of people living and working in cities, which contributes to substantial fossil fuel combustion by vehicles and the high energy consumption of homes, workplaces and industries. Even though efforts to reduce air pollution emissions within the European Union (EU) have been implemented in recent years, 96% of the urban population are still exposed to concentrations above the World Health Organization's most recent health-based guidelines.

In the European Union, there are 68 million children below 15 years of age. Out of these, 78% live in densely populated cities, urban areas or in towns and suburbs. This number is likely to increase in the coming years due to the global trend of urbanisation, as more and more people move to cities. Children living in urban areas also tend to be exposed to higher concentrations of air pollutants as they spend more time outside during hours when air pollution emissions tend to peak.

Children growing up in European cities have limited possibilities to play outdoors in areas sheltered from traffic and its harmful emissions. For the youngest children, who need to be accompanied outdoors, their most regular, or possibly only, outdoor environment is often the preschool or school yard. As cities expand and densify to accommodate a growing population and necessary infrastructure, these preschools and schools become more and more enclosed by traffic. A further worrying trend is the complete removal of yards from pre-schools and schools. Without them, the children are instead redirected to nearby parks and other small green areas.

Is one possible solution to protect our urban children from air pollutants to keep them indoors? The answer to this is no! A fact that is frequently overlooked is that the outdoor air is our "fresh air". This is the air we use to ventilate our homes, workplaces, schools and indoor facilities. Consequently, the air we breathe indoors will almost never be cleaner than the air outside. Instead, to ensure clean air that does not pose a risk to our children and the younger generation's present and future health, we urgently need to integrate a children's perspective into our air quality regulations and the way we design and plan our cities, with particular care for and prioritisation of our children's outdoor environments.