

THE IMPACT OF AIR POLLUTION ON HUMAN HEALTH

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ARTICLE INFORMATION

ABSTRACT:

ARTICLE HISTORY:

Received: 09.04.2026

Revised: 10.04.2026

Accepted: 11.04.2026

KEYWORDS:

Air pollution, Health, Respiratory diseases, Environment, Public health, Toxic substances, Prevention

Air pollution has become one of the most critical global environmental health challenges of the 21st century. This article examines the adverse effects of air pollution on human health, focusing on both short-term and long-term consequences. Exposure to polluted air is associated with respiratory diseases, cardiovascular disorders, and increased mortality rates. The paper analyzes major air pollutants, their sources, and their physiological impact on the human body. Furthermore, it highlights vulnerable populations and discusses preventive strategies to reduce health risks. The findings emphasize the urgent need for public health interventions and environmental policies aimed at reducing air pollution and improving population health.

Introduction

Air pollution is a major environmental risk to human health worldwide. Rapid industrialization, urbanization, and increased use of fossil fuels have significantly contributed to the deterioration of air quality. According to global health reports, millions of people are exposed daily to harmful air pollutants, which pose serious threats to their well-being.

Air pollution consists of a mixture of harmful substances, including particulate matter (PM_{2.5} and PM₁₀), carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen oxides (NO_x), and ozone (O₃). These pollutants originate from various sources such as vehicle emissions, industrial processes, burning of fossil fuels, and agricultural activities.

The human respiratory system is the primary route of exposure to air pollutants. However, these substances do not only affect the lungs; they also enter the bloodstream and impact other organs, leading to systemic health effects. Understanding the mechanisms by which air pollution affects human health is essential for developing effective prevention strategies.

Literature Review

Numerous scientific studies have demonstrated the significant impact of air pollution on human health. Research in environmental health and epidemiology has established a strong link between air pollution exposure and increased morbidity and mortality rates.

From a physiological perspective, inhaled pollutants cause inflammation and oxidative stress in the respiratory tract. Fine particulate matter (PM_{2.5}), due to its small size, can penetrate deep into the lungs and even enter the bloodstream. This leads to damage of lung tissues, reduced lung function, and increased susceptibility to respiratory infections such as bronchitis and pneumonia.

Long-term exposure to polluted air is strongly associated with chronic respiratory diseases, including asthma and chronic obstructive pulmonary disease (COPD). Studies show that children exposed to high levels of air pollution are more likely to develop asthma and experience impaired lung development. In adults, prolonged exposure increases the risk of lung cancer and chronic respiratory failure.

The cardiovascular system is also significantly affected by air pollution. Pollutants such as fine particles and nitrogen dioxide contribute to the development of atherosclerosis, hypertension, and heart attacks. These substances promote inflammation in blood vessels, increase blood viscosity, and disturb normal cardiac function. Epidemiological data indicate that air pollution is a major risk factor for stroke and ischemic heart disease.

In addition to physical health effects, air pollution has been linked to negative impacts on mental health. Recent studies suggest that exposure to polluted air may contribute to cognitive decline, anxiety, and depression. Neuroinflammation and reduced oxygen supply to the brain are considered key mechanisms behind these effects.

Certain populations are more vulnerable to the harmful effects of air pollution. These include children, elderly individuals, pregnant women, and people with pre-existing health conditions.