

Air Pollution and Children – Protect our Future Generation with Improved Ambient Air Quality Guidelines

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June 2023

Key Points

- Air pollution is a significant health threat to children with both short- and long-term health effects.
- Children and adolescents are particularly vulnerable and the health impacts can continue throughout their lives.
- Negative health impacts from air pollution are not limited to the respiratory system, and include cardiovascular system, weight and brain function and development, meaning air pollution can impact children's ability to learn.
- Approximately 33% of European childhood asthma cases can be attributed to air pollution. If the minimum levels of some air pollutants (e.g., PM_{2.5}, NO₂, and BC) were met, Europe could prevent more than 200,000 new cases of childhood asthma each year.
- Higher air pollution can lead to inequalities early in life and a competitive disadvantage because it affects learning and performance.
- Urgent action is needed to reduce current ambient air pollution levels. Aligning the EU Ambient Air quality Directive with WHO air quality guidelines is an critical opportunity for child health.

Background

It is often only when we read about the tragic death and legal case of Ella Roberta, the school-girl in London that died of asthma due to air pollution (Ella Roberta Foundation 2021), that we pause and think what kind of environment our children are growing up in. But then it is too late. In the meanwhile, millions of children are suffering.

Our youngest and most vulnerable do not have the environments they deserve and need to thrive. Our children are our future. Most children live in cities which are focal points of air pollution (Khomeenko et al 2021). Moreover, schoolchildren spend up to a quarter of the day in the school micro-environment. Schools are often urban 'hotspots' for environmental exposures, located in dense areas of high pollution.

Early Air Pollution Effects during Pregnancy

Effects of air pollution are already observed during pregnancy and exposure to air pollution during pregnancy leads to lower birth weight (Boogaard et al 2022). Low birth weight leads to an increased risk for other longer-term health conditions.

Air Pollution and Respiratory Health

Exposure to air pollution affects respiratory systems. Long-term exposure to air pollution may lead to lower respiratory infections, asthma exacerbations, asthma-related emergency department visits, and hospitalizations (Burbank et al., 2018, Ibrahim et al 2021). High concentrations of NO₂ and other air pollutants in and around the school and home can result in airflow obstruction and impaired lung function and development in children, especially children with asthma (Health Effects Institute, 2022).

Moreover, alterations caused in the normal functioning of the lungs due to childhood air pollution exposure are likely to remain unaltered during adulthood. Since the strongest predictors of adult COPD are childhood asthma, airflow obstruction, and worse lung function symptoms originating from childhood exposures, strategies for reducing children's exposure to air pollution would positively impact their adult life (Mocelin et al., 2022).

Finally, approximately 33% of European childhood asthma cases can be attributed to air pollution (Khreis et al., 2019). If the minimum levels of some air pollutants (e.g., PM_{2.5}, NO₂, and BC) were met, Europe could prevent more than 200,000 new cases of childhood asthma each year (Khreis et al. 2019).

Air Pollution and Cognitive Health and Academic Performance

Children's acute and prolonged exposure to air pollution from road traffic may lead to impaired mental brain and cognitive development, poorer executive functions, and increased risk and prevalence of Autism Spectrum Disorder (ASD) and Attention Deficit and Hyperactivity Disorder (ADHD)(Volk et al., 2021; Costa et al., 2021; Vilcins et al., 2021, Shang et al 2020).

High concentrations of air pollution in and around schools can negatively impact academic performance and academic scores, impair problem-solving skills and result in lower IQ, increased hyperactivity, and inattention problems in children and adolescents (Stenson et al., 2021; Donzelli et al., 2020).

Air pollution can also reduce their learning memory function and increase the risk of developing learning difficulties. A study conducted on air pollution and cognitive development in Barcelona primary schools found that children from highly polluted schools had a smaller annual growth in cognitive development (7.4%) compared to children from lower polluted schools (11.5%) ($p = 0.0024$) (Sunyer et al., 2015).

Air pollutants are also associated with changes in brain structural morphology, structural connectivity, and functional connectivity that may have lasting effects (Guxens et al 2022, Cotter et al 2023, Yuan et 2023).

Adolescents' mental health is also affected as studies show that exposure to air pollution is associated with symptoms of depression, anxiety, psychotic disorders, and poorer general mental health (Theron et al 2022).

Air Pollution and Cardiovascular Health

Lastly transport related air pollution exposure can result in increased blood pressure and hypertension and increased risk for rapid weight gain and childhood obesity (An et al., 2021; Kim et al., 2020 Parasin et al 2021, Wang et al 2021). Childhood obesity is one of the main health challenges for European children and adolescents with health impacts into adulthood.

Action Needed

Better air is within our reach. We urgently need to create a safer and healthier environment for our children in our cities and beyond. High air pollution levels are an obvious concern and require action, especially around schools. Adopting new EU air quality guidelines that are aligned with the WHO air quality guidelines is critical for the health of our children and future generations.

The EU air ambient air quality directive is an essential opportunity to protect the health and wellbeing of European children and will provide the catalyst for member states and cities to take action.

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