AT A GLANCE

Air Quality and Early Childhood Development

Learn how indoor air quality affects early childhood development—and find practical, actionable solutions that you can apply to support children and caregivers in your community.

Science Snapshot: What We Know

Most adults spend more than 90% of their time inside; during pregnancy and early childhood, it's likely even more. And levels of **indoor air pollutants can be two to five times higher than outdoor levels** due to:

- Poor ventilation
- Chemicals released from furniture, carpets, and cleaning products
- Indoor sources of pollution, such as gas stoves
- Outdoor pollution coming in due to "leaky" doors, windows, and walls

Our indoor air can contain a wide range of pollutants, including particulate matter, volatile organic compounds (VOCs), pesticides, "forever chemicals" known as PFAS, and more.[1]

Not only are young children exposed to more indoor air pollutants, but they are often more affected. That's because:

- They breathe more rapidly.
- They inhale a larger volume of air relative to their body size.
- Their respiratory, reproductive, endocrine, immune, digestive, and neurological systems are still developing—making them especially sensitive to exposures.

Air quality affects young children's health and well-being in many ways, including:

- **Birth outcomes:** Exposure during pregnancy to airborne particles and gases such as nitrogen dioxide is associated with an increased risk of premature birth and low birth weight, which are associated with increased rates of infant mortality, respiratory infections, ADHD, autism, anxiety, depression, and more.
- **Disrupted brain development:** The most common airborne particles can affect the developing brain—including regions associated with memory, learning, and regulating emotions and behavior.
- **Endocrine disruption:** Exposure to certain chemicals may disrupt developmental pathways during pregnancy and early childhood and impact the start of puberty.

[1] To learn more, see "What Pollutes Indoor Air" in our Working Paper.

- **Out-of-balance immune response:** Airborne particles, chemicals, and allergens trigger the immune and inflammation systems to respond, which is healthy and protective in the short term. But too much inflammation for too long—especially when the organs and brain are still developing—can weaken the immune system and contribute to lifelong inflammatory conditions like heart disease.
- **Combined effects:** There is likely a multiplier effect when stress and pollution combine to cause even greater spikes in the inflammatory response. For example, the combination of pollutants with high levels of psychosocial stress during pregnancy—such as significant stress caused by poverty or environmental disasters—is associated with hypertension, preterm birth, and respiratory illness.

Solutions Snapshot: What We Can Do

Actionable solutions to improve indoor air quality already exist, and many communities in the US and around the world are already implementing such strategies with positive effects. Policymakers, organizations, and community leaders can:

- **Monitor indoor air quality in early care centers and classrooms.** To adjust ventilation systems to improve air quality, it's important to know what substances are contaminating the air and the extent of the problem. This can be done through inexpensive indoor air quality sensors.
- **Switch to safer building, cleaning, and other household products.** Use products with low levels of VOCs and products free of PFAS, flame retardants, and phthalates in homes, childcare facilities, schools, camps, offices, and other buildings.
- **Install and maintain adequate ventilation and filtration systems.** Upgrade filters in existing HVAC systems to those with ratings of MERV 13 or higher, which can help remove up to 90% of airborne particles.
- **Utilize portable, room-based air purifiers with HEPA filters.** These freestanding, cost-effective filters can be useful when HVAC system updates are not possible or as an additional way to improve air quality.
- **Enact regional, state, and local policies and regulations.** Policies that tackle pollutants at the source—such as transitioning from fossil fuels to renewable energy—are critical. Regulations can also specifically address indoor air quality, such as requiring childcare centers and schools to be sited in areas with less air pollution.

Learn more and take action in your community:

- Read our full Working Paper on air quality and early childhood development.
- View our InBrief for more key takeaways.
- See our Solutions Spotlight to learn how communities are improving indoor air quality.
- Watch our webinar for a conversation on the impacts of air quality during pregnancy and early childhood—and strategies to improve it—or listen to the podcast episode.