

# FIRST WHO GLOBAL CONFERENCE ON AIR POLLUTION AND HEALTH

IMPROVING AIR QUALITY, COMBATting CLIMATE CHANGE – SAVING LIVES

## The invisible killer – health effects of air pollution

**BREATHE  
LIFE**

### Key messages

- » Air pollution exposure has a wide range of both acute and chronic adverse effects on human health.
- » Globally, air pollution is the second leading cause of noncommunicable diseases (NCDs), and the leading cause of pneumonia in children under five.
- » Exposure to some air pollutants even at low concentrations can damage human health.

## Introduction

Ambient and household air pollution are among the world's leading causes of premature death. Although it may be invisible, and often overlooked as a source of risk, air pollution takes a devastating toll on the health of millions of people.

Air pollution can damage the lungs, heart, brain and other critical systems of the human body in diverse ways, with both acute and chronic effects. There is clear evidence linking air pollution exposure to early death and reduced life expectancy. Air pollution is a major cause of chronic respiratory disease, acute lower respiratory infections (ALRI) in children, chronic bronchitis in adults and lung cancer. It is one of the world's leading causes of noncommunicable diseases (NCDs) such as stroke, heart disease and chronic obstructive pulmonary disease (COPD) in adults.

Even at low concentrations, air pollution can be a potent threat to human health. Exposure to a range of pollutants – especially particulate matter (PM) – can trigger airway inflammation and oxidative stress and exacerbate asthma. Fine particles are an especially strong indicator of health risks as further discussed below.

## How air pollution causes harm

Exposure to air pollution occurs through inhalation, but exposure can also happen in the womb. There are clear links between maternal exposure and adverse outcomes such as stillbirth, premature birth, and low birth weight.

**Infections:** Air pollutants contribute to respiratory infections via several mechanisms. Inhaled particles can damage the normal defense mechanisms of the respiratory tract by causing inflammation and oxidative stress. There is some evidence that combustion-derived PM interferes with processes essential to the immune response, increasing the susceptibility of individuals to infections.

**Noncommunicable diseases (NCDs):** Air pollution is one of the leading causes of NCDs, which are on the rise worldwide. There is increasing evidence that chronic exposure to even low concentrations of air pollution contributes to NCDs, and that exposure at a young age can increase a person's chances of suffering from an NCD later in life. There is strong evidence that exposure to PM<sub>2.5</sub> is associated with elevated risk of cardiovascular diseases such as ischaemic heart disease (IHD) and stroke.

# THE INVISIBLE KILLER

Air pollution may not always be visible, but it can be deadly.



**29%**

OF DEATHS FROM  
**LUNG CANCER**



**24%**

OF DEATHS FROM  
**STROKE**



**25%**

OF DEATHS FROM  
**HEART DISEASE**



**43%**

OF DEATHS FROM  
**LUNG DISEASE**

**BREATHELIFE.**  
Clean Air. Healthy Future.



World Health  
Organization

**UN**  
environment



CLIMATE &  
CLEAN AIR  
COALITION  
TO REDUCE SHORT-LIVED  
CLIMATE POLLUTANTS

**Other adverse health outcomes:** There is growing evidence of links between ambient air pollution and neurodevelopmental disorders and cognitive conditions. There is also strong evidence that exposure to household air pollution (HAP) is associated with the formation of cataract, which is the leading cause of blindness in adults in developing countries. Up to one quarter of the total disease burden from cataract may be due to HAP.

**Effects on children:** Children are especially vulnerable to air pollution, as their lungs and other organs are still maturing. Exposure in childhood can contribute to lifelong increased risk of cardiovascular and other illnesses that may only manifest in adulthood. There is compelling evidence that air pollution exposure is associated with increased risk of infant mortality, ear infections, reduced lung function and developing asthma. There is also epidemiological evidence of links between air pollution exposure and low birth weight, preterm birth and stillbirths. A growing body of research suggests that air pollution can negatively influence neurodevelopment and cognitive performance. There is emerging evidence of links with childhood obesity and diabetes.

### Pollutants causing negative health outcomes

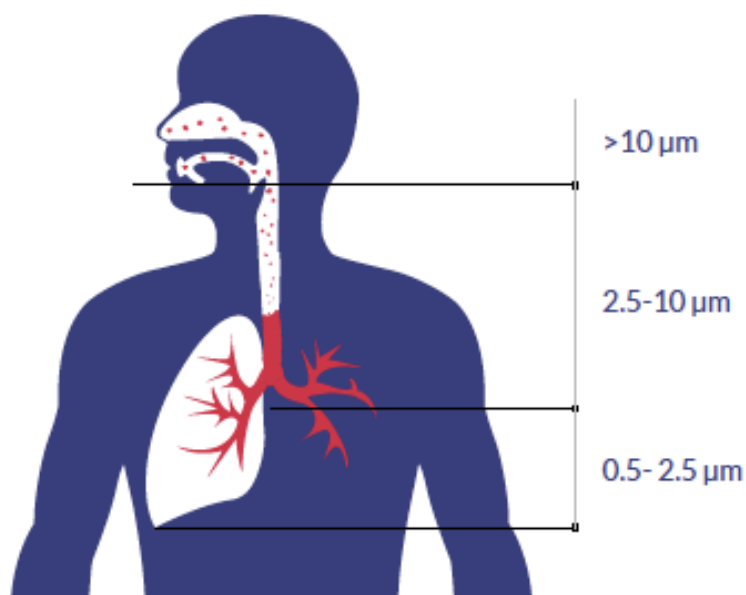
Pollutants with the strongest evidence for public health concern include particulate matter (PM), ozone (O<sub>3</sub>), and nitrogen dioxide (NO<sub>2</sub>). Other important pollutants are sulfur dioxide (SO<sub>2</sub>), carbon monoxide (CO), and volatile organic compounds (VOCs). These pollutants vary in their chemical properties and composition, and their ability to diffuse over long or short distances. For almost all pollutants, both short-term and long-term exposures can damage health.

**Particulate matter (PM)** refers to inhalable particles, composed of sulphate, nitrates, ammonia, sodium chloride, black carbon, dust or water. The health risks of PM are especially well documented and PM levels are most widely used indicator for assessing the health effects from exposure to ambient air pollution. Generally, the smaller the particle, the more dangerous it is. Coarser particles tend to be captured in the nasal cavity, upper airways or thoracic cavity.

**Fine particles (PM<sub>2.5</sub>)** can penetrate deep into lung passageways and enter the alveoli (tiny air-filled sacs located at the end of the bronchioles in the lungs where oxygen exchanges with carbon dioxide in the blood). There they can cross into the bloodstream, causing serious cardiovascular, cerebrovascular and respiratory effects. They can also inflame and constrict blood vessels, and dislodge fatty plaque from artery walls, raising the risk of stroke and heart attack. The toxins that make up particulate matter can also cause cell mutations, increasing the risk of lung cancer.

Even at very low concentrations, PM has been found to have significant health impacts. Both long-term and short-term exposure to PM is associated with morbidity and mortality from cardiovascular and respiratory diseases. In 2013, PM was classified as a cause of lung cancer by WHO's International Agency for Research on Cancer (IARC).

Other key air pollutants include polyaromatic hydrocarbons (PAH), volatile organic compounds (VOCs), carbon monoxide (CO), ground-level ozone (O<sub>3</sub>), sulfur dioxide (SO<sub>2</sub>), and nitrogen dioxide (NO<sub>2</sub>).



## Challenges and information gaps

- More research is needed on the long-term health effects of exposure to desert dust and sand storms.
- Greater focus on the health effects of air pollution exposure among vulnerable population subgroups and occupationally exposed workers is also a priority.
- There is a need for more long-term observational studies, randomized control trials, and case–control studies of the health effects of household air pollution.
- There is a need for more accountability studies, where it can be shown that a decrease in air pollution exposure is related to a decrease in health effects.

