

# HEALTH EFFECTS OF AIR POLLUTION

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In the decades since some of the first episodes of severe air pollution levels resulted in large numbers of deaths (e.g., in London, UK, and Donora, Pennsylvania, USA), air pollution and its effects on human health have been studied in detail. Air pollution is arguably the most well studied of any environmental exposure. The large body of research that now exists has shown conclusively that both short-term (i.e., a few days to weeks) and long-term (i.e., months to years) exposures to air pollution can contribute to serious effects on health ranging from temporary to chronic, and from mild to debilitating, and even fatal, conditions.

## Who Is Most Affected by Air Pollution?

Some groups of people, including children, pregnant women, the elderly, and people with heart and lung diseases, are more affected by exposure to air pollution than others. Others, because of disadvantage related to socioeconomic position or ethnicity, are more likely to be exposed to higher levels of air pollution and are also at greater risk of adverse health effects.

## Health Effects of Short-term Exposures

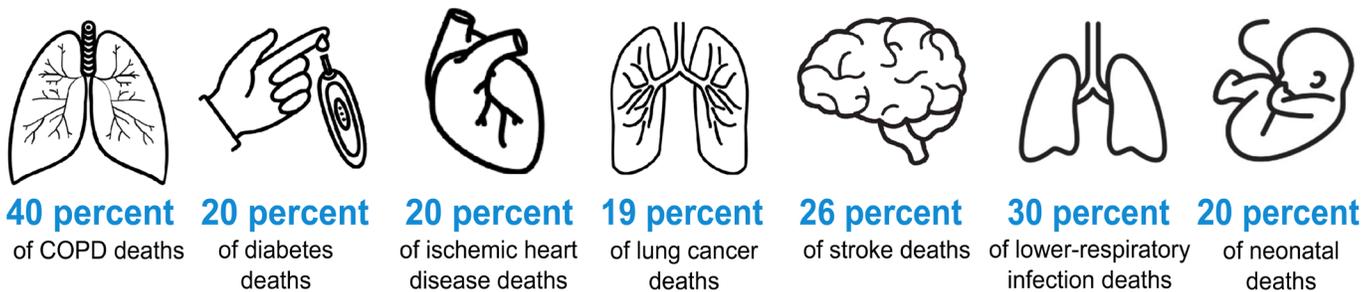
In the short term, exposure to air pollution (represented as daily air pollution concentrations or air quality index values) can impact an individual's health. During certain high-pollution days (or *episodes*), the effects can be more severe. Exposures over a few hours to a few days can contribute to ear, nose, and throat irritation. The irritation usually disappears as air pollution levels decline.

Short-term exposure may also cause and aggravate lower-respiratory and chronic conditions such as allergies, asthma, chronic obstructive pulmonary disease, and bronchitis. In people with heart disease, short-term exposure to PM<sub>2.5</sub> can lead to arrhythmias, heart attacks, and even death.

## Health Effects of Long-term Exposures

From a public health standpoint, some of the most substantial effects of air pollution come from long-term exposures to air pollutants. These exposures increase a person's chances of developing and even dying prematurely from chronic heart disease, respiratory diseases, lung infections, lung cancer, diabetes, and other health problems. Growing scientific evidence has found that a mother's exposure to air pollution during pregnancy can contribute to adverse birth outcomes for her infant in the first month of life; that is, infants may be born preterm or underweight, which puts them at high risk for other serious diseases and mortality. Finally, a growing number of studies suggest that air pollution can contribute to several other diseases including brain health outcomes (e.g., neurological effects in childhood and adolescence, and neurodegenerative disease in adulthood). Given these effects, exposure to air pollution can also reduce life expectancy (i.e., the number of years that a person might expect to live).

## Percentage of Global Deaths (by Cause) Attributed to Air Pollution in 2019



## Burden of Disease Due to Air Pollution

Air pollution is a complex mixture of particles and gases. [The State of Global Air](#) reports on the effects of three pollutants that are the focus of the [Global Burden of Disease \(GBD\) study](#): outdoor fine particulate matter (PM<sub>2.5</sub> or particles less than 2.5 micrometers in diameter), ground-level ozone, and indoor fine particulate matter resulting from the household burning of solid fuels for cooking (wood, charcoal, coal, and dung, etc.). The GBD analysis estimates air pollution's burden on society in terms of its impacts on years lived with illness and in the numbers of deaths resulting, in most cases, from long-term exposures. Air pollution's collective impact is based on the contributions of PM<sub>2.5</sub>, ozone, and household air pollution to mortality due to five chronic noncommunicable diseases for which the strongest scientific evidence currently exists — diabetes, stroke, chronic obstructive pulmonary disorder (COPD), lung cancer, and ischemic heart disease — and one communicable disease — lower-respiratory infection (see descriptions below). This year the overall burden includes new estimates of the impacts of outdoor and household particulate matter on mortality on the youngest infants from complications of being born too early and too small.

The burden of disease linked to air pollution is substantial — air pollution contributes to a large percentage of deaths globally from each of these major types of disease.

## Air Pollution-Related Diseases Included in the Global Burden of Disease Analysis



**Ischemic heart disease** Ischemic heart disease refers to heart problems caused by narrowed heart arteries. When arteries are narrowed, less blood and oxygen reach the heart muscle. Also called “coronary artery disease” and “coronary heart disease,” ischemic heart disease can ultimately lead to heart attack. [MORE](#)

*In 2019, 9.14 million global deaths were attributed to ischemic heart diseases, 20% of which were linked to air pollution.*



**Stroke** A stroke occurs when the blood supply to part of the brain is suddenly interrupted or when a blood vessel in the brain bursts, spilling blood into the spaces surrounding brain cells. Brain cells die when they no longer receive oxygen and nutrients from the blood or there is sudden bleeding into or around the brain. [MORE](#)

*In 2019, 6.55 million global deaths were attributed to stroke, 26% of which were linked to air pollution.*



**Diabetes** Diabetes is a chronic disease caused by the inherited and/or acquired deficiency in production of insulin by the pancreas, or by the ineffectiveness of the insulin produced. Such a deficiency results in increased concentrations of glucose in the blood, which in turn damage many of the body's systems, in particular the blood vessels and nerves. The most common types are type 1, type 2, and gestational diabetes. The GBD program estimates air pollution burden for type 2 diabetes. [MORE](#)

*In 2019, 1.55 million global deaths were attributed to diabetes, 19% of which were linked to air pollution.*



**COPD** Chronic obstructive pulmonary disease (COPD), including chronic bronchitis and emphysema, is a lung disease characterized by chronic obstruction of lung airflow that interferes with normal breathing and is not fully reversible. [MORE](#)

*In 2019, 3.28 million global deaths were attributed to COPD, 40% of which were linked to air pollution.*



**Lung Cancer** Cancer is a disease in which cells in the body grow out of control. When cancer starts in the lungs, it is called lung cancer. Unlike normal cells, cancer cells grow without order or control, destroying the healthy lung tissue around them. [MORE](#)

*In 2019, 2.04 million global deaths were attributed to lung cancer, 19% of which were linked to air pollution.*



**Acute Lower-Respiratory Lung Infections** Acute lower-respiratory lung infections include pneumonia (infection of the lung alveoli), as well as infections affecting the airways such as acute bronchitis and bronchiolitis, influenza, and whooping cough. Such infections are a leading cause of illness and death in children and adults across the world. [MORE](#)

*In 2019, 2.49 million global deaths were attributed to lower-respiratory lung infections, 30% of which were linked to air pollution.*



**NEW: Exposure to Air Pollution and Adverse Birth Outcomes** Low birthweight and preterm birth are major risk factors for disease among infants 0–27 days old. Babies born preterm (birth prior to 37 weeks of gestation) or with low birth weights (initial infant weight below the lowest risk birth weight of 2,500 grams or 5.5 lbs) are linked to a higher risk of lower-respiratory infections, diarrheal diseases, and other impacts such as brain damage and inflammation, blood disorders, jaundice, and serious infections. [MORE](#)

*Of the deaths attributed to low birth weight and premature birth, outdoor PM<sub>2.5</sub> and household air pollution together are responsible for around a fifth globally. In 2019, this meant that these exposures contributed to nearly 500,000 deaths of infants in their first month of life worldwide.*

#### FOR MORE INFORMATION:

To learn more about daily local air quality in your neighborhood or city, please visit [www.aqicn.org](http://www.aqicn.org).

To access data on real-time air quality from around the world, please visit [www.openaq.org](http://www.openaq.org).

To learn more about long-term trends on air pollution and the associated health burden, please visit [www.stateofglobalair.org](http://www.stateofglobalair.org).

#### ADDITIONAL RESOURCES:

Boogaard H, Walker K, Cohen A. 2019. Air pollution: The emergence of a major global health risk factor. *Int Health* 11(6):417–421; doi:10.1093/inthealth/ihz078.

Schraufnagel DE, Balmes JR, Cowl CT, et al. 2019. A review by the Forum of International Respiratory Societies' Environmental Committee, Part 1: The damaging effects of air pollution. *Chest* 155(2):409–416; <https://doi.org/10.1016/j.chest.2018.10.042>.

Schraufnagel DE, Balmes JR, Cowl CT, et al. 2019. A review by the Forum of International Respiratory Societies' Environmental Committee, Part 2: Air pollution and organ systems. *Chest* 155(2):417–426; <https://doi.org/10.1016/j.chest.2018.10.041>.

Thurston GD, Kipen H, Annesi-Maesano I, Balmes J, Brook RD, Cromar K, et al. 2017. A joint ERS/ATS policy statement: What constitutes an adverse health effect of air pollution? An analytical framework. *Eur Respir J* 49:1600419; doi:10.1183/13993003.00419-2016.

[American Heart Association](#) | [National Institute of Neurological Disorders and Stroke](#) | [World Health Organization](#)  
[American Lung Association](#) | [Centers for Disease Control and Prevention](#) | [European Lung Foundation](#)



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The State of Global Air website is a collaboration between the Health Effects Institute and the Institute for Health Metrics and Evaluation, with expert input from the University of British Columbia.