

Air Pollution and Its Effects: Need to Take An Immediate Stand Against Air Pollution in India

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ABSTRACT: A smokey brown haze blankets India's northern plains and the national capital, New Delhi, every year as winter sets in, affecting the health of millions of people, but the authorities have found few solutions to the pollution crisis and are literally unable to clear the air. In recent days, the Air Quality Index (AQI) in the capital of 20 million people, where few use air purifiers or wear masks to protect themselves, has risen above 350 on a scale of 500, near "very poor" levels, according to SAFAR, the federal environment monitoring agency. The AQI measures the concentration of poisonous particulate matter PM_{2.5} in a cubic metre of air. Anything above 60 is considered unhealthy. PM_{2.5} particles can go deep into the lungs, causing deadly diseases including cancer and cardiac problems. The rainy season usually ends in September and come October, the air quality starts deteriorating as cooler temperatures and a drop in the wind trap pollutants in the atmosphere for longer. The pollution gets worse in November, exacerbated by the burning of crop stubble in the states of Punjab and Haryana, part of the farm belt that borders New Delhi.

KEYWORDS: air pollution, India, AQI, effects, immediate, stand, need, health, diseases

I. INTRODUCTION

Farmers in the bread-basket states have adopted mechanised farming and are increasingly using harvesters for their rice crops. But unlike with manual harvesting, the machines leave stubble and paddy straw in the fields, which are removed by burning to clear space for them to sow wheat. New Delhi generates much of its own pollution and the situation deteriorates in December, [1,2] even when the stubble burning is largely over. The capital's nearly 10 million vehicles, more than that of the other three major cities of Mumbai, Chennai and Kolkata combined, churn out exhaust fumes, while industrial emissions, dust from construction sites and smoke from household fires add to the murky mix. The rapidly expanding city is losing the few patches of oxygen-producing forest it had around it and illegal miners are grinding down a range of nearby hills to feed the construction industry with gravel, and removing a natural barrier to dust from the Thar Desert in the northwestern part of the subcontinent. When the smog becomes unbearable, the authorities ban construction work and close schools to protect children, but they acknowledge they just don't have the resources to clamp down effectively on illegal industries and to enforce emission rules. [3,4] The Supreme Court has rebuked officials for their failure to effectively tackle the pollution crisis and has asked the government of Delhi, its neighbouring states and federal authorities to work together to improve it. Prime Minister Narendra Modi's Bharatiya Janata Party does not govern Delhi – it is run by the opposition Aam Aadmi Party – and there's little cooperation between them. It is nature that brings some improvement with warmer weather ending the atmospheric conditions that trap the smog before the return of the rains in around June. India has one of the fastest growing economies in the world and air pollution is one of the challenges associated with this growth and development. Of the world's 30 cities with the worst air pollution, 21 are in India. The capital, New Delhi, has the poorest air quality among capital cities globally. Concentrations of particulate matter (PM_{2.5}) in New Delhi are nearly 10 times higher than the World Health Organization guidelines. Thermal power plants, pollution from vehicles, industrial emissions, [5,6] and the burning of wood and dirty fuels for cooking and heating are some of the main causes of air pollution in India. The effects are devastating. Air pollution is a silent killer, causing more than 2 million deaths a year in India. It also leads to health problems like respiratory and cardiovascular diseases.

If India had achieved safe air quality levels in 2016, its GDP would have increased by \$95 billion. Read the full economic analysis from Dalberg. This is because cleaner air would result in lower rates of absenteeism from work,

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higher productivity at work, higher consumer footfall and fewer premature deaths. Public awareness of air pollution as a problem is on the rise, especially in Delhi where 85% support stricter air quality laws and enforcement of policies. India has launched an ambitious National Clean Air Program to reduce particulate matter pollution by 30% by future. Indian Institute of Technology Kanpur has collaborated with the Department of Environment, Forest & Climate Change [and others], supported by Clean Air Fund, to enable real time measures to mitigate and plug pollution sources. Clean Air Fund's work in India is relatively new and we will continue to build our partnerships as our grant portfolio grows. We work with government and business, and at every level of society, to help reach India's clean air goals. [7,8] Our work includes:

Supporting air quality monitoring and management initiatives, Building capacity on air quality data collection (including concentrations and impact), Facilitating dialogue and information sharing among the air quality movement. Engaging the community is also crucial to bringing about cleaner air. Our grant to Health Care Without Harm is building a network of health workers who can act as clean air champions for patients, policy makers and the wider public. In 2016 we supported the Sesame Workshop India Trust to survey 10,000 children from low resource communities in Delhi about their environmental concerns. The children had the opportunity to bring their concerns to their local leaders. Businesses have a significant role to play in tackling the problem too. The India CEO Forum for Clean Air is growing, with 70 members signed up in the first year. Two major Indian businesses, Wipro and Mahindra Group, are both in the Clean Air Alliance, launched in partnership with the World Economic Forum in 2016. Clean Air Fund has been instrumental in empowering healthcare professionals and amplifying the health voices in the clean air movement. It is a privilege to be a partner and work together towards ensuring clean and healthy air for humankind. [9,10]

II. DISCUSSION

Air pollution in India is a serious environmental issue. [1] Of the 30 most polluted cities in the world, 21 were in India in 2016. [2][3] 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 [4] and 13 of the world's 20 cities with the highest annual levels of air pollution are in India. [5] 51% of the pollution is caused by industrial pollution, 27 % by vehicles, 17% by crop burning and 5% by other sources. [6] Air pollution contributes to the premature deaths of 2 million Indians every year. Emissions come from vehicles and industry, whereas in rural areas, much of the pollution stems from biomass burning for cooking and keeping warm. In autumn and spring months, large scale crop residue burning in agriculture fields – a cheaper alternative to mechanical tilling – is a major source of smoke, smog and particulate pollution. [7][8][9] India has a low per capita emissions of greenhouse gases but the country as a whole is the third largest greenhouse gas producer after China and the United States. [10] A 2013 study on non-smokers has found that Indians have 30% weaker lung function than Europeans. [11] The Air (Prevention and Control of Pollution) Act was passed in 1981 to regulate air pollution but has failed to reduce pollution because of poor enforcement of the rules. [12] In 2015, Government of India, together with IIT Kanpur launched the National Air Quality Index. [13] In 2016, India launched 'The National Clean Air Programme' with tentative national target of 20%-30% reduction in PM2.5 and PM10 concentrations by 2024, considering 2016 as the base year for comparison. It will be rolled out in 102 cities that are considered to have air quality worse than the National Ambient Air Quality Standards. [14] There are other initiatives such as a 1,600-kilometre-long and 5-kilometre-wide The Great Green Wall of Aravalli green ecological corridor along Aravalli range from Gujarat to Delhi which will also connect to Shivalik hill range with planting of 1.35 billion (135 crore) new native trees over 10 years to combat the pollution. [6] In December 2016, IIT Bombay, in partnership with the McKelvey School of Engineering of Washington University in St. Louis, launched the Aerosol and Air Quality Research Facility to study air pollution in India. [15] According to a Lancet study, nearly 1.67 million deaths and an estimated loss of USD 28.8 billion worth of output were India's prices for worsening air pollution in 2016. [16]

Fuel wood and biomass burning is the primary reason for [near-permanent haze and smoke](#) observed above rural and urban India, and in satellite pictures of the country. Fuelwood and biomass cakes are used for cooking and general heating needs. These are burnt in [cook stoves](#) known as [chulha](#) (also chullha or chullah) in some parts of India. These cook stoves are present in over 100 million Indian households, and are used two to three times a day, daily. Some reports, including one by the World Health Organization, claim 300,000 to 400,000 people die of [indoor air pollution](#) and carbon monoxide poisoning in India because of biomass burning and use of chullhas. [11,12] Some Indian taxis and [auto-rickshaws](#) run on adulterated fuel blends. Adulteration of gasoline and diesel with lower-priced fuels is common in South Asia, including India. Some [adulterants](#) increase emissions of harmful pollutants from vehicles,

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worsening urban air pollution. Financial incentives arising from differential taxes are generally the primary cause of fuel adulteration. In India and other developing countries, gasoline carries a much higher tax than diesel, which in turn is taxed more than kerosene meant as a cooking fuel, while some solvents and lubricants carry little or no tax. [Traffic congestion](#) is severe in India's cities and towns. Traffic congestion is caused by several reasons, some of which are: increase in number of vehicles per kilometre of available roads, a lack of intra-city divided-lane highways and intra-city expressways networks, lack of inter-city expressways, traffic accidents and chaos due to poor enforcement of traffic laws. [Climate change in India](#) is having profound effects on [India](#), which is ranked fourth among the list of countries most affected by [climate change](#) in 2015. [India](#) emits about 3 gigatonnes (Gt) $\text{CO}_{2\text{eq}}$ of [greenhouse gases](#) each year; about two and a half tons per person, which is less than the world average[13,14]

The most important reason for concern over the worsening air pollution in the country is its effect on the health of individuals. Exposure to [particulate matter](#) for a long time can lead to respiratory and cardiovascular diseases such as asthma, bronchitis, [COPD](#), lung cancer and heart attack. The [Global Burden of Disease Study](#) for 2010, published in 2013, had found that outdoor air pollution was the fifth-largest killer in India and around 620,000 early deaths occurred from air pollution-related diseases in 2010. According to a WHO study, 13 of the 20 most-polluted cities in the world are in India; however, the accuracy and methodology of the WHO study was questioned by the Government of India. India also has one of the highest number of [COPD](#) patients and the highest number of deaths due to COPD.[15,16]

III.RESULTS

Over a million Indians die prematurely every year due to air pollution, according to the non-profit Health Effects Institute. Over two million children—half the children in Delhi—have abnormalities in their lung function, according to the Delhi Heart and Lung Institute. Over the past decade air pollution has increased in India significantly. Asthma is the most common health problem faced by Indians and it accounts for more than half of the health issues caused by air pollution. The Global Burden of Disease Study of 2016 analysed in a report by The Lancet indicated that 76.8% of Indians are exposed to higher ambient particulate matter over $40 \mu\text{g}/\text{m}^3$, which is significantly above the national limit recommended by national guidelines on ambient air pollution. The study estimated that of 480.7 million Disability-Adjusted Life Years in India 4.4% of could be ascribed to ambient particulate matter pollution and 15.8 million of them were the result of polluted air in households. In terms of average life expectancy it is suggested that average life expectancy in India would increase by 1.7 years if exposure was limited to national minimum recommendations.[17,18] Ambient air pollution in India is estimated to cause 670,000 deaths annually and particularly aggravates respiratory and cardiovascular conditions including chronic bronchitis, lung cancer and asthma. Ambient air pollution is linked to an increase in hospital visits, with a higher concentration of outdoor pollution particulates resulting in emergency room visit increases of between 20 and 25% for a range of conditions associated with higher exposure to air pollution. Approximately 76% of households in rural India are reliant on solid biomass for cooking purposes which contributes further to the disease burden of ambient air pollution experienced by the population of India.[19,20]

India's [Central Pollution Control Board](#) now routinely monitors four air pollutants namely sulphur dioxide (SO_2), oxides of nitrogen (NO_x), suspended particulate matter (SPM) and respirable particulate matter (PM_{10}). These are target air pollutants for regular monitoring at 308 operating stations in 115 cities/towns in 25 states and 4 Union Territories of India. The monitoring of meteorological parameters such as wind speed and direction, relative humidity and temperature has also been integrated with the monitoring of air quality. The monitoring of these pollutants is carried out for 24 hours (4-hourly sampling for gaseous pollutants and 8-hourly sampling for particulate matter) with a frequency of twice a week, to yield 104 observations in a year.[21,22] The key findings of India's central pollution control board are:

- Most Indian cities continue to violate India's and world air quality PM_{10} targets. Respirable particulate matter pollution remains a key challenge for India. Despite the general non-attainment, some cities showed far more improvement than others. A decreasing trend has been observed in PM_{10} levels in cities like Solapur and Ahmedabad over the last few years. This improvement may be due to local measures taken to reduce Sulphur in diesel and stringent enforcement by the government.
- A decreasing trend has been observed in Sulphur dioxide levels in residential areas of many cities such as [Delhi](#), [Mumbai](#), [Lucknow](#), [Bhopal](#) during last few years. The decreasing trend in Sulphur dioxide levels may be

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due to recently introduced clean fuel standards, and the increasing use of LPG as domestic fuel instead of coal or fuelwood, and the use of CNG instead of diesel in certain vehicles.

- A decreasing trend has been observed in nitrogen dioxide levels in residential areas of some cities such as Bhopal and Solapur during last few years.
- Most Indian cities greatly exceed acceptable levels of suspended particulate matter. This may be because of refuse and biomass burning, vehicles, power plant emissions, industrial sources.
- The Indian air quality monitoring stations reported lower levels of PM₁₀ and suspended particulate matter during monsoon months possibly due to wet deposition and air scrubbing by rainfall. Higher levels of particulates were observed during winter months possibly due to lower mixing heights and more calm conditions. In other words, India's air quality worsens in winter months, and improves with the onset of monsoon season.
- The average annual [SO_x and NO_x](#) emissions level and periodic violations in industrial areas of India were significantly and surprisingly lower than the emission and violations in residential areas of India
- Of the four major Indian cities, air pollution was consistently worse in [Delhi](#), every year over 5-year period (2004–onwards). [Kolkata](#) was a close second, followed by [Mumbai](#). [Chennai](#) air pollution was least of the four.[23,24]

IV. CONCLUSIONS

- The government in Delhi launched an Odd-Even Rule in November, 2016 which is based on the [Odd-Even rationing](#) method: This meant that cars running with number plates ending in Odd digits could only be driven on certain days of the week, while the Even digit cars could be driven on the remaining days of the week.
- Local governments of various states also implemented measures such as tighter vehicle emissions' norms, higher penalties for burning rubbish and better control of road dust.
- The Indian government has committed to a 50% reduction in households using solid fuel for cooking
- Some goals set for future are:
 - Clean up the transportation sector by introducing 1,000 electric public transport buses to its existing 550 busses.
 - Upgrade all fossil fuel combustion engine vehicles to BS6 emission standards
 - Meet a goal of 25% of private vehicles to be electricity powered by future
 - Renewable energy in all power plants
 - Provide farmers with a machine called a [Happy Seeder](#) which converts agricultural residue to fertilizer
 - Encourage crop diversification to farmers and grow sustainable water-conserving crops such as [coarse grains](#) and [pulses](#).
 - Analyze health data and study the efficiency of different room filtration systems in areas where indoor air pollution is highest.
 - Identify effective ways to inform the public about air pollution data
 - Launch new citizen science programs to better document exposures
 - Reduce Carbon Emissions: "According to Inter-governmental Panel on Climate Change, to limit warming well below 2 degree Celsius, CO₂ emissions should decline by about 20 per cent and reach net zero in further future; to limit warming below 1.5 degree Celsius, CO₂ emissions should decline by 50 per cent and reach net zero in further future. [25].

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