Focusing on Children's Health

Children may look like miniature adults, but they're not. Air pollution is especially dangerous to them because their lungs are growing and because they are so active.

Just like the arms and legs, the largest portion of a child's lungs will grow long after he or she is born. Eighty percent of their tiny air sacs develop after birth. Those sacs, called the alveoli, are where the life-sustaining transfer of oxygen to the blood takes place. The lungs and their alveoli aren't fully grown until children become adults. In addition, the body's defenses that help adults fight off infections are still developing in young bodies. Children have more respiratory infections than adults, which also seems to increase their susceptibility to air pollution.

Furthermore, children don't behave like adults, which also affects their vulnerability. They are outside for longer periods and are usually more active when outdoors. Consequently, they inhale more polluted outdoor air than adults typically do.

World Health Association, American Academy of Pediatrics Confirm Harm to Children

The effects of air pollution on children are striking. In 2004, two major analyses concluded that air pollution is especially harmful to children.

The World Health Organization (WHO) published an in-depth look at the research on children's health and air pollution. Most importantly, the scientists concluded that particle pollution caused infant deaths. In addition, they found that air pollution caused a host of harmful effects on children, including:

- short-term and long-term decreased lung function rates and that caused lower lung function levels, critical measures of how well the child will breathe throughout his or her life (due primarily to exposure to particle pollution and traffic-related pollution);
- aggravation of asthma (from exposure to particle as well as ozone pollution);
- increased prevalence and incidence of cough and bronchitis (primarily from particle pollution); and
- increased risk of upper and lower respiratory infections.[48]

The American Academy of Pediatrics published a statement on the dangers of outdoor air pollution on children's health, pointing out the special differences for children.[49] The Academy reported many of the health effects cited by the WHO study, but also focused on the sources common to far too many children. Both the WHO monograph and the Academy statement highlighted recent studies showing how children living near highly

traveled highways appear to be particularly harmed by traffic-related pollution. The Academy statement highlighted the specific concern over diesel school buses, citing a pilot study that showed children riding inside a school bus may be exposed to four times more diesel exhaust than if they were riding in a car.[50]

New Research on Prenatal Exposure to Air Pollution

Several studies published in 2005 found prenatal exposure to air pollution can harm children. A study of pregnant women in four Pennsylvania counties found an increased risk of preterm births linked to chronic exposure to high levels of air pollution during the last six weeks of pregnancy.[51] A study of three low-income neighborhoods in New York City found that infants born to nonsmoking mothers faced a possible increased risk of cancer from living in areas with elevated urban area air pollutants.[52] A third study in the Czech Republic found evidence that the mother's exposure to air pollution may even alter the immune system of the fetus.[53]

Air Pollution Linked to Asthma Attacks, New Onset of Asthma

Researchers from Yale University studied children with asthma whose mothers had tracked their symptoms on a daily basis. The study, published in the *Journal of the American Medical Association*, found that children with asthma were particularly vulnerable to ozone even at levels below EPA's current eight-hour ozone standard.[54] An accompanying editorial warned, "Air pollution is one of the most under-appreciated contributors to asthma exacerbation."[55]

A recent study suggests that year-round exposure to ozone may be associated with an increased risk of the development of asthma. While more research is needed to confirm this finding, researchers tracking 3,500 students in Southern California found an increased onset of asthma in children who were taking part in three or more outdoor activities in communities with high levels of ozone.[56]

Air Pollution Increases Risk of Underdeveloped Lungs

Another finding from the Southern California Children's Health study looked at the long-term effects of particle pollution on teenagers. Tracking 1,759 children between ages 10 and 18, researchers found that those who grew up in more polluted areas faced the increased risk of having underdeveloped lungs, which may never recover to their full capacity. The average drop in lung function was 20 percent below what was expected for the child's age, similar to the impact of growing up in a home with parents who smoked.[57]

Community health studies are pointing to less obvious, but serious, effects from year-round exposure to ozone, especially for children. Scientists followed 500 Yale University students and determined that living just four years in a region with high levels of ozone and related co-pollutants was associated with diminished lung function and frequent reports of respiratory symptoms.[58] A much larger study of 3,300 school children in

Southern California found reduced lung function in girls with asthma and boys who spent more time outdoors in areas with high levels of ozone.[59]

Cleaning Up Pollution Can Reduce Risk to Children

There is also real-world evidence that reducing air pollution can help protect children. Two new studies published in 2005 added more weight to the argument.

Changes in air pollution from the reunification of Germany proved a real-life laboratory. Both East and West Germany had different levels and sources of particles. Outdoor particle levels were much higher in East Germany, where they came from factories and homes. West Germany had higher concentrations of traffic generated particles. After reunification, emissions from the factories and homes dropped, but traffic increased. A German study explored the impact on the lungs of six-year olds from both East and West Germany. Total lung capacity improved with the lower particle levels. However, for those children living near busy roads, the increased pollution from the increased traffic kept them from benefiting from the overall cleaner air.[60]

In Switzerland, particle pollution dropped during a period in the 1990s. Researchers there tracked 9,000 children over a nine-year period, following their respiratory symptoms. After taking other factors such as family characteristics and indoor air pollution into account, the researchers noted that during the years with less pollution, the children had fewer episodes of chronic cough, bronchitis, common cold, and conjunctivitis symptoms.[61]

In this country, the 1996 Olympics in Atlanta, Georgia, remains one of the most interesting cases. Atlanta is a prime example of an urban area with a history of serious ozone problems. The determined efforts of the city to reduce traffic during the Olympics succeeded in not just reducing congestion, but in improving the health of children with asthma. Concerned with an expected traffic nightmare, the city brought in more buses, more subway cars, and encouraged ridesharing and telecommuting during the Summer Olympic Games. These measures created a prolonged period of low ozone pollution that resulted in significantly lower rates of childhood asthma events for children aged 1–16. The number of asthma acute care events (e.g., treatment and hospitalization) decreased 42 percent in the Georgia Medicaid claims files. Pediatric emergency departments also saw significant reductions, as did the Georgia Hospital Discharge Database and a health maintenance organization database. It is important to note researchers determined that weather was not the determining factor in the reduced ozone levels.[62]

Living Near Highways May Be Especially Dangerous

Back to the truck we talked about earlier. Being in heavy traffic, or living near a road, may be even more dangerous than being in other places in a community. Several studies have found that the vehicle emissions coming directly from those highways may be

higher than in the community as a whole, increasing the risk of harm to people who live or work near busy roads.

In San Francisco, researchers found in 2004 an increase in bronchitis and physician-diagnosed asthma in children who lived near highways.[63] A newer study of children in 10 communities in Southern California also found that the closer children lived to a freeway, the greater their chances of having asthma.[64] Studies have found increased risk of premature death from living near a major highway or an urban road.[65] Another study found an increase in risk of heart attacks from being in traffic, whether driving or taking public transportation.[66]

How To Protect Yourself from Ozone, Particle Pollution

To minimize your exposure to ozone and particle pollution:

- Pay attention to forecasts for high air pollution days to know when to take precautions;
- Avoid exercising near high-traffic areas;
- Avoid exercising outdoors when pollution levels are high, or substitute an activity that requires less exertion;
- Eliminate indoor smoking; and
- Reduce the use of fireplaces and wood-burning stoves.

Bottom line: Avoid doing anything that causes you to breathe very deeply on days when pollution levels are high. The more deeply you breathe, the deeper into your lungs the particles will go. Listen to local news reports about air quality and reduce your exposure. Support national, state and local efforts to clean up sources of pollution, as discussed in this report.