



Impact of Air Pollution On Human Health

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ABSTRACT

Air pollution is nowadays considered as the world's main serious environmental health risk by the World Health Organization (WHO). Several readings have regularly shown its injurious effect on human health. It is projected that polluted air was accountable for over 6 million deaths worldwide in 2016, double as many as AIDS, tuberculosis and malaria joint. Ambient particulate matter, nitrogen dioxides and other pollutants have been connected with increased occurrence of a number of respiratory and cardiovascular diseases, cancers and even seem to be connected with neuro-developmental disorders in children and neurodegenerative diseases in adult. Data on air quality indicators is pretty progressively accessible and the science essential the related health impact is also developing fast. This review summarizes the current knowledge on impact of air pollution on human health.

Keyword: *Impact, Air pollution, Human health, Source of air pollution, Toxicology.*

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INTRODUCTION

Air pollution source severe environmental problems and has develop a foremost health risk for living [8]. Air pollution from fossil fuel burning has been famous to affect human health for centuries. Air is whatever all living humans and animals need for a good health and well-being. Owing to overwhelming town progress, the air is constantly polluted [2]. The Air pollution may be any atmospheric condition in which definite substances are present in such concentrations that may create injurious effects on man and its environment. Air Pollution is a worldwide health hazard with serious public health consequences, mainly for children and elders. Human weakness to adverse health effects from introduction to air pollution can be related to genetic profile: race and ethnicity, lifestyle, behavior, socio-economic position and location of house or daily activities. The major most cause behind air pollution is due to the burning of fossil fuels, used for the generation of energy and moving .most of the developing countries use more fossil fuels results in increase industrialized emission by which the rate of air pollution in the countries also increased [3]. It is well recognized that air pollution has a sum of negative effects on human health and is measured a key issue for the worldwide community [14]. Air is the primary necessity to weather healthy lives of humanity and those of the secondary ecosystems which in return affect the human health. Rural air pollution is basically a result of fire of fossil fuels that are used in transportation, power generation, industrial sector, and other economic activities [13]. Air is an essential natural resource providing the root of life on earth. The air in the atmosphere provides oxygen to plants and animals by asset of which they are able to live. The effects are frequently first seen as wheezing, coughing, shortness of breath and a worsening of current respiratory and cardiac conditions particularly in sensitive portions of the population counting the very young, old or those with surviving medical conditions such as asthma. Pollutants similarly have hurtful effects on the environment through damage to plants, buildings and a reduction in visual feature from smoke or haze [11]. Air pollution is a vital determinant of health. There is sine class in contact to air pollution and related health risks: air pollution combines with other sides of the social and physical environment to make an unequal disease burden in less rich parts of society [9].

There are many common types of air pollutants, such as fine particulate matter, ozone carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen oxides (NO₂), volatile organic pollutants and some other toxic air pollutants [7]. Poor air class adversely affects human health and the environment [6]. Air pollution is a major problem of recent decades, which has a serious toxicological impact on human health and the environment. Extensive period effects of air pollution on the onset of diseases such as respiratory infections and inflammations, cardiovascular dysfunctions, and cancer is widely recognized therefore, air pollution is connected with billions of death globally each year.

INDOOR AIR POLLUTION

Indoor air class has occurred as one of the most vital matters of environment and health worldwide. Household air pollution (HAP) due to biomass cooking fuel use is an important risk factor for worldwide. Household air pollution (HAP) due to biomass cooking fuel use is an important risk factor for a range of diseases, particularly among adult women who are primary cooks [13]. Contacts to indoor air pollution reducing from the incomplete combustion of solid fuels are substantial in developing countries and confuse health impact assessments trying to isolate exposures to ambient pollution [12].

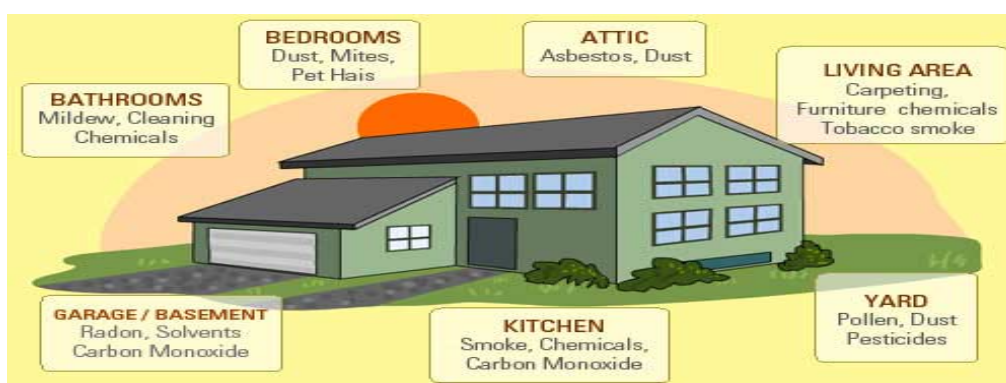


Figure 1: Indoor air pollution

OUTDOOR AIR POLLUTION

Outdoor air pollution is a combination of the thousands of the components. among them , airborne particulate matter (PM) and the gaseous pollutants ozone, nitrogen dioxide (NO₂), volatile organic compounds , carbon monoxide (CO), and sulphur dioxide (SO₂) are the most important from a health viewpoint. Primary pollutants such as soot particles and oxides of nitrogen and sulphur are emitted directly into the air by the combustion of fossil fuels. Main sources of primary particles include motorized road traffic, power generation, industrial sources, and residential, power generation, industrial sources, and residential heating. Secondary pollutants, made when primary pollutants react or interact in the atmosphere, include mainly ozone (O₃) and particulate matter [14].

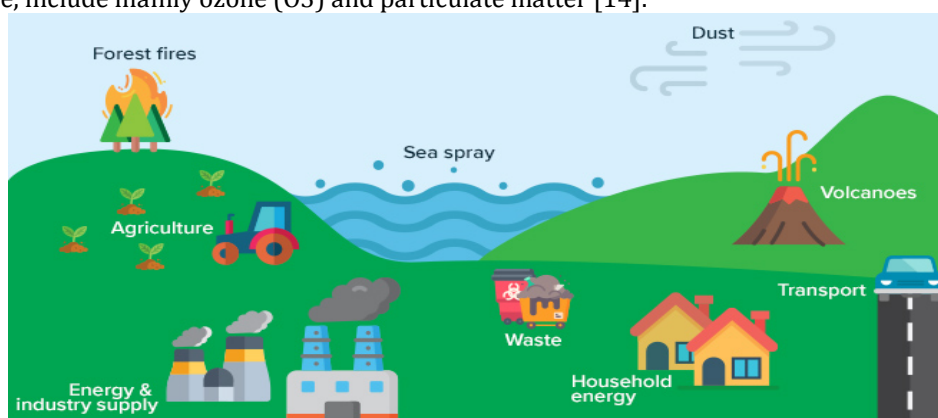


Figure 2: Outdoor air pollution

TYPES OF AIR POLLUTANTS

Pollutants may be natural or man-made and can be further classified as primary or secondary.

1) Primary pollutants:

These are major pollutants produced by human activity, they include the following

a) Particulate matter

Particulate matter is the sum of all solid and liquid particles suspended in air many of which are hazardous. This complex mixture includes both organic and inorganic particles, such as dust, pollen, soot, smoke, and liquid droplets. These particles vary greatly in size, composition, and origin.

PM_{2.5} (particles less than 2.5 micrometers in diameter) can penetrate deeply into the lung, irritate and corrode the alveolar wall, and consequently impair lung function. Hence it is important to investigate the impact of PM_{2.5} on the respiratory system and then to help combat the current air pollution problems.

b) Oxides of sulfur

c) **Carbon monoxide:**

It is a colorless, odorless, non-irritating but very poisonous gas. It is a product of incomplete combustion of fuel such as natural gas, coal or wood

d) **Nitrogen dioxide:**

Nitrogen dioxides are emitted from high temperature combustion. Nitrogen dioxide is a chemical compound with the formula NO₂.

e) **Sulfur dioxide:**

Sulfur dioxide is a chemical compound with the formula SO₂. SO₂ is produced by volcanoes and in various industrial processes.

2) **Secondary pollutants:**

These are pollutants which are formed in the air when pollutants react or interact and they include particulate matter, ground level ozone.

a) **Particulate matter:** Particulate matter is formed from gaseous primary pollutants and compounds in photochemical smog. Classic smog results from large amounts of coal burning in an area caused by a mixture of smoke and sulphur dioxide.

b) **Ground level ozone:** (O₃) is formed from NO_x and VOCs. Ozone (O₃) is a key constituent of certain regions of the stratosphere commonly known as the ozone layer [11].

PAHs :Polycyclic aromatic hydrocarbons (PAHs) are a class of chemicals that occur naturally in coal, crude oil, and gasoline. They also are produced when coal, oil, gas, wood, garbage, and tobacco are burned. PAHs generated from these sources can bind to or from small particles in the air.

VOCs :Volatile organic compounds are organic chemicals that have a high vapor pressure at ordinary room temperature. Common examples of VOCs that may be present in our daily lives are: benzene, ethylene glycol, formaldehyde, methylene chloride, tetrachloroethylene, toluene, xylene, and 1,3-butadiene.

ROUTE OF EXPOSURE

Pollutants enter the human body in three main different ways: by inhalation, ingestion or skin absorption. People are often exposed to different pollutants simultaneously. Exposure to these may occur at different locations (e.g. in the workplace and/or at home) and at different times.

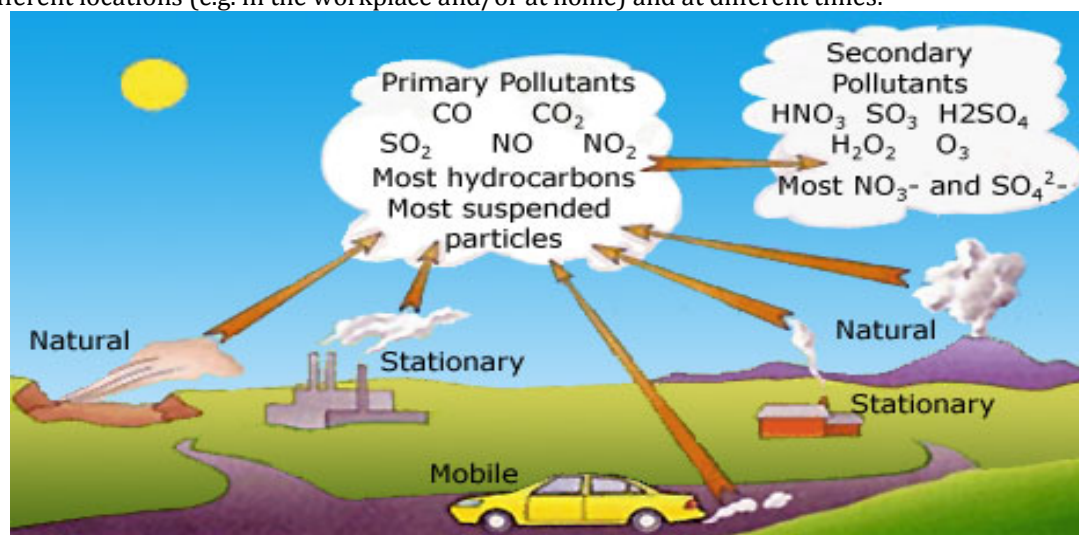


Figure 3: Primary and secondary pollutants

HEALTH EFFECTS OF AIR POLLUTANT: (OVERALL HEALTH EFFECTS)

Equal healthy people can experience health impacts from polluted air including respiratory irritation or breathing difficulties during exercise or outdoor activities. Your actual risk of adverse effects depends on

your current health status, the pollutant type and concentration, and the length of your exposure to the polluted air.

High air pollution levels can cause immediate health problems including:

1. Serious cardiovascular and respiratory illness
2. Damaged cells in the respiratory system
3. Other stress to heart and lungs, which must work harder to supply the body with oxygen

Long-term exposure to polluted air can have permanent health effects such as:

1. Faster aging of the lungs
2. Shortened life span
3. Loss of lung capacity and decreased lung function
4. Progression of diseases such as asthma, bronchitis, emphysema, and possibly cancer

Those best susceptible to severe health problems from air pollution are:

1. Individuals with heart disease, coronary artery disease or congestive heart failure
2. Children under age 14
3. Outdoor workers
4. Older adults and the elderly
5. Pregnant women
6. Athletes who exercise vigorously outdoors
7. Individuals with lung diseases such as asthma, emphysema or chronic obstructive pulmonary disease (COPD)

People in these groups may experience health impacts at lower air pollution exposure levels, or their health effects may be of greater intensity.

Contact to pollutants generated from heating cooking oils to high temperatures has also been connected with lung cancer [5]. Air pollution is a major global public health risk in cities across the world [12].

- 1) Eye irritation
- 2) Increase cardiovascular morbidity
- 4) Depleted immune system
- 5) Degradated ventilator functions
- 6) Increased respiratory ailments
- 7) Impact on long-term mortality linked to the carcinogenic effect of pollutant [10].
- 8) Increased mortality in infants and young children's
- 9) Increased risk of dying from cancer
- 10) Slowed lung function and growth in children and teenagers
- 11) Inflammation of lung tissue in young and healthy adults
- 12) Death from respiratory and cardiovascular cause, including strokes
- 13) Increased risk of lower birth weight and infant mortality
- 14) Increased hospitalizations for asthma among children.
- 15) Increased number of heart attack, especially among the elderly and in people with heart condition
- 16) Increased severity of asthma attacks in children [2].

Several studies have found a relationship between air pollution and several adverse health effects in the general population. These effects range from subclinical effects to premature death. Air pollution is a major cause of non-communicable diseases [10].

- a) Cardiovascular disease
- b) Respiratory disorders
- c) Cancer

a) Cardiovascular disease:

Air pollution is also related with changes in white blood cell counts which also may affect the cardiovascular functions. The traffic related air pollution, especially exposure to high levels of NO₂ associated with right and left ventricular hypertrophy [1].

Together with respiratory disorders, cardiovascular diseases have also been widely recognized as being associated with air pollution. Particulate matter has also been associated with the short-term risk of mortality from ischemic heart disease, hemorrhagic stroke and ischemic stroke(10). Once toxic substances reach the cardiovascular system, a number of reactions do occur. These include physical changes, degeneration, and inflammation of the heart and other areas of the cardiovascular system [11].

b) Respiratory disorder:

Since most of the pollutants enter the body through the airways, the respiratory system is in the first line of battle in the onset and development of diseases resulted from air pollutants. Depending on the dose of inhaled pollutants and deposition in target cells, they cause a different level of damages in the respiratory system. In the upper respiratory tract, the first effect is irritation, especially in trachea which induces

voice disturbances [1]. The respiratory system is tremendously susceptible to pollutants. Ozone, metals, and other pollutants from the air enter the lungs and can cause damage. Ozone has been known to attack the alveoli, an integral piece of the respiratory system responsible for filtering in oxygen and out carbon dioxide. Pollutants are also able to cause secondary damage to lung tissue by reacting with airway enzymes to cause inflammation or infection of the lungs [11].

c) **Cancer:**

Particulate matter, a major factor of outdoor air pollution, was evaluated separately and was also classified as carcinogenic to humans. Lung cancers take time to develop and might be associated with chronic long-term exposure to air pollution rather than with short-term peaks [10].

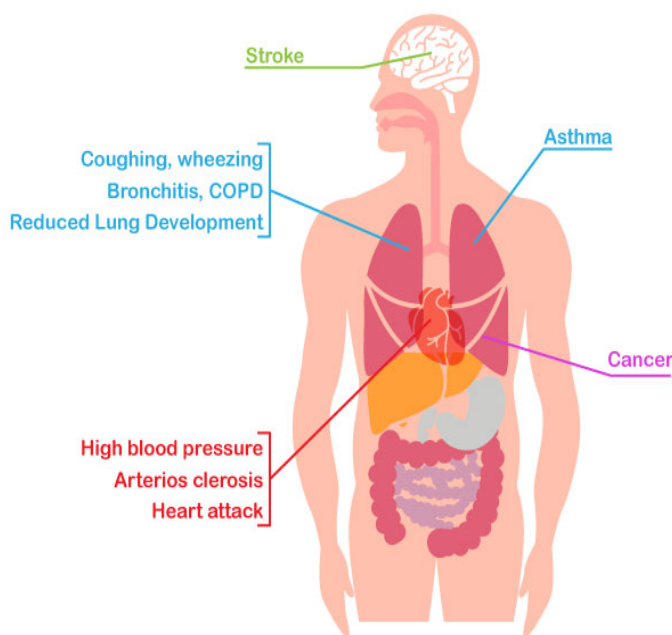


Figure 4: Health effect of pollution

CELLULAR MECHANISMS INVOLVED IN AIR POLLUTANTS

The effects of pollution on health are commonly attributable to particulate matter (PM), a complex mixture of particles suspended in the air. PM can penetrate the lower respiratory tract and has harmful direct and indirect effects on different organs and tissues. Direct effects are caused by the ability of PM components to cross the respiratory membrane and enter the bloodstream; indirect effects are systemic consequences of the local airway response. Recent work suggests that PM is an independent risk factor for low bone mineral density and osteoporosis-related fractures.

TOXICOLOGY OF AIR POLLUTION:

A physical, biological or chemical alteration to the air in the atmosphere can be termed as air pollution toxicology. Air pollution toxicology is the highly concerned environmental hazard. On a temporal basis, air has immense capacity for moving a large mass of pollutants. Mammals and birds are exposed to pollutants in air by the inhalation (nose and mouth), cutaneous or ocular routes.

Effects of air pollutants on living organism will not only be limited to the human and animal health but also include the whole environment.

- 1) Environmental damages
- 2) Air pollution and their toxicities
- 3) Carbon monoxide
- 4) Sulfur dioxide
- 5) Ozone
- 6) Particulate matter

1) **Environmental damages:**

Air pollution can root serious environmental damages to the groundwater, soil and air. Acid rain, temperature inversion, and global climate changes due to the emissions of greenhouse gasses to the atmosphere are other major ecological impacts of air pollution.

2) **Air pollution and their toxicities:**

Each material in the air which could affect human health or have a deep impact on the environment is defined as air pollutants. There are many pollutants of suspended materials such as dust fumes, smokes, mists, gaseous pollutants, hydrocarbons volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons

3) Carbon monoxide:

CO is a colorless and odorless gas, which is produced by fossil fuel, particularly when combustion is not appropriate, as in burning coal and wood. Symptoms of CO poisoning may include headache, dizziness, weakness, nausea, vomiting, and finally loss of consciousness. The indications are very similar to those of other illnesses, such as food poisoning or viral infections

4) Sulfur dioxide:

SO₂ is a colorless, extremely reactive gas, which is considered as an important air pollutant. It is commonly emitted from fossil fuel consumption, natural volcanic activities, and industrial processes. SO₂ is very harmful for plant life, animal, and human health. People with lung disease, children, older people, and those who are more exposed to SO₂ are at higher risk of the skin and lung diseases

5) Ozone:

Ozone is well-known as the high altitude shield of the Earth, where it protects the atmosphere against the harmful ultraviolet radiation emitted by the sun. Decreases the lungs growth. Asthma exacerbations All respiratory hospitalization. Asthma hospitalization. School absence for respiratory illness [1].

6) Particulate matter:

The chemical compounds of PM include sulfates, nitrates, ammonium and other inorganic ions such as sodium, potassium, calcium or magnesium, metals such as cadmium, copper, nickel and zinc and biological components such as allergens or microbes [10].

Pollution from different sources:

Numerous sources like industries, vehicles, construction, open biomass burning and dust from roads are responsible for air pollution.

- 1) Pollution from industries.
- 2) Pollution from Vehicles.
- 3) Pollution from dust.

1) Pollution from industries:

Many sources like industries, vehicles, construction, open biomass burning and dust from roads are responsible for air pollution. Industries are the major contributors of SO_x and NO. The fuels used in industries contain high-sulphur materials such as furnace oil, coke and petroleum, which cause industrial pollution.

2) Pollution from Vehicles:

Vehicular emission mostly contributes carbon monoxide, hydrocarbon, HC and dust particulate matters, which are a threat to human health the mitigation of vehicular pollution includes the following:

- (i) Increase pollution control system for vehicles using advance emission control technology.
- (ii) Development in fuel class for vehicles and popularization of compressed natural gas (CNG).

3) Pollution from dust:

Dust is emitted due to abrasion of tyres during application of brakes. Construction activities, like excavation, block cutting, demolition, road construction, mixing, drilling, loading and unloading of debris, etc. also emit dust particles. [8].

PRESENT AND PAST CONDITION OF AIR POLLUTION IN INDIA

Air pollution in India is a serious health problem. Of the most polluted cities in the world, 21 out of 30 were in India in 2019. As per a study based on 2016 data, at least 140 million people in India breathe air that is 10 times or more over the WHO safe limit and 13 of the world's 20 cities with the highest annual levels of air pollution are in India. The 51% of pollution is caused by the industrial pollution, 27% by vehicles, 17% by crop burning and 5% by diwali fireworks. Air pollution contributes to the premature deaths of 2 million Indians every year.

PRACTICAL MEASURES TO REDUCE AIR POLLUTION

1. Using public transports
2. Recycle and Reuse
3. Turn off the lights when not in use
4. No to plastic bags
5. Use filters for chimneys
6. Implement Afforestation
7. Avoid usage of crackers

8. Avoid using of products with chemicals
9. Use of fans instead of Air Conditioner
10. Reduction of forest fires and smoking

CONCLUSION

This review concludes that: Air pollutions have key impacts on human health, activating, and inducing many diseases noticeable to high morbidities and mortalities. Air pollution not just will harm human health but also other aspects of the environment such as visual qualities, vegetation, animals, soils and water class. The protection of air class in the environment must be a first priority goal. Air pollution will be an increasing worry in the coming years, with important significances on the insurance industry. Air pollution has become a major environmental issue due to rapid population growth, increase of agriculture and industrialization.

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