VOLUME 11 ISSUE 1 2025

ISSN 2454 – 3055

INTERNATIONAL JOURNAL OF ZOOLOGICAL INVESTIGATIONS

Forum for Biological and Environmental Sciences

Published by Saran Publications, India

International Journal of Zoological Investigations Vol. 11, No. 1, 214-218 (2025)

International Journal of Zoological Investigations

Contents available at Journals Home Page: www.ijzi.net

Editor-in-Chief: Prof. Ajai Kumar Srivastav

Published by: Saran Publications, Gorakhpur, India

ISSN: 2454-3055

Impacts of Air Pollution on Human Health

Mhatre Manda Anil

Department of Zoology, Changu Kana Thakur Arts, Commerce and Science College, New Panvel, Dist. Raigad, Navi Mumbai 410 206, Maharashtra, India

**Corresponding Author*

Received: 26th September, 2024; **Accepted:** 22nd December, 2024; **Published online:** 8th February, 2025

https://doi.org/10.33745/ijzi.2025.v11i01.022

Abstract: Human activities generate various toxic air pollutants such as ash, dust, fog, smoke, soot, steam, etc. which spoils the air quality and affects the environment and human health. The major pollutants of the ambient air are carbon dioxide, hydrocarbons, lead, nitrous oxide, ozone, and sulphur dioxides. Air pollution is a public health hazard in concern to cardiovascular disease; diabetes; obesity; reproductive, neurological, and immune system disorders; and as a human carcinogen. Health hazards of air pollution can cause serious public health consequences mainly for pregnant women, infants, children and even adults. Health effects caused by air pollutants depend on the absorbed dose, the type of pollutants and the individual susceptibility. Present review aims to provide an illustrative account of impacts of air pollution on human health, and strategies to be adopted for effective prevention and control of air pollution.

Keywords: Air, Disease, Human health, Impacts, Particulate matter, Pollution, Vulnerability

Citation: Mhatre Manda Anil: Impacts of air pollution on human health. Intern. J. Zool. Invest. 11(1): 214-218, 2025.

https://doi.org/10.33745/ijzi.2025.v11i01.022

Introduction

Kampa and Castanas (2008) suggested that pregnant women, children, older adults, people who are active outdoors, and people with heart or lung diseases are highly susceptible to air pollution. People exposed to higher levels of certain air pollutants may experience irritation of the eyes, nose, and throat; wheezing, coughing, chest tightness, and breathing difficulties; worsening of existing lung and heart problems, such as asthma; and increased risk of heart attack (LRTAP, 2012). Kuylenstierna *et al*. (2020) stated that air pollution has the greatest impact on human health and develop cardiovascular and respiratory diseases, and lung cancer. Other effects include premature deaths, low birth weight, pre-term births, severe asthma attacks, childhood pneumonia, heart attacks and strokes. Human health is impacted markedly by increasing temperatures and air pollutants. Health risks of air pollution are directly correlated with the increase in heat and humidity (RCRCC, IFRC and ICRC, 2023).

UNICEF (2019) and Marcoa *et al*. (2019) reported that air pollution produces negative impacts on human health, ecosystems, climate, society, and economy. Exposure to air pollutants produces adverse health outcomes, especially the respiratory and cardiovascular diseases, congestive heart failure, increases in asthma attacks, acute bronchitis, and altered lung function (Zhou *et al*., 2023). In extreme cases, along with breathing and respiratory problems, it can cause premature death, as well as damage the environment (Sharma, 2020).

Hazardous effects of air pollution on human health include adverse effects on the developing foetus, age-unseemly behaviours, allergic diseases in children, Alzheimer's and Parkinson's disease, asthma, cardiovascular dysfunctions, dry eye syndrome, immune dysfunction, irritation of the eyes, lung cancer, male infertility, malignant growth, neurobehavioral hyperactivity, neuro-inflammation, pigmented spots on the face, respiratory diseases, retinopathy, and skin aging (Kelly and Fussell, 2015; Gurmeet, 2020).

EPA (2023) described that; health impacts of air pollution depend upon the short term exposure or long term exposure to air pollutants. Short-term exposure to air pollution can cause coughing, dizziness, fatigue, headache, irritation to eyes, nose, and throat, and wheezing or difficulty during breathing (Rajak and Chattopadhyay, 2019). Long-term exposure to air pollution can leads to birth defects, cancer, cardiovascular damage, death, harm to liver, spleen, and blood, nervous system damage, and respiratory diseases (asthma, emphysema) (Demoury *et al*., 2024).

WHO (2019) stated that factors that affect the healthy person's vulnerability to air pollution include: age of person exposed; close proximity to high levels of pollution (heavy traffic on roads, coal-based power plants emitting polluting smoke, construction or demolition sites, use of biomass fuel for cooking, bursting fire crackers, burning waste from houses, hospitals, electronic waste, crop residues, etc.); health status of exposed person; high concentrations of particulate matter (increased burning of fuel for winter, burning of agricultural crop residues, weather patterns); low socioeconomic status; occupational exposures; pregnant women; and smoking of tobacco products and exposure to second-hand smoke (Rajak and Chattopadhyay, 2019; Walton and Yan, 2020).

This study aims to investigate the air pollution with special emphasis on types, sources, major air pollutants, and impacts of air pollution on human health. It also suggests control measures for prevention and to reduce the air pollution.

For present review the searched literature contains research papers, reviews, reports, and conference papers with the help of Internet search engines like Google, Google Scholar, PubMed, ScienceDirect, and ResearchGate. The purpose of this review was to summarize the updated published literature on air pollution with respect to its impacts on human health, and strategies to be practiced for control measures.

Common Air Pollutants

Gul and Das (2023) reported that common air pollutants are ammonia (NH_3), carbon dioxide (CO_2), carbon monoxide (CO), ;ead (Pb), oxides of nitrogen (NOx): NO and NO_2, sulphur dioxide (SO_2), ozone (O_3), and particulate matter (PM 2.5 and PM 10). Sources of these common air pollutants are as follow:

- Ammonia (NH_3): Combustion of fossil fuels, transport and waste disposal.
- Carbon dioxide (CO_2): Burning of fossil fuels, industries, etc.
- Carbon monoxide (CO): Incomplete combustion of fossil fuels. Automobile, industrial furnaces, open fires, forest fires and domestic fuel.
- Lead (Pb): Fumes from diesel/petrol, paints, metal mining and smelting, waste incineration, battery recycling, wood and coal burning.

Table 1: Impacts of Specific Air Pollutants on Human Health

Air pollutants	Impacts on Human Health	Reference
Ammonia (NH_3)	Affect human health through eutrophication by pollutants and through acidifying pollutants.	Penard and Maesano (2004)
Carbon dioxide (CO_2)	Respiratory problems, greenhouse effect, global warming.	Mabahwi *et al*. (2014)
Carbon monoxide (CO)	Reduce the oxygen-carrying capacity of haemoglobin.Cause nausea, headaches, blurred vision and drowsiness, reduced ability to think, and even death.	Shaharukh *et al*. (2020)
Oxides of Nitrogen (NOx): NO_2 & NO	Bronchial hyper-responsiveness.Decrease in lung function in asthmatic subjects. Respiratory irritant.Worsen existing respiratory illness.	Kelly and Fussell (2015), NIH (2020), Shetty *et al*. (2023)
Sulphur oxides (SOx): Sulphur dioxide (SO_2)	Alters children's' lung function. Increases adults' respiratory symptoms: cough. Provokes asthma attacks in asthmatic subjects. Respiratory irritant.	Doreswamy and Sudheendra (2010), Marcoa *et al*. (2019)
Ozone (O_3)	Exacerbates asthma attacks. Eye irritation. Irritate the respiratory tract. Respiratory illnesses: bronchitis and pneumonia. Severe coughing, shortness of breath and lung irritation.	National Institute of Disaster Management (2023)
Particulate matter (PM): SPM, UFP, PM_1, $PM_{2.5}$, PM_{10}	Bronchitis. Carcinogen effects. Lung damage. Nose and throat irritation. Risk of cardiac arrest. Early death.	Department of Environment and Natural Resources (2008), Gurmeet (2020)
Volatile Organic Compounds(VOC)	Adverse neurological, reproductive and developmental effects.Cancer.	Demoury *et al*. (2024)
Heavy metals		
Arsenic	Dermatomes, genetic toxicity, respiratory cancer.	WHO (2019)
Cadmium	Aminoaciduria, emphysemia, glucosuria, osteomalacia, proteinuria.	Walton and Yan (2020)
Lead	Abnormalities in fertility and pregnancy. Affects intellectual development in young children. Anaemia.Damage to the gastrointestinal tract, joints, kidney, liver, nervous system, and reproductive systems. Encephalopathy, neurobehavioral changes, and peripheral neuropathy.	Marchwinska-Wyrwal *et al*. (2011), Rajak and Chattopadhyay (2019)
Mercury	Cardiovascular diseases, hypertension, myocardial infarction, proteinuria.	Zhou *et al*. (2023)
Nickel	Cancer, dramatis.	Sharma (2020)

- Oxides of Nitrogen (NOx): Road transport, electricity supply industry and other industrial and commercial sectors.
- Sulphur dioxide (SO_2): Oil refineries and ore smelters using sulphur containing fuels.
- Ozone (O_3): Vehicular emission, industries and power generation. Automobile exhaust emission consists of toluene, xylene and ethyl-benzene isomer.
- Particulate matter (PM2.5 and PM10): Power sector, industries, transport, and residential sector.

Impacts of Air Pollutants on Human Health

Overall Effects of Air Pollution on Human Health:

According to Marcoa *et al*. (2019), air pollution is the largest environmental risk for human health and cause premature deaths due to cardiovascular and cerebrovascular diseases, lung diseases, and lung cancer. Gurmeet (2020) and National Institute of Disaster Management (2023) stated that prolonged exposure to certain air pollutants is associated with an increased risk of ailments such as:

- Cardiovascular diseases: Impair blood vessel function; speed up calcification in arteries, heart attacks and strokes.
- Effects on eyes: Retinopathy and ocular outcomes. Irritation of the eyes, dry eye syndrome, and some of the major blinding.
- Neuropsychiatry manifestations: Neuro-behavioral hyperactivity, crime, age-unseemly behaviours, neuroinflammation, and Alzheimer's and Parkinson's disease.
- Pregnancy: Pre-term birth, low birth weight, still birth, growth restriction, and adverse cardiovascular and respiratory outcomes.
- Reduced lung function: Infants, children, pregnant women and the elder people are vulnerable and suffer from reduced lung function.
- Respiratory problems: Asthma, bronchitis, and other respiratory infections.
- Risk of cancer risk: Exposure to benzene and formaldehyde increases the risk of cancer.
- Visibility issues: High levels of particulate matter can reduce visibility.

Impacts of Specific Air Pollutants on Human Health:

Penard and Maesano (2004) reported that the health effects caused by air pollutants depend on the type of pollutant, the absorbed dose, and the individual susceptibility. According to Rajak and Chattopadhyay (2019), short- and long-term exposure to air polluted with NOx, SO_2, PM, O_3 and CO is associated with adverse health effects (Mackenzie and Turrentine, 2023; UCAR, 2024) (Table 1).

Control Measures of Air Pollution

According to National Institute of Disaster Management (2023), air pollution can be controlled by minimizing release of pollutants in the air to avoid further consequences. Air pollution can be effectively controlled by following recent and innovative measures such as: control of particulate matter, education and public awareness, improvement of fuel quality, proper urban planning with green spaces, source control, and implementation of recent technology.

Conclusion

This review revealed that acute or chronic exposure to the hazardous air pollutants affects the human health with the manifestation of severe symptoms of diseases and in extreme cases, becomes fatal also. Effects of air pollution results in the development of respiratory problems, cardiovascular diseases, reduced lung function, risk of cancer, visibility issues, and even death in extreme cases. For betterment of human health and to avoid health consequences by air pollution, use of green technologies, priority to natural gas as a fuel, and awareness among general public regarding hazardous effects of air pollution is recommended.

References

Demoury C, Raf Aerts, Finaba B, Wouter L, Arno P, Charlotte V, Johan VH and Eva MDC. (2024) Impact of short-term exposure to air pollution on natural mortality and vulnerable populations: a multi-city case-crossover analysis in Belgium. Environ Health 23:11.

Department of Environment Natural Resources (2008) Guidelines on Air Pollution Control Techniques and Devices. Air Quality Management, pp. 76.

Doreswamy HS and Sudheendra SR. (2010) Major air pollutants and their effects. Mapana J Sci. 9(2): 21-27.

EPA (Environment Protection Agency) (2023) How air pollution affects our health? https://www.eea.europa.eu/en/topics/in-depth/air-pollution/eow-it-affects-our-health.

Gul H and Das BK. (2023) The impacts of air pollution on human health and well-being: A comprehensive review. J Environ Impact Managem Policy. doi: 10.55529/jeimp.36.1.11.

Gurmeet SS. (2020) Air pollution: Health effects. Revista Medicina Legal De Costa Rica 37(1): 33-38.

Kampa M and Castanas E. (2008) Human health effects of air pollution. Environ Pollut. 151: 362-367.

Kelly FJ and Fussell JC. (2015) Air pollution and public health: emerging hazards and improved understanding of risk. Environ Geochem Hlth. 37(4): 631-649.

Kuylenstierna J, Chris M, Patrick B and Tangmar Marmon. (2020) Air pollution and its impact on human health An important driver for achieving the 1.5°C goal of the Intergovernmental Panel on Climate Change. Stockholm Environment Institute, pp. 1-9.

LRTAP (Convention on Long-range Transboundary Air Pollution) (2012) Impacts of air pollution on ecosystems, human health and materials under different Gothenburg Protocol scenarios. Report by The Working Group on Effects, pp. 57.

Mabahwi NAB, Oliver LHL and Dasimah O. (2014) Human health and wellbeing: Human health effect of air pollution. Procedia - Social Behavioral Sci. 153: 221–229.

Mackenzie J and Turrentine J. (2023) Air pollution: everything you need to know. NRDC; https://www.nrdc.org/stories/air-pollution-everything-you-need-know#whatis.

Marchwinska-Wyrwal E, Dziubanek G, Hajok I, Rusin M, Oleksiuk K and Kubasiak M. (2011) Impact of Air Pollution on Public Health. In: The Impact of Air Pollution on Health, Economy, Environment and Agricultural Sources, (ed.) Mohamed K. K., InTech Janeza Trdine 9, 51000 Rijeka, Croatia, pp. 3-16. doi: 10.5772/17906.

Marco AD, Proietti C, Anav A, Ciancarella L, D'Elia I, Fares S, Fornasier MF, Fusaro L, Gualtieri M, Manes F, Marchetto A, Mircea M, Paoletti E, Piersanti A, Rogora M, Salvati L, Salvatori E, Screpanti A, Vialetto G, Vitale M and Leonardi C. (2019) Impacts of air pollution on human and ecosystem health, and implications for the National Emission Ceilings Directive: Insights from Italy. Environ Int. 125: 320-333.

National Institute of Disaster Management (2023) How air pollution control measures works? Ministry of Home Affairs, Govt. of India, pp. 13.

NIH (National Institutes of Health) (2020) Air pollution and your health. U. S. Department of Health and Human Services, pp. 1-4.

Penard Morand C and Maesano IA. (2004) Air pollution: from sources of emissions to health effects. Breathe 1(2): 109-119.

Rajak R and Chattopadhyay A. (2019) Short and long-term exposure to ambient air pollution and impact on health in India: a systematic review. Int J Environ Health Res. 30(6): 593-617.

RCRCC (Red Cross Red Crescent Climate Centre), IFRC (International Federation of Red Cross and Red Crescent Societies) and ICRC (International Committees of the Red Cross) (2023) Understanding the compound risk of heat, humidity and air pollution on human health: A scoping review. https://climate-adapt.eea.europa.eu/en/metadata/publications/understanding-the-compound-risk-of-heat-humidity-and-air-pollution-on-human-health-a-scoping-review

Shaharukh M, Prerana P, Ahmed AY, Prasadkumar T, Ahmad A, Mohd. Razi A, Hifjurrahman S and Asif S. (2020) Impact of air pollution on human health. Bull Environ Pharmacol Life Sci. 9(7): 91-97.

Sharma A. (2020) Types of air pollutants. Department of Environmental Studies, Shivaji College (University of Delhi), pp. 1-12.

Shetty SS, Deepthi D, Harshita S, Sonkusare S, Naik PB, Kumari NS and Madhyastha H. (2023) Environmental pollutants and their effects on human health. Heliyon 9(9): e19496.

UCAR (University Corporation for Atmospheric Research) (2024) Effects of Air Pollution. https://scied.ucar.edu/learning-zone/air-quality/effects-air-pollution

UNICEF (The United Nations International Children's Emergency Fund)., 2019. Impact of Air Pollution on health and measures to reduce exposures in Kosovo. https://www.unicef.org/kosovoprogramme/media/1091/file/UNICEF%20Report_Air%20Pollution.pdf%20.pdf

Walton H and Li Y. (2020) Health effects of short-term exposures to air pollution with particular reference to the concentration range on high and very high days. Environmental Research Group, School of Public Health, Imperial College, Michael Uren Biomedical Engineering Hub, White City Campus, Wood Lane, London W12 0BZ, pp. 68.

WHO (World Health Organization) (2019) What is Air Pollution? Fact Sheet 1, pp. 1-2.

Zhou P, Jing M, Xueying L, Yixue Z, Kunyao Y, Rui S, Rui Z, Hui Wang and Guangfa W. (2023) The long-term and short-term effects of ambient air pollutants on sleep characteristics in the Chinese population: big data analysis from real world by sleep records of consumer wearable devices. BMC Medicine 21: 83.