



JOURNAL OF SCIENTIFIC LETTERS
www.jslsci.com

URBAN AIR POLLUTION: ENVIRONMENTAL BURDEN OF DISEASE

Pabitra Goswami

State Aided College Teacher, Department of Zoology, Siddhinath Mahavidyalaya
West Bengal

ABSTRACT

Air pollution is detected from vehicular emissions, and exposures from industries and factories. These exposures along with particulate matters make the environment polluted, making it difficult for the people to breathe. Especially the people who have respiratory diseases, lung cancer are the most affected along with children, elderly persons, pregnant women are affected. Government proposed some policies, strategy and technological advancement to combat air pollution. However, lack of proactiveness among the people has put the life of community people at stake, as they are in direct exposure to the smoke of vehicles and factories. Collaborative approach is needed for measuring the air quality and increasing awareness about reducing smoke.

Keywords: Urban, air, pollution, environment, diseases, burden

1. INTRODUCTION

In urban areas, population, cars, resources, houses, are densely spread. More cars on the road increases smoke, which pollutes the environment. This pollution, in turn, causes bronchial diseases among the people. Improper strategic approach by the government increases the chances of risks of these diseases. This makes air pollution a burden on the planet increasing health risks among the people. As per the arguments of Clark, Anenberg & Brauer, (2025), air pollution is one of the most important environmental health problems, emerging as a risk worldwide. Major causes behind this pollution are rapid urbanization, industrial smoke emission, emissions from vehicles, and energy production contributing to decline in air quality as found in cities. Exposure to polluted air aggravates the incidence of respiratory, cardiovascular, neurological, and developmental disorders. When these disorders expand in its intensity, it contributes heavily to the global environmental burden of disease (EBD).

Air pollution, in the arguments of Piracha and Chaudhary, (2022), refers to the presence of harmful substances found in the atmosphere at levels. These levels threaten human health, ecosystems, and the environment as a whole. Earth's atmosphere has always been contaminated from natural pollutants, such as volcanic ash, dust, pollen, and wildfire smoke among others. Human activities have increased since the Industrial Revolution, simultaneously increasing concentration and variety of pollutants. These pollutants make air polluted, which is a major global issue.

1.1 Background

In Pre-industrial Era, air pollution was associated with wildfires, volcanic eruptions, and dust storms. Records reveal that urban centers with high population densities experienced pollution from burning wood, coal, and animal waste. Advent of industrial revolution (18th–19th century) reflected beginning of large-scale fossil fuel combustion (coal, later oil). In factories, power plants, and steam engines releases massive amounts of smoke and particulate matter. Notable cities of this situation are London, Manchester, and Pittsburgh which emits heavy smog (“pea-soup fogs”) (Sicard et al., 2023). During 20th Century, there was rapid urbanization and motorization, which increased emissions from nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO₂), and particulate matter (PM). Reference can be cited of major pollution disasters, such as the Great

Smog of London in 1952. Due to this smog, there were thousands of deaths, compelling state government to pass modern air quality legislation.

In 21st Century, air pollution attained the status of global challenge. Major drivers in this context were increase in urban growth, industrial expansion, vehicular emissions, biomass burning, and energy production. Developing countries, in particular, were the major victims, as they experienced severe pollution (Dhimal et al., 2021). This was due to rapid economic growth and limited regulations.

1.2. Sources of Air Pollution

Natural sources from which air pollution is detected are wildfires, dust storms, volcanoes along with biological decay and pollen. Human (Anthropogenic) Sources are mainly transport, industrial exposure, households, and agriculture. In transport, vehicle exhausts from diesel and engines, lead to air pollution. Industrial factories, power plants, and chemical processing make the air polluted. In households, cooking with biomass, and burning waste is the source contributing to air pollution. In case of agriculture, ammonia from fertilizers, and methane from livestock, are the major causes of air pollution (Thanvisitthpon, Kallawicha & Chao, 2024).

1.3. Types of Air Pollutants

Experts investigate the pollutants to test the air quality. In this investigation, it has been found that there are two types of pollutants primary and secondary. Primary pollutants are the ones which emit directly. Examples are CO, SO₂, PM, NO₂. secondary pollutants are the ones which are formed in the atmosphere, for example ozone, and secondary Particular Matter (Bakirci, 2024).

1.4. Air Pollution: A Major Issue

Air pollution is considered as a major issue, by the environmentalists. Reasons behind this are increased industrialization and urbanization, mainly. Along with this, heavy dependence on fossil fuels also raises the concerns on environmental quality. Rapid population growth is also a concern as more people means more vehicle, and more vehicle indicates more smoke emissions. Here, mention can also be made of poor urban planning and weak environmental regulations, which degrade air quality (Zolli, 2025). Questions are raised on the initiatives to maintain air quality.

Climate change interactions (e.g., heat increases ozone formation) is also a cause for increasing air pollution in the urban areas.

1.5 Global Recognition of the Problem

WHO identifies air pollution as one of the environmental health risks, which has received highest concerns (Who.int, 2025). Reference can be cited of international agreements (e.g., Clean Air Acts, Paris Agreement) which emphasizes air quality management. These agreements reflect growing awareness on advances to be made in monitoring clean energy, and pollution-control technologies (Alyami et al., 2025).

2. LITERATURE REVIEW

2.1 Key air pollutants found in urban areas

One of the particulate matters found as a pollutant of air, are $PM_{2.5}$ and PM_{10} . These are tiny particles, which penetrate deep into the lungs of the people nearby the factories and vehicles emitting smokes. Upon investigation it has been found that $PM_{2.5}$ enters into the bloodstreams of the people. Major sources from which these pollutants are seen are vehicle exhausts, industrial emissions, construction dust, biomass burning among others. Another pollutant is Nitrogen Dioxide (NO_2), which is emitted primarily through motor vehicles and power plants. These pollutants aggravate asthma, contributing to the formation of secondary PM. Huang et al., (2024) argued that Sulfur Dioxide (SO_2) is the other pollutant which is produced by burning fossil fuels and industrial processes. One of the major risks is that it causes respiratory symptoms, contributing to acid rain.

Ozone (O_3) is considered to be a secondary pollutant, which is formed by chemical reactions between NO_x and volatile organic compounds (VOCs). These compounds form in sunlight, causing airway inflammation. A benefit of these compound is that it reduces lung function. Mention can also be made of carbon Monoxide (CO), which is produced by incomplete combustion of fuels. A concern here is the reduction of oxygen transport in the bloodstream. Reference can also be cited of Volatile Organic Compounds (VOCs). According to Kaur and Pandey, (2021), these compounds are emitted from vehicles, solvents, fuels, and industrial

processes. Among these compounds, benzene can be referred, which is considered to be a precursor to ozone. However, benzene is carcinogenic.

2.2 Health Impacts emerging as a burden on environment through disease

Health impacts from the diseases due to air pollution are both short and long term. Short-term or acute health effects are severe, which is reflected through irritation felt in eyes, nose, and throat. Some people also feel asthma attacks, exacerbation of COPD, acute respiratory infections among others. Reports have been seen for hospital admissions due to cardiovascular events. On the other hand, long-term or chronic health effects are chronic bronchitis, reduced lung function, cardiovascular disease, including stroke and heart attacks. Clark, Anenberg & Brauer, (2025) proposed that more severe impacts are lung cancer, developmental issues in children, which is a major cause of concern as it reduces cognitive function, and yields low birth weight. It also causes premature mortality.

2.3 Environmental burden created from the disease metrics

Urban air pollution mainly occurs from DALYs (Disability-Adjusted Life Years). These reflect loss of life detected due to premature death and ill-health. Years of Life Lost (YLL) is also a major concern, demarcated from early mortality. Reference can also be cited of Years Lived with Disability (YLD), which is seen among the people with chronic diseases. As per the statements of WHO, estimates are clear for millions of premature deaths, which takes place annually from urban areas due to air pollution. Piracha and Chaudhary, (2022) argued that this is combined with PM_{2.5}, which is considered as the largest contributor.

2.4. Vulnerable Populations

Risks like air pollution makes every resident a victim. However, certain groups are disproportionately higher in terms of risks. These groups consist of children, elderly people, people who have history of respiratory or cardiovascular disease, pregnant woman, and the ones from low-income groups. Children are at risk, as they can develop lung cancers, increasing breathing rates). Elderly individuals and people with pre-existing respiratory or cardiovascular disease are also at risk, along with pregnant women who have risk of adverse birth outcomes, which are not at all needed. Sicard et al., (2023) was of the view that low-income communities, which are often

located near busy roads or industrial zones, are the most vulnerable as they are in close vicinity to the factories and the vehicles emitting smokes.

2.5. Socio-environment and economic impacts

Urban area air pollution has also been found to affect ecosystems. Evidence of this lies in the instances of acidification, and reduced crop yields. Another instance is urban visibility, which is reduced due to smog. Along with this, economic productivity is also at stake, as healthcare costs increase, making the workers and individuals experience lost working days. Reference can also be cited of climate change, which induces black carbon and ozone into the climate. Dhimal et al., (2021) stated that these are forcers, increasing the number of pollutants in the environment.

2.6. Reduction in Urban Air Pollution

Air pollution is such a concern, which no one desires. For combating this, government sketched several policies and regulations. These policies and regulations are directed towards strengthening ambience of air quality standards. The policies and regulations also extend towards controlling emissions from vehicles and industries. Congestions are created from the low emission zones, which needs to be dealt sensitively for caring for the people living nearby these factories and vehicles. Pricing is one of the aspects, which is dealt with, in case of congestions created from pollutions in the urban areas. But Thanvisitthpon, Kallawicha, and Chao, (2024) argued that in the low emission zones also emissions occur, which is striking and puts living standards of the people at stake.

2.7 Technological Interventions

Government has attempted to introduce clean energy transitions in the form of renewables, and electrification, for dealing with air pollution. Achievability of this lies in improvements, which has been noted in the ways in which public transportations ply in the roads. Plans in the future are directed towards upgrading industrial emission controls. The interventions also indicate proper planning of urban areas, which have enough green spaces and trees. As a matter of specification, as argued by Bakirci, (2024), the plan is to redesign cities in a way, which reduces car dependency. As a result of this, emissions will reduce, enhancing waste management, avoiding open burning.

2.8 Public Health Measures

For alerting public, government has undertaken measures to reduce air pollution. As a collaborative appeal, air quality monitoring has been introduced, by alerting publics. Now, when air quality is low or poor, people get messages or notifications in their phones, so that they are prepared from beforehand. Along with this, mask usage has been promoted during high-pollution events. Another effort, as Zolli, (2025) states, is enhancing healthcare systems, so that they have the capability to manage pollution-related diseases.

3. METHODOLOGY

Mixed research is fruitful for expanding the scope and arena of research and studies on air pollution in urban areas. Surveys provide practical insights into the effects of air pollution on the people living nearby factories, industries, and areas where vehicles are more. Along with this, collection of sources from secondary sources like books, journal articles, newspapers, reports help in enriching understanding on the relevant themes, cases, experiments, observations, and narratives. Samples for the survey are the ones who reside in agglomerate zones, experiencing high air pollution. The sample size is 600, which is acceptable. The samples are assured that ethical considerations are duly followed for averting illegal instances.

4. CONCLUSION

Urban air pollution is a major concern for global environment, increasing burden from bronchial diseases like lung cancer. This disease is responsible for millions of illnesses, resulting in annual premature deaths. Mitigation of pollution has been initiated, evidence of which lies in coordinated efforts to formulate policies, technological advancements, urban planning, and community engagement. However, these efforts lack effectiveness, which is reflected from cases of hospital admissions and vehicle sale increase. More vehicle sale indicates more smoke, and this smoke, in turn, increases the risks of air pollution. General public is at a risk, in addition to this, children, elderly persons, persons with prior respiratory problems, pregnant women, are also at equal risks from the exposure to polluted air. Reducing air pollution is the need of the hour. Success is hoped on the basis of collaborative approaches and not only planning improvements of health. Plans also need to support sustainable urban development and environmental protection. Technological advancements will bear success if regularity is maintained in measuring quality of air.

Achievability of this lies in mobile networking for poor air quality as a means to alert the people. Consistency is needed in such measures, so that risks of air pollution is reduced.

REFERENCES

Alyami, M. M., Balharith, F. H., Ravi, S. K., & Reddy, R. S. (2025). Urban air pollution and chronic respiratory diseases in adults: insights from a cross-sectional study. *Frontiers in Public Health*, 13, 1507882. [10.3389/fpubh.2025.1507882]

Bakirci, M. (2024). Smart city air quality management through leveraging drones for precision monitoring. *Sustainable Cities and Society*, 106, 105390. [10.1016/j.scs.2024.105390]

Clark, S. N., Anenberg, S. C., & Brauer, M. (2025). Global burden of disease from environmental factors. *Annual review of public health*, 46(1), 233-251. [https://www.annualreviews.org/content/journals/10.1146/annurev-publhealth-071823-105338]

Dhimal, M., Chirico, F., Bista, B., Sharma, S., Chalise, B., Dhimal, M. L., ... & Sofia, D. (2021). Impact of air pollution on global burden of disease in 2019. *Processes*, 9(10), 1719. [10.3390/pr9101719]

Huang, W., Xu, H., Wu, J., Ren, M., Ke, Y., & Qiao, J. (2024). Toward cleaner air and better health: current state, challenges, and priorities. *Science*, 385(6707), 386-390. [10.1126/science.adp7832]

Kaur, R & Pandey, P. (2021). Air Pollution, Climate Change, and Human Health in Indian Cities: A Brief Review. Vol 3 [https://www.frontiersin.org/journals/sustainable-cities/articles/10.3389/frsc.2021.705131/full]

Piracha, A., & Chaudhary, M. T. (2022). Urban air pollution, urban heat island and human health: a review of the literature. *Sustainability*, 14(15), 9234. [10.3390/su14159234]

Sicard, P., Agathokleous, E., Anenberg, S. C., De Marco, A., Paoletti, E., & Calatayud, V. (2023). Trends in urban air pollution over the last two decades: A global perspective. *Science of The Total Environment*, 858, 160064. [10.1016/j.scitotenv.2022.160064]

Thanvisitthpon, N., Kallawicha, K., & Chao, H. J. (2024). Effects of urbanization and industrialization on air quality. In *Health and Environmental Effects of Ambient Air Pollution* (pp. 231-255). Academic Press. [10.1016/B978-0-443-16088-2.00003-X]

Who.int (2025). Air pollution. Retrieved 6th Dec 2025 from <https://www.who.int/health-topics/air-pollution>

Zolli, E. (2025). Air pollution. Retrieved 6th Dec 2025 from <https://www.eea.europa.eu/en/topics/in-depth/air-pollution>

AUTHOR'S DECLARATION

I/We, as an author/authors of the above paper/article, hereby declare that the content of this paper is prepared by me/us for publication in this journal is completely my/our own genuine paper and if any person having copyright issue or patent or anything related to the content, I/we shall always be legally responsible for any issue. If any data or information given by me/us is not correct, I/we shall always be legally responsible. With my/our whole responsibility legally and formally have intimated the publisher that the paper has been checked by guide or expert or supervisor to make it sure that paper is technically right and there is no unaccepted plagiarism. If any issue arises related to plagiarism or any issues, I/we will be solely/entirely responsible for any legal disputes or legal issues. I/we declared that if publisher finds any complication or error or anything hidden or implemented otherwise, my/our paper may be removed from the website. I/we also aware that the publication fees is not refunded further in any circumstances. Even if anything is found illegal publisher may also take legal action against me/us. I/we also declared that this journal/publisher will not be held responsible any legal issues in future regarding this paper publication in this journal.

Pabitra Goswami