

A call to action: Air pollution in early childhood

The evidence is clear: Air pollution is harmful in early childhood, and can also lead to lifelong health and developmental impacts. In this brief, we provide more information about this issue and suggest a list of actions that we can take, whether as individuals or collectively. If you would like to learn more and get in touch, please email ecdclimate@gmail.com.

Air pollution is deadly, estimated to kill an average of 7 million people every year. And even when it doesn't kill, it affects every organ in the body and increases the risk of many diseases, including stroke, heart disease, diabetes, cancer and depression. Even at low levels invisible to the naked eye, air pollution can cause measurable differences in the health of populations. Air pollution affects not just young children's health: The ripple effects prevent them from realizing their full potential in life.

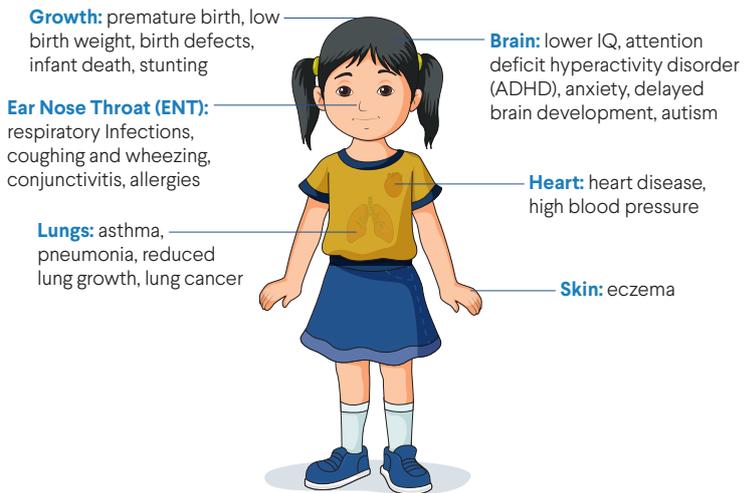


Figure 1: The health impacts of air pollution on a child. The list in this diagram is not comprehensive.



Figure 2: Components of the nurturing care framework. Source: <https://nurturing-care.org>

A clean, healthy, and sustainable environment¹ underpins the Nurturing Care Framework, influencing health and development of young children.

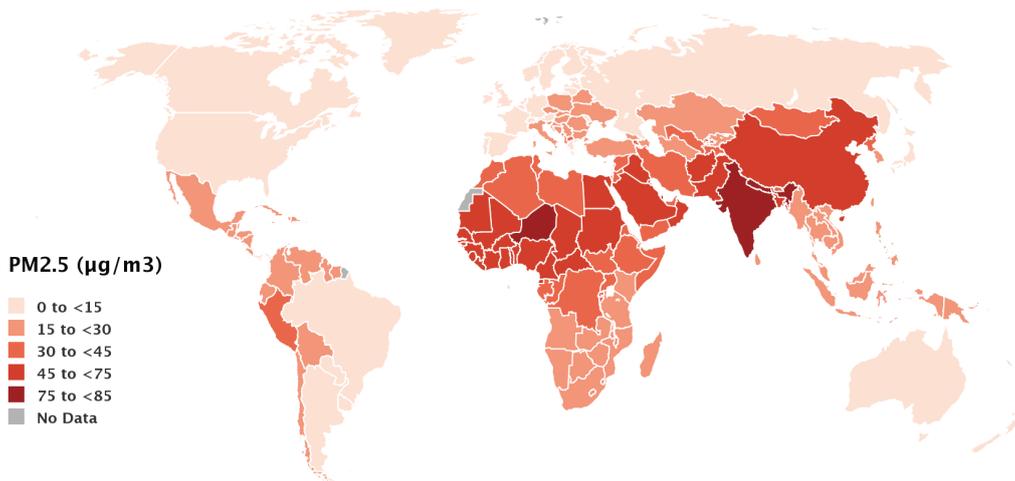
Young children in the Asia-Pacific bear the highest burden of air pollution

Air pollution affects everyone, from the young to the old, the poor to the rich. But the youngest children are at particular risk from the effects of pollutants because their bodies and brains are still rapidly developing, particularly during the first 1,000 days of life.

Every year, air pollution is responsible for 6 million preterm births (WHO, 2023) and the deaths of over 600,000 children under 5 years of age (UNICEF, 2016). It is also linked to children's respiratory illnesses, brain damage, and stunting. Four out of the top five countries with the highest death rates due to air pollution are in Asia: China, India, Pakistan and Indonesia (SOGA 2020), and 70% of air pollution-related deaths occur in the Asia-Pacific region (UNEP).

1. UNCRC General Comment 26 <https://childrightsenvironment.org/about/>

Average Annual Population-Weighted PM2.5 Concentrations in 2019



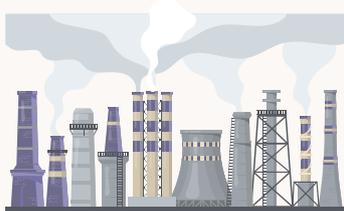
State of Global Air 2020

Figure 3: Average annual population weighted PM2.5 (air pollution) concentrations in 2019, showing that countries in Africa and Asia are the most polluted globally. Source: State of global air 2020

Air quality improvements also mitigate climate change

The causes of climate change often begin with air pollution, and the solutions involve pollution reduction. Emissions from transport, the power sector, industry and agriculture contribute the majority of global carbon emissions. In fact, 85% of all global air pollution comes from the burning of fossil fuels and biomass. Some climate pollutants are also air pollutants. Known as short lived climate pollutants (SLCPs), they are both harmful to human health and contribute to global warming. Examples include black carbon, ground-level ozone and methane.

Climate change can also worsen air quality, with longer summers, wildfires and drought leading to increased levels of dust and air pollution. Many countries have yet to update their climate goals and policies to factor in the health and economic benefits from air pollution mitigation, particularly for their youngest citizens.²



- Fossil fuels combustion in stationary and mobile sources



- Energy efficiency
- Wind, Solar, tidal
- Hybrids, low emission vehicles
- Carbon capture and storage
- Reforestation

Figure 6: Policy interactions between air quality and climate change

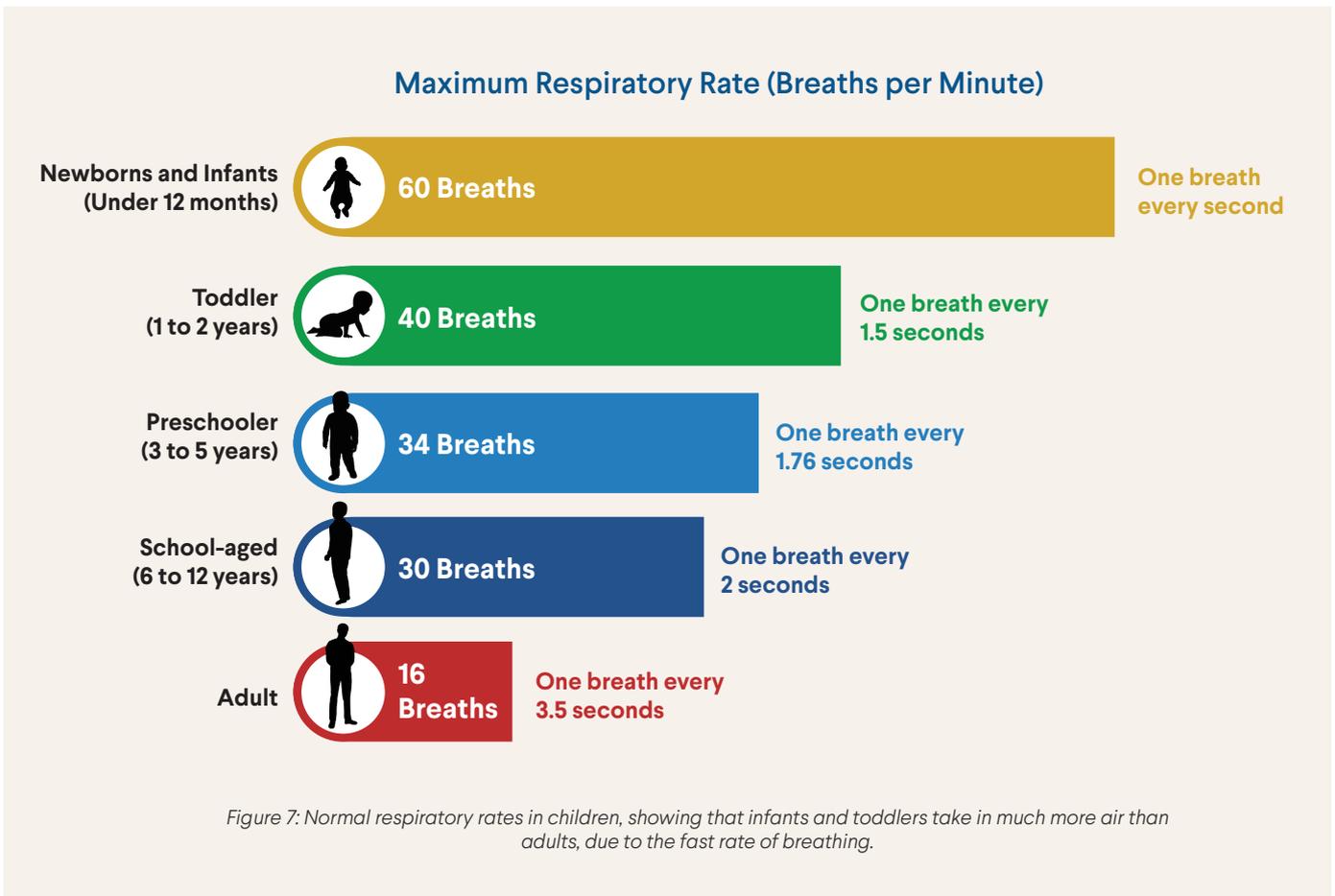
Source: Adapted from Defra (2010). Air pollution: Action in a changing climate

2. <https://climateandhealthalliance.org/initiatives/clean-air-ndc-scorecard/>

Why is air pollution so harmful in early childhood?

1. Infants take in more polluted air than adults.

Young children, especially babies and infants, breathe up to five times faster than adults, and with every breath, take in more air per unit of body weight than adults. By extension, when air is toxic, they take in more toxic air per unit of body weight than adults.



Because of their height, toddlers and young children are in a breathing zone closer to the ground where many pollutants are found in higher concentrations. Moreover, children inhale a larger fraction of air through their mouths than adults. Due to this increased oral breathing, pollution penetrates deep into the lower respiratory tract where it is more readily absorbed to affect other organs.

2. Young children's bodies and brains are fragile and still developing.

The most important impacts of air pollution on young children are on growth and on brain and lung development.

a. Brain Development. Due to the small size of air pollution particles, they can easily be absorbed into the bloodstream and travel to the brain. Ultrafine particulate matter (over 700 times thinner than the width of a single human hair) poses great threat to children.

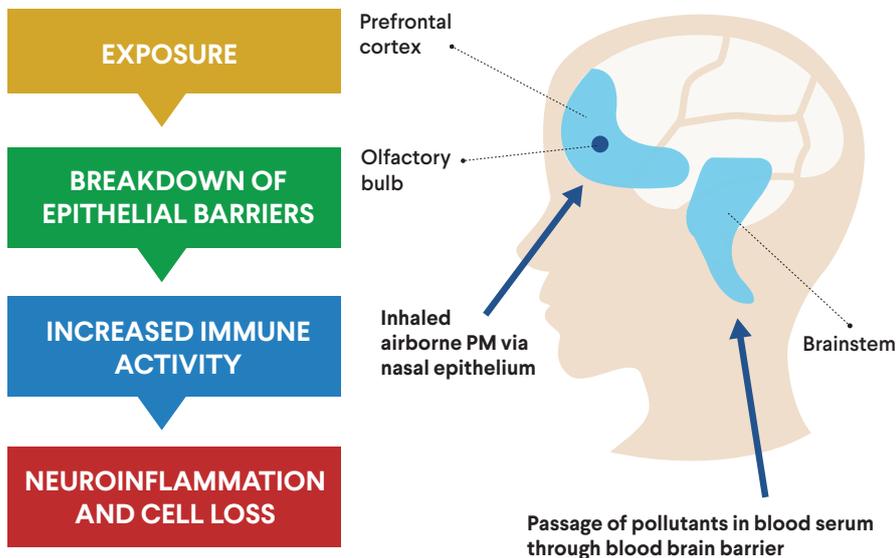


Figure 8: Possible channels through which air pollution may affect the brain

Particulate matter is a complex mix of chemicals and elements that trigger the body's inflammatory processes. When this occurs in the brain, it harms neurons and other brain cells. Prenatal and early childhood exposure to air pollution is linked to development delays in early childhood and symptoms of attention deficit hyperactivity disorder, anxiety and, later in life, depression. Studies have shown that breathing polluted air is also linked to adverse cognitive outcomes, lower IQ and poor test scores in children.³

Air pollution is linked to adverse cognitive outcomes in children, and to ADHD, anxiety and depression later in life.

b. Children's lungs are in the essential stages of development in the first few years of life, making them especially vulnerable to damage from air pollution. The inner lining of children's respiratory tracts is more permeable than that of adults. Their airways are also smaller, and common infections are more likely to cause blockages in children than adults. Studies have also shown that children who are exposed to chronic air pollution tend to have more respiratory problems later in life.

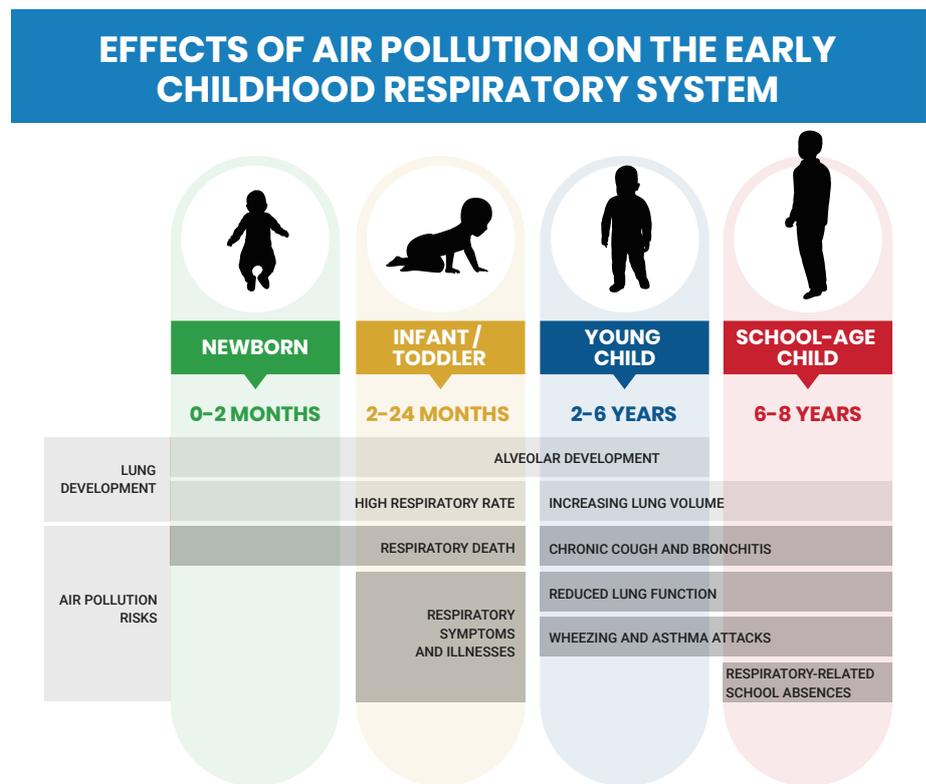


Figure 9: Air pollution effects on the respiratory system in early childhood. Source: UNICEF Clear the Air

3. Ni, Yu, Christine T. Loftus, Adam A. Szpiro, Michael T. Young, Marnie F. Hazlehurst, Laura E. Murphy, Frances A. Tylavsky et al. "Associations of pre-and postnatal air pollution exposures with child behavioral problems and cognitive performance: a US multi-cohort study." Environmental health perspectives 130, no. 6 (2022): 067008.



c. Stunting—children being too short for their age—is another irreversible outcome of air pollution exposure. While stunting is a well-established indicator of child development with known contributing factors such as malnutrition and sanitation, the role of environmental factors like air pollution is only recently coming to light. Stunting not only leads to diminished physical development but also has long-term impacts on children and their communities, including impaired cognitive and socio-emotional development and reduced economic opportunity. Even short-term extreme air pollution events can have a lasting impact on a child's height.

For example, a study from Indonesia revealed that children born to mothers who were pregnant during the 1997 forest fires were significantly shorter than their peers in adolescence.⁴ Several studies from countries in South and Southeast Asia, where use of solid cooking fuel is still common, also reveal a consistent link between household air pollution and stunting. Switching to clean cooking fuels is shown to significantly reduce the risk of stunting over time.⁵

Health impacts begin in utero



The health impacts of air pollution on a child begin in utero. A mother's exposure to air pollution during pregnancy can lead to babies born too small or too early. The earlier a baby is born, the smaller the baby is and the higher the risk of complications. If they survive infancy, they continue to remain at higher risk of infectious diseases throughout their early childhood and chronic diseases throughout life.

In 2019 alone, air pollution accounted for 20% of newborn deaths worldwide, nearly half a million babies. Most of these deaths are related to household air pollution with South Asia being the highest risk area within the Asia-Pacific region. While the reliance on solid fuels for cooking has steadily declined in the Asia-Pacific region, it remains at a high level of concern with more than half of the population in South, East and Southeast Asia and Oceania regions exposed to household air pollution. It is estimated that over 640 million children in Asia live in households that rely on solid fuel for cooking and heating.

Air pollution can be categorized into two categories:



Indoor or household air pollution primarily results from the use of solid fuels like wood, coal, charcoal, animal dung, crop waste, etc. for cooking and heating. Globally, about 3 billion people, many of whom are poor and living in low- or middle-income countries, rely on these poor-quality fuels.



Outdoor or ambient air pollution refers to the air pollution existing outside of homes and buildings. Most common sources of outdoor air pollution are vehicular traffic, industrial emissions, coal power plants, municipal and agricultural waste burning, and forest or wildfires.

4. Tan-Soo, Jie-Sheng, and Subhrendu K. Pattanayak. "Seeking natural capital projects: Forest fires, haze, and early-life exposure in Indonesia." *Proceedings of the National Academy of Sciences* 116.12 (2019): 5239-5245.

5. Yao, Min, et al. "Household air pollution and childhood stunting in China: A prospective cohort study." *Frontiers in Public Health* 10 (2022): 985786.

3. Young children are not in control of their environments.

Young children often do not have a say where they go—they rely on their caregivers to provide them with most if not all their needs, and as a result are physically attached to them. This is particularly true for babies, infants and toddlers. Even if a young child can be somewhat independent and mobile, he or she will likely not be fully aware of the negative impacts of air pollution and will not have the knowledge or ability to avoid breathing unhealthy air.



Mother and daughter wear masks in Beijing, which used to be one of the most air polluted cities in the world, Feb. 12, 2013. Thanks to decisive action by the government, Beijing has achieved impressive improvement in air quality in the past decade, with particulate pollutant levels dropping by 66.5% between 2013 and 2022.



4. Early exposure to air pollution leads to lifelong impacts

The effects of air pollution on children may not be apparent until later in life. Many diseases caused by air pollution take time to manifest. Health impacts sustained in early childhood, such as lung and brain damage, are likely to continue into adulthood, affecting quality of life and general productivity.

Most of the children who are living in highly polluted areas are already the worst affected by environmental and socio-economic factors. Air pollution further compounds the damage and can perpetuate intergenerational inequities. There are ripple effects, for example, missing school due to respiratory infections affects learning and future potential.

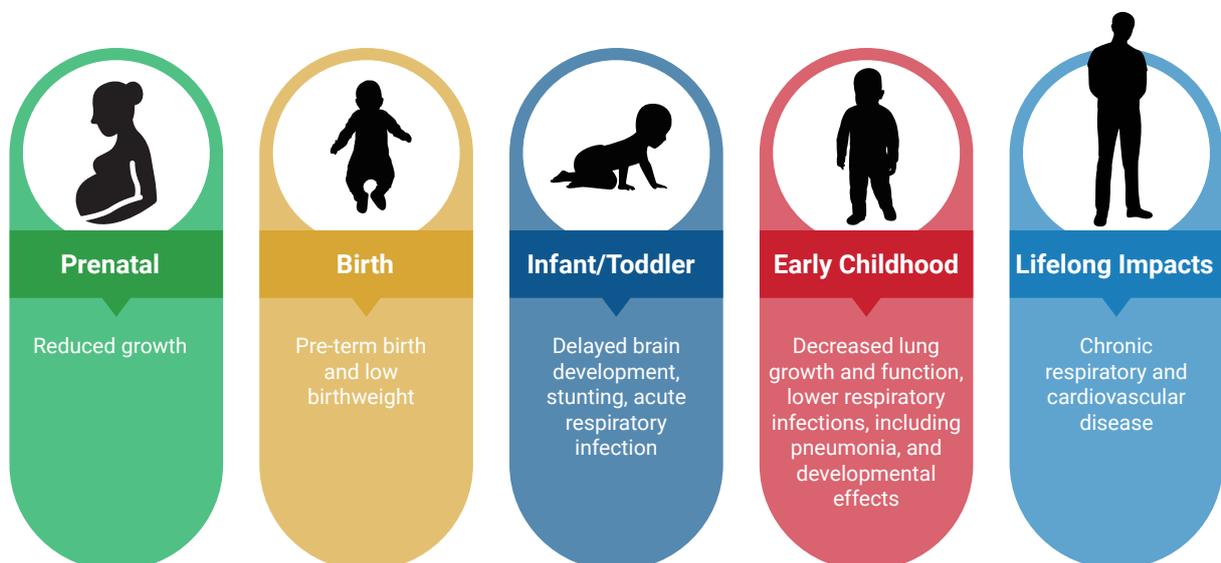


Figure 10: Impact of air pollution at different life stages.

Six common sources of air pollution in the Asia-Pacific

1. Waste burning :

When there aren't any reliable waste collection services, communities may resort to burning to get rid of their waste. In particular, burning plastics, rubber and electronics can lead to toxic airborne chemicals that are highly detrimental to children. The recycling of e-waste, which often involves burning, is an emerging source of concern.



2. Agricultural burning :

Agricultural burning is a common low-cost method for farmers to remove crop residue. Forested land has also been known to be deliberately burned to clear land for farming. This is especially harmful when peat forests are burned.

3. Traditional stoves and fuels :

Burning biofuels for household cooking and heating emits large amounts of harmful smoke. In Asia, over 640 million children are estimated to live in such households. In India, 81% of rural households use biomass fuel because it is relatively inexpensive and readily available. In Mongolia during the winter months, the burning of coal briquettes for heat leads to hazardous air pollution levels for the entire city of Ulaanbaatar. This coincides with levels of fetal deaths up to three times greater during those months.



4. Smoking :

Young children whose family members smoke around them are at a high risk of exposure to harmful smoke particles, especially if the person smokes indoors. And just because the smoke particles are not visible, does not mean they are not there. Not all air pollutants can be seen with the naked eye.

5. Vehicular emissions :

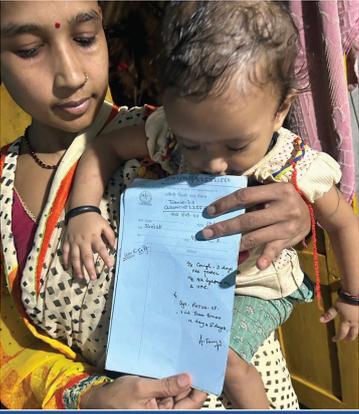
Too many Asian cities suffer from traffic congestion and weak vehicular emissions controls. In Jakarta, Indonesia, which is one of the more polluted cities in the Asia-Pacific region, nearly half of air pollution is attributed to the transportation sector.



6. Power stations and industrial emissions:

Much of Asia still relies on fossil fuels for power generation, a key source of both climate and air pollution emissions. Transitioning to cleaner forms of energy and investing in state-of-the-art end-of-pipe measures can result in both climate and air pollution benefits.

India: Transforming Lives Through Clean Cooking



In the bustling heart of New Delhi, a small room measuring 6 by 6 feet holds a story that resonates with countless families across India. This is the home of Nibha Devi and her family, who, like many others, migrated from Bihar in search of a better life. For the past two decades, they have called this modest space their home. For years, their daily cooking routine relied on the traditional "chulha" fueled by wood and coal, filling the air with dense biomass smoke.

This environment took a toll on the health of Nibha Devi's family, especially the older children, who frequently suffered from persistent coughs and breathing difficulties, resulting in frequent visits to the doctor, as Nibha Devi illustrates with a packet of old prescriptions. In 2017, a government-subsidized scheme allowed Nibha Devi's household to switch to cooking gas*, and the impact was immediate and profound. Nibha Devi recalls that the shift to cooking gas changed their lives. "No longer did we have to worry about the harmful smoke that affected the children and our health, it brought convenience of cooking," she said. Nibha Devi's story shows the transformative power of clean cooking solutions, providing not only improved health but also a renewed sense of hope and well-being.

Photos and story courtesy of Warrior Moms

**Although it produces less harmful pollutants, natural gas is a fossil fuel and not a clean energy source.*

Indonesia: Hope for Clean Air

Novita Natalia Kusumawardani is a community program manager and co-founder of Bicara Udara, a community-based group that is working to lobby policymakers to address air pollution in Indonesia. As a mother, she was concerned about how the high level of pollution in Jakarta could affect her unborn child. She also witnessed how a friend's young son started to experience frequent respiratory issues when pollutant levels increased.

After taking the child to various doctors and hospitals, her friend was told that the son's health issues were indeed linked to the poor air quality. This story is just one of many in terms of how air pollution imposes a significant cost to families—including health care expenses and loss of productivity due to sick days. But it is also stories like this that fuel Novita in her work. After years of advocacy, she is now working with the Ministry of Health in Indonesia as a member of the Committee of Respiratory Diseases. She has a message for others who may be trying to start a movement in their own cities: "Public pressure can play a significant role in influencing policies. When individuals, communities and organizations come together to voice their concerns, it creates a powerful collective voice that policymakers can't ignore. The evidence around the harms of air pollution is extremely robust, so collaborate with experts and health professionals to bring opinions and research findings to policy discussions. Our hope for clean air goes beyond our families; it extends to our communities and the planet we share. When we advocate for clean air, we stand not just for our children, but for the elderly, the vulnerable, and for all living beings that depend on the air we collectively breathe."

Photos and story courtesy of Bicara Udara



Call to action: What can we do?

Air pollution is harmful in early childhood. And there is plenty that you can do about it, depending on your level of interest, capacity and influence. However, keep in mind that the list of actions here are by no means prescriptive or definitive.

Everyone:

Parents, caregivers, childcare workers, preschool workers and the general public.



- Take individual actions to reduce air pollution exposure.** Pay extra attention to air pollution exposure for young children in your care and remove children from these sources where possible. Every little reduction in exposure to air pollution helps. Examples:
 - Switch to clean (smokeless) cooking and heating options
 - Do not smoke around pregnant women and children
 - Avoid taking children through polluted areas
 - Reduce open burning or any activity that generates smoke, e.g., trash burning
 - Make sure your vehicle does not produce excessive emissions
 - Monitor the local air quality data in your community. Heed public health advisories according to the air quality level alerts.
 - When pollution is generated indoors—for example through incense burning—open the windows to let the smoke out. When pollution is heavier outdoors, close the windows and turn on an air purifier.
- Share your knowledge** on air pollution with your family, peers and networks. The more people know about the problem, the more we can work together to drive change. One immediate action: You can forward this fact sheet and our social media messages to your network.

Advocates:

Parent advocacy groups, youths, managers in early child development settings, civil society, local governments.



- Facilitate innovative initiatives to involve young children** in understanding the importance of clean air and a clean environment. Examples: nature-based activities, art or storytelling competitions, science experiments
- Organize community-based events and campaigns** to inform families about the risks of air pollution and influence government stakeholders to take climate and clean air action. Examples:
 - Start a local community advocacy network
 - Organize a local campaign (e.g. Raise awareness about a key source of air pollution in your community)
 - Join existing parent advocacy efforts (e.g., Warrior Moms India, Our Kids Climate) or youth groups (e.g. Youth empowerment in climate action platform, YOUNGO)
- Advocate for the integration of climate and air pollution issues and strategies** in early childhood settings. Examples:
 - Reflect air pollution and climate in educational programs (or curricula) aimed at parents and children to empower them to take personal and collective action
 - Convene parents and early childhood development workers to discuss ways of managing suspensions or disruptions to early child development services due to poor air quality
 - Advocate for ways to ensure well-ventilated learning spaces, including retrofitting buildings and monitoring air quality
- Support citizen-generated localized air quality data, research and innovation.** This can build understanding of young children's exposure to pollution sources, patterns and impacts to inform air pollution mitigation strategies. Examples:
 - Encourage partnerships between early child development providers and air quality scientists and research institutions involved in air quality
 - Convene learning initiatives to learn from cities and countries that have established good air quality management and monitoring systems

Influential stakeholders:

Development partners,
private sector funders,
philanthropists,
policymakers.



- Promote the link with air pollution in climate policies and mitigation strategies.** Examples:
 - Encourage climate goals and funding to be funneled into air pollution mitigation, achieving win-win solutions for climate and human health
 - Advocate for solutions that address both climate and health. These include energy efficiency, reforestation, renewable energy (wind, solar, tidal), walkability, low-emission vehicles.
- Advocate for greater financing and investments** in air pollution and climate mitigation efforts by familiarizing policymakers with key information. Examples:
 - Only 1% of international development and 2% of international climate finance tackles outdoor air pollution.
 - Health and socioeconomic analysis should be integrated in policy interventions. Air pollution reduction policies and interventions may appear costly initially, but the case for investment is strong taking into consideration clean air's health benefits and cost savings.
 - U.N. Convention on the Rights of the Child's adoption on General Comment 26 affirming children's rights to a clean, healthy, and sustainable environment, including the effects of climate change.
- Enforce and implement specific policies that will reduce air pollution.** Examples:
 - Establish subsidy programs for clean household energy
 - Set up an air quality management program
 - Enforce a ban on open burning
 - Develop and enforce vehicle emission standards
- Increase strategic partnerships** between civil society, governments, and the private sector to advance change collectively on air pollution and climate mitigation. Examples:
 - Establish a platform to connect early childhood development policymakers and practitioners with the environmental health and climate science community
 - Convene communities via civil society with academia, governments and decision-makers to advocate for locally led solutions
 - Support and fund youth and child-led organizations at the forefront of tackling air pollution and climate
 - Strengthen regional coordination and cooperation to tackle air pollution, including via regional transboundary haze efforts

Key References

State of Global Air, 2020
Danger in the Air, UNICEF, 2017
Clean the air for children, UNICEF 2016
Global Burden of Disease, IHME, 2019
Most vulnerable to most valuable: A scoping study to put young children at the heart of climate actions and environmental protection, ARNEC 2022
Born too soon: decade of action on preterm birth, WHO 2023

Acknowledgements

Authors: Lynn Tang, Meenakshi Kushwaha (Vital Strategies), Peck Gee Chua (ARNEC)
Advisors: Dan Kass, Sumi Mehta (Vital Strategies), Rowan Ainslie (Save the Children), Evelyn Santiago (ARNEC)
Nicole Rodgers (Plan International), Kristy Kyungah Bang and Catherine Wilczek (UNESCO),
Thitiporn Sukaew (Ministry of Public Health, Thailand)

ecdclimate@gmail.com