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The Air We Breathe

A SPECIAL HANDBOOK

Designed for Mobile

The Indian EXPRESS

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Every year, with the onset of winter, air quality in major Indian cities worsens significantly. From Delhi to Mumbai, citizens find themselves holding their breath under the same grey sky.

In this month's handbook, we talk about the cost of air pollution — children falling ill within weeks of birth, a surge in respiratory illnesses, and families being forced to leave their homes in search of cleaner skies. We've also gone back to our archives, revisiting stories that show how long this battle has been fought — and lost — year after year. They remind us that this isn't a seasonal emergency but a systemic failure demanding permanent solutions.

Clean air isn't a luxury; it is everyone's right. It's the first vaccine every child deserves.

The Indian EXPRESS

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The cost of air pollution

– Ankita Upadhyay and Anonna Dutt

Every winter, 14-year-old Aahan Bhalla has to give up on his passion — cricket. As the smog descends on Delhi — and the AQI (air quality index) shoots past 300 — he is left wheezing and breathing hard in the middle of the game. He has been living with asthma for several years now. He religiously takes his inhaler and nasal drops, a routine now followed by his eight-year-old sister, an asthmatic who keeps waking up at night if she's not on the inhaler. Visiting doctors' clinics is now part of their winter routine.

They are not alone. Inside the paediatric OPD at AIIMS, Delhi, Dr Kana Ram Jat, professor, Pulmonology, Intensive Care, Tuberculosis and

Infectious Diseases, has his hands full with children, most of them restless and drained after severe coughing bouts. Many of them are regular patients, developing recurrent lung infections and breathing issues every season. “Over the last 10 years, there has been an increasing prevalence of asthma in children. Every November, as pollution spirals, their number increases. Some even report to the emergency with complicated respiratory conditions,” he says.

Although Aahan’s mother, Jaya Shroff, was distraught that both her children had become asthmatic, their doctor, Dr Rahul Sharma, additional director of Pulmonology at Fortis Noida, wasn’t. “Over the last few years, asthma and allergies have become common among children and pre-teens,” he says. Aahan needed injectable steroids. “In fact, it was while attending to our son in hospital that we found our daughter, too, was wheezing slightly. That’s when she was also diagnosed with asthma,” says Shroff.

It all begins in the womb

Dr Kana Ram explains that the problem begins from the time when the child is inside a mother’s womb and has a risk of being born with a compromised respiratory system, a reason why newborns have to be kept longer in the neonatal units these days. “A foetus exposed to pollutants is usually born with a low birth weight. Such babies are prone to allergies and asthma as they grow up,” he says.

The foetus, he explains, is entirely dependent on the mother's blood supply for oxygen and nutrients. "So, when pollutants enter the maternal bloodstream, the foetus is indirectly exposed too. This can cause inflammation, oxidative stress, and reduced oxygen delivery, all of which interfere with healthy growth and organ development even before birth."

Low birth weight and premature delivery can lead to a higher risk of infant mortality, developmental delays and chronic conditions later in life, such as diabetes and heart disease. Studies have shown that pollutants can lead to DNA sequence changes and chromosomal aberrations, which can increase susceptibility to certain diseases. In fact, the cumulative effect of air pollutants can delay developmental milestones.

About 30 km from AIIMS Delhi, Dr Manish Mannan, Head of Paediatrics and Neonatology at Paras Hospital, Gurugram, has been studying his patients for patterns of respiratory behaviour. "Infants with compromised lung capacity need longer stays in the NICU and extended oxygen support. The long-term risk is worrying because it can predispose them to chronic respiratory illnesses in adulthood," he says.

How do air pollutants impact child health?

Toxic particles breathed in by the pregnant woman can cross the placenta, which is a temporary

organ that connects the baby to the mother via an umbilical cord, and interfere with the baby's development process. "First, the placenta gets inflamed, so there is a resistance to blood flow. Then the blood vessels get damaged and there is reduced blood flow and nutrients to the foetus. Fine particulate matter like PM2.5, nitrogen dioxide, carbon monoxide can impair organ development in the foetus. Lung development starts early in pregnancy but continues till the very end. Chronic exposure to pollutants can lead to smaller lung volumes, immature airways and compromised immune function. In essence, these babies may be born with lungs that aren't ready for the outside world, leading to respiratory distress right after birth," says Dr Mannan.

Studies show a link between maternal exposure to air pollution and an increased risk of stillbirth, particularly during the third trimester. Microplastics floating in the air and emanating from sources like synthetic clothing, car tyres and breakdown of plastic waste are endocrine disruptors. They play around with hormones. They have been found in the human placenta, umbilical cord and umbilical cord blood, indicating they can pass from mother to foetus, where they hamper organ development and the central nervous system.

Over the past decade, Dr Mannan says, the change has been unmistakable. "Previously, most neonatal infections were due to delivery complications or hospital-acquired pathogens.

Now we see healthy babies developing respiratory distress and pneumonia within weeks. Pollution weakens both the mother's and the baby's immunity, especially among those in cities and industrial zones. More babies now require respiratory assistance at birth. Low birth weight, preterm delivery and persistent cough in infants were exceptions a decade ago. Now, they're routine," he adds.

What should be the preventive steps then?

Both pregnant women and children need good air quality at home, using air purifiers. Both should limit indoor smoke from incense and mosquito coils as well as outdoor exposure, keep windows shut during peak pollution hours and stay indoors. "Nutrition matters too, including foods rich in antioxidants like vitamins C and E, which help counter oxidative stress. Regular follow-ups help track lung and developmental milestones in infants," says Dr Mannan. Parents like Shroff are adding house plants, buying air purifiers and even crowd-funding for purifiers at school.

But on a larger scale, Dr Mannan emphasises, urban planning and public policy are just as crucial. "Cleaner fuels, stricter emission controls and better air monitoring systems aren't luxuries. Air quality isn't just an environmental issue — it's a neonatal health crisis," he says.

‘I can’t breathe’

– Ankita Upadhyay

Saans nahi aa rahi hai, sir (I am unable to breathe, sir),” says Krishna Koli softly. The doctor nods, places his stethoscope on the 10-year-old’s chest and listens.

He then swivels around in his chair, pulls a fresh sheet off his prescription pad and prescribes an inhaler and a spacer (to get the medication into the lungs more efficiently). “*Pollution ki wajah se hai* (It’s the pollution that’s making him sick). Let him wear a mask at all times and stay indoors,” says Dr Vikram Bhaskar, Associate Professor and head of the asthma clinic at Guru Teg Bahadur (GTB) Hospital, as Krishna’s mother Soni, 28, nods.

As Delhi's pollution levels peaked, the weekly asthma clinic for children at GTB Hospital, one of the biggest tertiary care health facilities run by the Delhi government, saw a steady stream of patients, many of them with chronic asthma.

The clinic sees around 10-15 patients every Tuesday, but it's around this time of the year, when the temperature dips and haze covers the city, that Dr Bhaskar and his team of two, which includes a junior doctor and a technician, have their hands full.

"Asthma is a chronic condition that inflames and narrows the airways in the lungs. There could be several factors — from genetic to environmental. Most of these children are on some sort of controller therapy for asthma and many are on regular inhalers. They also have their vaccine courses, including flu and pneumococcal vaccines. But if they are surrounded by aggravating factors like dust, smoke and pollution, their symptoms worsen," he explains.

The weekly clinic, which saw a monthly average of 40 child patients in July-August this year, has already seen 100 children so far in November — 35 new patients and 65 regular patients with chronic conditions.

"With the rising AQI, there has been a surge of patients in our hospital's emergency department. Of the children who were brought to the hospital, almost 60-70 per cent had respiratory issues.

Some of them were referred to our clinic. On Monday, our hospital's paediatric department saw 350 child patients, of whom 190 had respiratory illness," says Dr Bhaskar.

Krishna Koli undergoes a spirometry test. (Express photo by Abhinav Saha)

He then calls out to a staff member to bring the 'Asthma Register', which he maintains for his regular patients and enters Krishna's details. Dr Bhaskar then directs a staff member to take the child for the spirometry tests.

As Krishna waits in the queue for the test, clutching his mother's hand, his beanie now sliding down to almost cover his eyebrows, he watches the other children blowing into the mouthpiece of the spirometer device.

After a wait of 10 minutes, it's Krishna's turn. The technician instructs him, "You see these balls inside this tube? Inhale and then blow

hard... You'll see them rising." Krishna blows hard, his cheeks hollow from the effort, but the balls in the device barely move.

The technician now holds a piece of paper and asks Krishna to blow on it. He does, but the paper stays still.

Children and pollution

Children are known to be especially vulnerable to air pollution, with experts agreeing that exposure to high levels of pollutants can lead to significant, and worrying, long-term respiratory consequences — from structural changes in airways to altered immune responses and impaired cognitive development, besides worsening of existing respiratory illnesses such as asthma.

According to the Global Asthma Network, around 6 per cent of children in India suffer from the disease, a cohort for whom air pollution is an added cause of concern.

Dr Randeep Guleria, pulmonologist and former director of the All India Institute of Medical Sciences (AIIMS), who in 2011 set up the Department of Pulmonary, Critical Care and Sleep Medicine at the premier medical institution, says, "Long-term exposure to poor quality air affects lung growth. Studies have shown that children who grow up in poor AQI areas tend to have lower lung capacity as compared to those who live in areas with fresh air. Because their lungs

are still developing, pollution affects their lung growth, and their lung function becomes lower... and they have higher chances of developing wheezing and recurrent attacks of asthma."

Explaining how air pollution is especially severe on children, Dr Nikhil Modi, a respiratory medicine specialist at Delhi's Indraprastha Apollo Hospitals, says, "Because children breathe faster and are closer to the ground, they inhale more air per kg of body weight when compared to adults. When they do so, the pollutants can penetrate deep into the lungs, causing inflammation and irritation of the airways."

In March 2021, doctors at the Paediatric Pulmonology Department of AIIMS and Vallabhbhai Patel Chest Institute studied the link between ambient or outdoor air pollution and the daily visits of children to the Emergency departments of two hospitals in the Capital — AIIMS and Kalawati Saran Children's Hospital.

Out of 1,32,029 children screened for the study, 19,120 candidates with acute respiratory symptoms for less than two weeks and those residing in Delhi for the previous four weeks were enrolled. The study recorded a 29% increase in emergency room visits by children on 'high pollution cluster days' and 21% on 'moderate-level pollution cluster days'.

Dr S K Kabra, paediatric pulmonologist and former head of AIIMS' paediatric department,

who was part of the study, says, “We could see that if there was a 10-unit increase in PM 2.5, PM 10 or NO2 levels, there was a corresponding 20-40 per cent increase in the number of children landing up in the Emergency. This is not necessarily children with prior history of asthma or respiratory illnesses, but children as a whole.”

According to Dr Rajesh Chawla, Senior Consultant, Respiratory and Critical Care at Delhi’s Indraprastha Apollo Hospitals, pollution affects children across age categories. “For children under five, exposure can result in reduced lung growth, increased risk of asthma development, and chronic bronchitis. Studies indicate potential permanent reduction in lung capacity by 10-15%. Children aged 5-10 years may experience decreased lung function growth, increased susceptibility to respiratory infections, and higher risk of developing chronic respiratory conditions in adulthood. Cognitive development may also be impacted due to reduced oxygen delivery to the brain,” he says, adding regular pulmonary function monitoring throughout childhood can help track these impacts and guide interventional measures.

Dr Lancelot Pinto, senior pulmonologist and epidemiologist at Hinduja Hospital in Mumbai, a city that dealt with high AQI levels last year, says the impact of pollution could be more permanent than we imagine. “Adult Indians generally have significantly lower lung function when compared to other populations. We have

traditionally said that it might be because we are Asians. But now there is a stronger sense that inadequate childhood growth and exposure to environmental pollution contribute to lungs not fully developing," he says.

Krishna gets home

It's 4 pm and the OPD at the asthma clinic is winding up for the day. The mother and son prepare to head home to Nandgram in Ghaziabad, where Soni's two younger children — eight-year-old Anjali and five-year-old Kartik — have been waiting. Her husband Doulat Ram, who does house painting jobs, is out at work.

Krishna Koli at his house's terrace. (Express photo by Abhinav Saha)

After collecting their medicines from the hospital pharmacy, Soni and Krishna go to a nearby

general store to buy a packet of biscuits and apple juice — they haven't eaten since they left home five hours ago. "We will take an auto from the hospital to Dilshad Garden and from there, two more rickshaws till we get home. It costs me Rs 100 in all," she says.

The sun hasn't been out since morning and the smog hangs low. Sitting in the auto that's now weaving its way through the traffic, Soni says Krishna had to be brought here after he suffered an asthma attack on November 16, a day after she and her husband took the children out for a rare picnic to India Gate. The AQI at India Gate that evening was above 408 — 'severe'.

"The next morning, Krishna started coughing and had difficulty breathing. He used the inhaler, I got him to inhale steam and took him to the nearby clinic, where they put him on a nebuliser. But he didn't get better and I decided to get him here," she says.

Soni says Krishna's illness began sometime in 2020, when he would have frequent bouts of coughs, followed by fever, and she would manage with cough syrups and, if his condition worsened, take him to the local doctor. The family lived in East Delhi then. But last year, while on a visit to his aunt's in Ghaziabad, Krishna had a coughing fit and collapsed.

The family rushed him to a hospital in Ghaziabad, where he was admitted for a few days, after

which he was referred to the asthma clinic at GTB Hospital.

At their one-bedroom home in Deendayal Puri, Nandgram, a neighbourhood with narrow lanes and closely built houses, Krishna is greeted by his siblings Anjali and Kartik, who unlock the door after climbing onto a chair. The house is on a floor above a private school, where the children study.

“We decided to shift here because the hospital is close by, the rent (Rs 2,500 a month) is lower than in Delhi and the children don’t have to travel to school. Also, I can keep a watch on Krishna. There have been several occasions when I have had to bring him home after he fell ill in school,” she says, opening a file that’s bulging with Krishna’s prescriptions.

Over the last three years, she says, the family has spent about Rs 30,000 on Krishna’s treatment. “He has fallen sick about 20 times in this period. Since GTB Hospital is far away, we rush him to local doctors in case there’s an emergency,” she says.

Soni says she doesn’t let Krishna go out to play; he isn’t allowed spicy or fried food either. “Thankfully, Krishna doesn’t like fried food and prefers roti and dal. He probably knows it’s better for him,” she says.

As Anjali and Kartik step out to buy snacks, Krishna walks out to the school’s terrace, an

extension of their house. The terrace is his space — it's here that he spends time with himself, looking out at the grey sky, watching his siblings run around. He now leans against the terrace wall, watching Anjali and Kartik as they walk down the dusty lane that's lined by a wide, open drain.

"It's sad that he can't do a lot of things that other children can," says Soni. At times like these, she has often considered shifting to Chandigarh, the city she grew up in and where she has her family. "At least the air there is much cleaner... Maybe Krishna will be healthier," she says.

That day, Chandigarh recorded an AQI of 238 — 'poor'.

(This story was first published on November 25, 2024)

The Beijing template

– Anil Sasi

As a top-level meeting in the PMO flagged vehicular pollution as one reason for the stubborn smog choking the national capital region, alongside explicit directions to states to accelerate the shift to lower-emission vehicles and intensifying enforcement, a Chinese action plan for curbing pollution in its capital city offers some actionable cues.

Beijing, once one of the world's most polluted cities, has transitioned into one of the cleanest capital cities in Asia in little over a decade. Beijing's success could serve as a model for other cities worldwide, with China's efforts in air pollution reduction, built on a strong policy framework accompanied by a blueprint to foster

cooperation across sectors, including private and state-owned enterprises, offering a replicable pathway.

Despite registering a blistering economic growth rate of close to 10 per cent consistently for over two decades, China has significantly improved its air quality in the last decade of its near double-digit growth, as testified by the number of days with heavy pollution dropping sharply and fine particulate matter (PM2.5) concentrations tapering off sharply post-Covid.

The Beijing template

The Beijing municipal government started by launching a set of urgent measures to tackle air pollution in the months ahead of the 2008 Olympics. It also progressively began publishing weekly air quality reports and a set of measures to comprehensively track air pollution at the source that included regulations and enforcement mechanisms and an unusually high level of public engagement – something that helped rally public discourse on the compelling need to course-correct.

Importantly, China continued to double down on these initiatives to curb pollution even after the Games. In September 2013, Beijing announced a five-year action plan that acknowledged the Chinese capital's air pollution had turned "severe"

— an important first step. The plan for a national fightback set specific targets, strict emissions standards and tight enforcement and its early focus was on the country's transport sector.

Beijing kicked off China's embrace of electric vehicles, especially public transport, with other Chinese cities forced to follow the capital's example. The city of Shenzhen became the first in the world to electrify all of its 16,000 public buses in 2017, with Shanghai and Hangzhou following suit. As a result, China is now a leader in electric transit, with over 90 per cent of the world's 800,000 electric buses and among the fastest-growing markets for electric and hybrid cars.

For passenger vehicles, the local authorities in Beijing instituted a city-wide lottery on licence plates for anyone wanting to purchase a new internal combustion engine car. Those buying electric cars were able to get a plate more easily, providing a clear incentive. The plan also called for the scrapping of old cars and increased the frequency of inspections for those that were still on the road. The scheme also tightened standards on emissions from diesel trucks. To control the flow of truck traffic through the city, the blueprint required trucks to use bypasses around heavily populated urban areas.

Beyond the transport sector, the Chinese plan

focused on limiting the use of coal-fired boilers and restructuring industry to reduce emissions through a set of clear incentives and disincentives. It also aimed to prevent dust pollution by revamping run-down urban ecosystems in and around Beijing, while increasing the amount of green spaces within the city. Beijing's policy push also involved eliminating older production capacity, renovating coal-fired boilers and replacing thermal output, especially coal-fired generation capacities, with cleaner alternatives.

This all came at a cost. Beijing's spending to fight air pollution surged from just over $450 million in 2013 to more than $2.5 billion in 2017, according to the United Nations Environment Programme.

'Lot of low-hanging fruit'

According to Chim Lee, Senior Analyst, in the Economist Intelligence Unit's China and Asia teams, who leads the Unit's research on China's advanced technologies, industrial policy, energy transition and emission reduction pathways, the emission reduction policies have been comprehensive in scope. "While Beijing — and China as a whole — has made significant progress in reducing air pollution over the past decade, the policies introduced have been comprehensive, addressing major sources of pollution, including transport, electricity generation, industry and

construction. In the transport sector, there has been a concerted effort to expand public transport and promote the adoption of electric vehicles. Emission standards have also been gradually tightened."

China's reliance on coal in electricity generation and industrial production has decreased while the use of renewable energy has increased, Lee told The Indian Express in an interview earlier this year. Pollution standards for many industries have been strengthened, and heavy industries are generally encouraged to relocate outside the capital.

"During days of particularly severe pollution, authorities implement emergency measures, such as restricting the number of vehicles on the road and temporarily shutting down polluting factories. That said, tensions have arisen in recent years, as coal is considered vital to China's structural energy security, and heavy industries are integral to the economies of specific regions... A lot of Beijing's measures can be applied elsewhere in China — and indeed they were — but also the rest of emerging Asia. There are often a lot of low-hanging fruit," Lee said.

According to Chengcheng Qiu, China policy analyst at the Helsinki-based Center for Research on Energy and Clean Air, the country's "war on

pollution" since 2013 has really shown tangible results. "From 2014 to 2022, average levels of PM2.5 dropped faster than in any other country, according to the University of Chicago's Air Quality Life Index. Last year, nearly three-quarters of the country's cities had average PM2.5 levels below the national standard limit. Taken together, the level of PM2.5 in China's cities was 36% lower than it had been in 2015. This success followed a range of measures, including retrofitting coal power plants," Qiu said.

In India, it's exactly the opposite – even as Delhi's air quality deteriorated, many units of thermal power plants in a 300 km radius of the capital city continue to operate without flue gas desulphurisation or FGD systems, which are critical for reducing sulphur dioxide emissions. Sulphur dioxide causes fine particulate matter PM2.5; it reacts with other compounds in the air to form air particles with a diameter of 2.5 micrometres or less, which are not visible to the naked eye.

China's efforts at managing air pollution have hitherto focused on the eastern parts of the country. The national air pollution action plan that the country's State Council issued in 2013 set PM2.5 targets for cities clustered in the Beijing-Tianjin-Hebei area, and in the deltas of the Yangtze and Pearl rivers. In 2018 came another action plan, this time focused

on improving air quality in Beijing-Tianjin-Hebei, the Yangtze Delta and the Fenwei Plain on the middle reaches of the Yellow River. (The Pearl River Delta had been dropped due to its long-term good compliance with the national standard.) According to Qui, these three regions all have an energy mix dominated by coal, and significant air pollution issues connected with heavy industry.

But China has a new emission problem. While eastern China's overall air quality improved in the first quarter of 2025, Qiu noted in a CREA paper that pollution rose in provinces to the south and west of the country. PM2.5 levels in Guangxi, Yunnan and Xinjiang were substantially higher than a year earlier, at 32%, 14%, and 8% respectively – largely the result of heavy industry, such as steelmaking and coal processing, moving to the south and west of the country where energy is more abundant.

That, now, is the new challenge for Beijing.

Mumbai holds its breath, alarm bells ring but no one's listening

– Pratip Acharya and Rupsa Chakraborty

Mumbai is already holding its breath — bracing for the choking winter that lies ahead.

This year, the straws in the toxic wind have come unusually early.

On Wednesday, as the city's temperature soared to a four-year high for October, levels of PM10 — Particulate Matter, with a diameter of 10 microns or less (human hair is 50-70 microns) and, therefore, inhalable — crossed its levels in Delhi.

A day earlier, Mumbai's overall Air Quality Index

touched 191, way worse than Delhi's 84. Andheri and Mazgaon touched 300 plus; Sion and Bandra Kurla Complex crossed 200 — an AQI above 200 is considered Poor, above 300 Very Poor and a serious health hazard.

These alarm bells are loud and clear and yet they have a familiar, disquieting ring.

Records analysed by The Indian Express and data obtained by the newspaper under the Right to Information Act show a pattern emerging — and hardening. Of steadily worsening air — and an action plan gathering dust severely undermining the quality of life in the country's financial capital.

The warnings came as early as last year when several counters clocked alarm: The number of Poor air quality days in December-January 2022-23 almost doubled from the 17 in that two-month period in 2019-20.

Data from the System of Air Quality and Weather Forecast and Research (SAFAR) — under the Ministry of Earth Sciences — showed that Mumbai recorded its worst AQI last winter with the city registering Poor and Very Poor AQI on as many as 66 of the 92 days between November 2022 and January 2023 — compared to an average of 28 during those months over the previous three years.

(According to SAFAR, an AQI between 0-50 is Good; between 51-100 is Satisfactory; 101-200 is Moderate; 201-300 is Poor; 301-400 is Very Poor and beyond 400 AQI is Severe).

As comparison, during the same 92 days, Delhi had 79 days of Poor and Very Poor AQI and as many as eight days of Severe.

That's of little comfort, though.

For long, Delhi has held its infamous pride of place in the nation's pollution map. But it has registered tangible progress with a well-monitored ban on open burning, mechanised road sweeping during winter months, and a Graded Response Action Plan under which a set of restrictions — bans on vehicles to curbs on construction — kick in when pollution levels reach a certain threshold.

"Delhi has a disadvantage due to its landlocked geography but Mumbai is a coastal city that enjoys a natural cleansing advantage. Stronger surface winds favour faster dispersion and wind reversal cycles of strong sea breezes sweep away air pollutants from the land. However, in recent times we see that nature can take away the blessing it bestowed," says Gufran Beig, founder project director of Safar and chair professor at the National Institute of Advanced Studies in Bengaluru.

Changing wind patterns

Behind the recent spike in the city's pollution cycle, Beig says, and this is what makes it so fraught, is a set of factors, local, regional and meteorological. Climate change, the dip in La Nina — the cooling of the ocean surface — and changing wind patterns have all played a role.

"That's why despite Mumbai's geographical advantage, we have seen a sharp dip in AQI (because of) natural and human factors," says Beig. For one, over the past couple of years, the wind pattern has changed due to which the process of wind reversal is taking as many as 15 days — earlier, this used to happen every two days.

"Now, due to the delay in wind reversal, the suspended particulate matter lingers in the lower atmosphere for a longer period of time thus worsening AQI. Also, over the past few years several infrastructure and redevelopment projects have come up, due to which construction is ongoing everywhere, this has increased the proportion of particulate matter in the air, which in turn has worsened the AQI."

Indeed, "dust arising from construction site and construction debris" has been identified as one of the top five sources of air pollution (see adjacent story) by the Brihanmumbai Municipal

Corporation in its Mumbai Air Pollution Mitigation Plan released only in March this year.

The other four are: road dust and its displacement; open burning of solid waste and garbage; usage of unclean fuels in restaurants, dhabas, bakeries and roadside eateries; and a range of industries that include those using Ready Mix Concrete (RMC) plants and casting yard plants.

What this translates into is the need for what experts call a "holistic" action plan that tackles these simultaneously.
"The Union Ministry's National Clean Air Program (NCAP) aims towards improving the current AQI standards by 20%-30% but data shows that there has been an incremental increase in PM10 components in Mumbai in just one year and this is the result of absence of a holistic policy," says Bhagwan Kesbhat, CEO, Waatavaran Foundation, that works on hyper local projects aimed at slowing down the climate change and its impact on communities.

For example, there are several areas across Kalyan, Navi Mumbai, Bhiwandi where open burning of garbage and scrap happens at a massive scale. "The particulate matter often drifts towards Mumbai due to air movement and, in return, plays havoc with the AQI. Issues like these can only be addressed when all agencies would work together," said Kesbhat.

Over the next days and weeks, The Indian Express will report on each aspect of Mumbai's air pollution crisis and the possible solutions and interventions needed.

One imperative that is likely to drive change, experts agree, is the public health cost of pollution.

Warning bells sounded

Nothing moves the needle more effectively than a city and its residents suffering in hospital wards, say experts. "That affects our children, our loved ones...that's the alarm bell that's heard the loudest. That was heard in Delhi and that needs to be heard in Mumbai. This needs awareness on a scale that we have never seen," said a senior official.

One of them ringing a bell regularly is renowned pulmonologist and epidemiologist, Lancelot Pinto at Hinduja Hospital.

When AQI hits 300, as it did in several areas in Mumbai this week, indicating a PM2.5 level of 120, it implies that the air quality at this level carries a health impact equivalent to inhaling the particulate matter from about 5-6 cigarettes each day, says Pinto.

"Of even greater concern is the exposure of school children to this air quality (akin to smoking 5-6

cigarettes each day) particularly while their developing lungs remain vulnerable. This carries the potential for serious consequences, including the risk of respiratory diseases in their future," adds Pinto.

Data obtained from BMC by The Indian Express under the Right to Information Act reinforces this concern: the steady uptick in casualties — an average of six a day — to Chronic Obstructive Pulmonary Disease. COPD is a common lung ailment that hinders airflow and can lead to lung damage or phlegm congestion, causing breathing difficulties.

Over a six-year period from 2016 to 2021, a total of 14,396 individuals in Mumbai lost their lives due to COPD. Additionally, during the same period, records show, 1,220 people in Mumbai passed away from bronchitis, and 6,757 deaths were attributed to asthma, with 619 of these occurring in the M East ward, which encompasses Govandi. This area faces elevated air pollution levels due to the presence of Asia's oldest dumping yard in Deonar.

That's not all.

Mumbai has witnessed a gradual rise in lung cancer fatalities from 621 in 2009 to 923 in 2021, reflecting a 48.6% increase over 12 years. Daksha Shah, the BMC's executive health officer, told

The Indian Express that mortality figures for 2022 are currently under scrutiny.

In hospital after hospital, there are reports of a rising curve when it comes to asthma and respiratory illnesses. For example, records from Sion Hospital show asthma-related admissions going up, from 62 in 2018 to 86 in 2022. Dr Sanggita Checker, a Consultant Chest Physician at Wockhardt Hospitals, says that each winter, when reduced wind speed causes pollutants from construction sites and traffic to accumulate in the air, there is a surge in the number of patients with comorbid conditions like asthma, COPD, and bronchitis.

Prolonged exposure and respiratory health

Air pollution worsens the issue as PM2.5 particles bypass natural nose and respiratory defences.

“Micro air pollutants, such as PM2.5, deeply penetrate the respiratory system. These fine particles reach the alveoli where gas exchange occurs. They trigger inflammation, oxidative stress, and damage to lung tissues. Prolonged exposure can lead to chronic respiratory ailments, worsen existing conditions, and increase the risk of lung infections, ultimately compromising respiratory health,” said Dr Jalil Parker, pulmonologist at Lilavati Hospital. “PM2.5 can

thus access internal organs, posing a significant threat."

Global studies have observed associate air pollutants with lung cancer. The PM2.5 can induce mutations in normal cells, potentially leading to cancer. Regions with elevated air pollution exhibit a greater prevalence of lung cancer in non-smokers compared to areas with lower pollution levels.

Dr Sewanti Limaye, director of oncology and precision medicine at Sir HN Reliance Hospital, cites a recent UK study involving approximately 45,000 individuals that revealed a link between dust particles larger than 2.5 microns and a particular lung cancer type driven by specific EGFR gene mutations.

Said Limaye: "This mutation is present in 25% of lung cancer cases in India, predominantly affecting non-smokers."

(This story was first published on October 20, 2023)

‘We’ve built cities for cars, not people’

– Parveen K Dogra

On 16 November 2016, Delhi woke to a morning when the skyline disappeared behind a dense grey haze. Schools were shut for the first time after the Air Quality Index reached hazardous levels.

In the days that followed, hundreds of parents gathered at Jantar Mantar demanding action. What began as scattered demonstrations grew into national networks like Warrior Moms, founded by Bhavreen Kandhari — now a collective of more than 25,000 citizens across India. Their message was simple: clean air is everyone’s right.

A public health crisis

Every year, with the onset of winter, Delhi's air quality worsens significantly due to a combination of factors like low winds, industrial emissions, dropping temperatures, and stubble burning.

Hospitals across the Delhi-NCR region see a surge of patients with respiratory and other pollution-related illnesses in October and November.

"More people lose their lives each year due to air-pollution-related diseases than the number who died during the Covid pandemic," says Dr Arvind Kumar, Thoracic (Chest) Surgeon, Medanta Hospital, Gurugram. "Because there is no immediate threat of death, unlike with Covid, neither the public nor governments are taking it seriously. If pollution is not curbed, the next 20 years will be remembered for the deaths it causes."

Doctors warn that children in Delhi are growing up with weaker lungs compared to their peers in less polluted regions.

"22 mg of PM2.5 is equivalent to smoking one cigarette. So, if the PM2.5 level on a given day is around 500, then breathing that air for 24 hours, roughly 25,000 breaths, is comparable to smoking 25 cigarettes. In other words, we

are effectively exposed to the same harm as a person who smokes 25 cigarettes a day. What's even more alarming is that a newborn is inhaling this same toxic air, essentially being forced to 'smoke' 25 cigarettes a day," says Dr Kumar.

Odd-even schemes, air purifiers: A temporary fix

Experts agree that the science is clear; what's missing is political will. Systemic failures — understaffed departments, overlapping responsibilities, and virtually no accountability for violators — allow the crisis to exist.

"We've built cities for cars, not for people. Everything is designed to make driving easier. But who is thinking about children walking to school? Where is the priority for public transport?" asks Kandhari.

Policies exist, but implementation is weak. Temporary measures rolled out each winter — smog towers, air purifiers, and odd-even schemes — are widely criticised for not offering long-term solutions. "These are distractions. They don't solve the problem. You cannot filter the sky," says Kandhari.

Many are also critical of the growing reliance on indoor air purifiers, terming it a mere coping

mechanism. “They make us feel safe, but they also make us complacent... You cannot purify your way out of a public health crisis,” Kandhari adds.

Real solutions, experts insist, lie outdoors — cleaner public transport, walkable streets, regulated construction dust, and strict industrial controls.

“There is no harm if you have one (air purifier), but I only recommend it for those who need it,” says Dr Kumar, emphasising that air purifiers aren’t a solution to the whole problem. “For how long can one stay inside a room?”

Not just a Delhi story

While Delhi captures attention, the problem is nationwide. Pollution levels remain dangerously high throughout the year, and their effects are starkest on children and the elderly.

“Ninety-eight per cent of India’s surface area is battling air pollution, and no Indian city is unaffected,” says Dr Kumar.

Activists and researchers describe the situation as a “nationwide emergency” because toxicity is invisible. “If water is dirty, you can see it. But with air, the poison is invisible,” says Kandhari,

adding that this has allowed governments to downplay the scale of the crisis, while citizens quietly adapt.

So what's the solution? The need for city-specific strategies, say environmental researchers and doctors.

Twenty-four-year-old Abhiir Bhalla, youth environmentalist and four-time COP delegate, recommends aggressive EV policies, reducing private vehicle use through pricing reforms, cracking down on open burning and construction dust, and tackling vehicular emissions head-on as possible solutions.

Dr Kumar agrees. "We all have to ensure we do not burn garbage and biomass; dust sources must be addressed immediately; the number of vehicles must be controlled; public transport needs to be strengthened; and our policymakers must learn from Beijing, which curbed pollution drastically."

Rising public consciousness

Meanwhile, public anger is accelerating. Protests, including the recent 10 November demonstration at India Gate, have seen parents turning out with infants and toddlers, signalling a shift in public perception. Air pollution is no longer viewed as

a scientific issue; it is recognised as a survival issue for families.

“I have never seen Delhi citizens come out like this. It’s unfortunate that the peaceful protest was met with such heavy policing, but the citizen energy itself is encouraging,” says Bhalla.

Across communities, the message is unified and urgent: “Nobody can escape the air. Rich, poor, educated, uneducated — we’re all breathing the same toxins. It is a nationwide emergency demanding collective responsibility.”

Why poor indoor air quality is also a matter of health concern

– Rinku Ghosh

While outdoor air pollution is a matter of concern, most people assume their homes are safe. But indoor air can actually be two to five times more polluted and hazardous than outdoor air because pollutants get trapped inside. Neighbourhood construction dust, cooking emissions, incense sticks, strong cleaning chemicals and even stored household waste silently degrade the air we breathe for nearly 90 per cent of the day we stay indoors.

Yet, despite this high exposure, monitoring and regulations for indoor air are largely absent in India. Sensing this gap, a research team

from BITS Pilani Hyderabad's BEST Lab, led by Professor Sankar Ganesh and Dr Atun Roy Choudhury, has created India's first customised Indoor Air Quality (IAQ) scale, which can be accommodated in a small device with existing sensors available in India. "It is more effective than air purifiers, which currently can measure only particulate matter and humidity," says Prof Ganesh. The goal is to give Indian homes a simple and relatable scale — just like the outdoor AQI (air quality index) — to help people understand their indoor air health risks. They are in the process of securing an IP for it.

In their study, they examined the correlation between construction and demolition practices and the deterioration of IAQ, identifying common pollutants such as PM2.5, PM10, carbon monoxide, NOx (nitrogen oxide), and volatile organic compounds (VOCs or gases that are emitted from many household products and processes, including paints, cleaners, and fuels). Benzene emerged as the most dangerous, followed by carbon monoxide, VOCs and radon. The study was published in the Royal Society of Chemistry journal.

"The biggest indoor pollution is from construction dust from sites near your home, or even renovation and refurbishing of your own home. The total volume of construction and demolition dust has gone up from 150 million tonnes in 2016 to 300 million tonnes today. By 2030, this is expected to go up to 430 million tonnes," says Ganesh.

The study calls for including IAQ standards in building codes, smart cities and workplace regulations.

How is the IAQ scale different from air purifiers?

Ganesh: High-end model air purifiers measure only particulate matter and humidity, which is not comprehensive enough for calculating indoor air quality. The USP of the proposed sensor system is to measure all the critical pollutants that are required to estimate the indoor air quality and present their values.

Is there an IAQ monitor in use in the West?

Ganesh: Yes, the US, UK and EU have their standard scales. However, we don't have anything customised for our geographical lay of the land, climate, population, the nature of housing and economic resources.

What are the health impacts?

Choudhury: Poor IAQ is linked to sick building syndrome, which triggers headaches, fatigue and irritation. Given that most modern constructions lack cross ventilation, poor IAQ can cause asthma, bronchial allergies, COPD (chronic obstructive pulmonary disorder), reduced immunity, cardiovascular disease and cancer. Women and infants are the most vulnerable due to longer

indoor exposure and cooking-related emissions.

What is the new scale based on?

Choudhury: We did a pan-Indian survey of indoor environment and indoor pollutant concentration based on age groups, income category and geography. We refined that data and fed it into a learning model, and decided to have a scale based on four weighted parameters. We graded our scale, assigning 59.5 per cent to pollution concentration, 25.9 per cent to exposure time, 9.8 per cent to ventilation efficiency and 4.4 per cent to enclosure size. This weighting reflects India's dense urban living, varied housing sizes and ventilation challenges.

A score has been calculated based on these inputs, ranging from 22 to 100, 22 being the most severe and 100 being the best quality.

What are the key findings from your study?

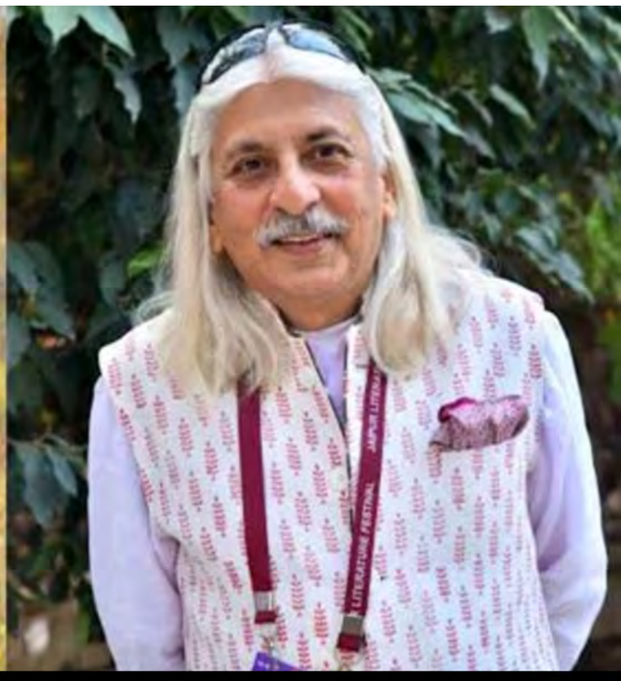
Our study found that fine particulate matter, such as PM2.5 and PM10, can rise well above safe exposure limits during routine activities like cooking and cleaning. Poor ventilation causes these pollutants to accumulate, making the indoor environment even more harmful. Seasonal fluctuations — especially during winters and festive periods — further worsen indoor air toxicity.

What are the unexpected sources of indoor pollution?

Choudhury: Many don't know that benzene is generated by aromatic disinfectants. In a closed setting and with low oxygen, incomplete burning of incense sticks produces carbon monoxide. When organic waste is not segregated and is left to decay in bins, it releases methane and foul-smelling gases indoors. Methane is a powerful climate-warming gas — around 80 times stronger than carbon dioxide over a 20-year period — and it contributes to ozone layer damage and harmful ground-level ozone that affects breathing. It can also pose fire risks if accumulated in confined spaces. Even a small dustbin may act like a mini-landfill if waste is not properly separated, so a simple habit of keeping wet and dry waste separate can protect both household air and the environment.

What can households do today to reduce indoor pollution?

Households can take simple yet impactful steps such as improving ventilation by opening windows during low-pollution hours, using exhaust fans during cooking, reducing incense burning, and segregating organic waste. Regular dusting, indoor greenery, and minimising synthetic air fresheners and harsh chemicals can further improve air quality. Small lifestyle changes can create healthier homes.



Toxic AQI damaged their lungs, forcing them to shift base

– Rinku Ghosh

Once true-blue Delhiites, who grew into their own in the city, became a part of its culture and loved the Delhi winters, they have now fled its toxic air and relocated to other cities. Sanjoy K Roy, MD of Teamwork Arts, which produces the Jaipur Lit Fest, has set up a second home in Goa, as years of pollution have left him battling an acute bronchial allergy. “I have to keep coming to Delhi for work, but doctors tell me my bronchial tubes have thickened and scarred severely,” he says. Meanwhile, musician and co-founder of the Ziro Music Festival, Anup Kutty, has permanently moved base to the Northeast, moving between Shillong, Guwahati and Itanagar. “I had a persistent cough that just wouldn’t settle for over a month,” he says.

Both had been quintessentially Delhi boys, graduating from St Stephen's College in different years, but roughing it out to create their own spaces, Roy as a theatre person, Kutty as a musician. Yet the city air turned out to be their silent enemy.

How Delhi pollution impacted them over the years

For the past 10 years, the winter inversion that leads to increased smog and pollution beginning around Diwali has impacted Roy's bronchial condition. "I suffer from acute bronchial allergy. My allergies have been on the rise and worsened over the years, largely because of pollution. My bronchial tubes have now thickened to what the doctor says is stage 3," says Roy.

This stage, says Dr Nikihil Modi, senior consultant, Respiratory and Critical Care, Indraprastha Apollo Hospital, New Delhi, is when the airways and air sacs in the lungs lose their natural ability to stretch and recoil, which impairs proper breathing. "Chronic inflammation leads to the development of scar tissue, which stiffens and narrows the airways. The airways, in turn, are filled with thick mucus, which further obstructs airflow and makes it difficult to clear the lungs. The walls of the alveoli (air sacs) are damaged, leading to enlarged spaces that trap air, a condition known as emphysema, which reduces the lung

function substantially," he explains.

For Kutty, problems started developing in the winter of 2018 and 2019. "I had been struggling with a recurring throat infection and a persistent cough that lasted for months. I kept ignoring it, assuming it was just the lingering effect of years of cigarette smoking, which I had given up. But then I started noticing something strange — the cough would disappear every time I left Delhi for a few days, only to return the moment I came back. You always read about pollution-related health issues, but having lived all my life (until then!) in Delhi, I never imagined it would affect me personally. Those were always stories that happened to other people," recalls the co-founder of the band Menwhopause, which did gigs around town.

To confirm his suspicion, he consulted his family physician, Dr MM Paithankar. "He told me that the recurring throat problems were indeed a side effect of living in Delhi's polluted air. His advice was simple: Take multivitamins (to build immunity), use an air purifier and do regular steam inhalation. Or, he said, I could make the harder choice — leave Delhi altogether. I chose the latter. I packed my car, drove all the way to Assam with my partner, and now live under bright blue skies and breathe fresh, clean air," he says.

What he had was a chronic cough, something that Dr Pujan Parikh, consultant, pulmonary and sleep medicine at Sir H N Reliance Foundation Hospital, Mumbai, is seeing a lot of in his OPD as a brown haze envelopes the city. “Pollutants directly irritate the nerve endings in the throat and airways, causing a persistent cough as the body tries to clear the irritants. This irritation can also increase mucus production, choking you up further,” he says.

How they deal with Delhi pollution now

“Goa is relatively free of pollution, and my sons say we must stay clear of Delhi during the winter months. But all my festival work happens here. I mostly stay indoors or at the office with a high-grade air purifier. I never step out for walks, and I start coughing instantly if I do so. The bouts can get so intense that sometimes I pass out. I am on a medicated puff which I have to take twice a day,” says Roy.

Kutty tries to avoid Delhi this time of the year. “I don’t spend more than a couple of days. Most of the places I stay have air filters,” he says.

How air pollution can silently damage lungs over a long time

Air pollution has different components, but

it is the fine particulate matter, PM2.5, that is the culprit. “Such particles can go deep down in your windpipes and damage the lining of the bronchus or airways that branch out from the windpipe. They trigger excess mucus secretion, and the sputum is not able to clear itself out. As the windpipe gets scarred, PM2.5 remodels it further, narrowing it. In fact, among non-smokers, PM2.5 can trigger symptoms akin to Chronic Obstructive Pulmonary Disease (COPD). An exposure to AQI of 300 to 400 for a day is equivalent to smoking up to 30 cigarettes a day,” Dr Modi warns. Sustained exposure can even change lung cell DNA and lead to cancer, with many studies now reconfirming the link. Inflammation can even affectthe blood vessels of the heart.

Gases like nitrous oxide and sulphur dioxide act as irritants, producing inflammatory reactions comparable to an asthma patient, leading to irritation and wheezing.

“Children are the hardest hit as their organs are still maturing. Pollutants impair their lung capacity and function, even stall development milestones as they affect their cognitive ability. The elderly, who could take seasonal flu in their stride, now get routinely hospitalised with complications. In pregnant women, pollutants can restrict the flow of essential nutrients and oxygen to the foetus via the placenta, leading

to restricted growth and low birth weight. Air pollution is linked to an increased risk of maternal complications like preeclampsia and hypertension," says Dr Parikh.

What about prevention?

Both pulmonologists insist upon wearing N95 masks, which filter out 95 per cent of pollutants. "Steaming humidifies your channels, but do not overdo it, as it may result in inflammation. Just limit it to a 3 to 5-minute routine twice a day. Have a diet rich in antioxidants, vitamins A, C and E and coloured vegetables, all of which minimise damage. Exercise indoors, clear your AC vents and filters of mould and dust, clean your furnishings," advises Dr Modi.

If cities like Delhi and Mumbai continue to face severe air pollution, then we are looking at creating a whole new demographic of "pollution refugees."

Why air pollution can trigger heart attacks

– Dr Nishith Chandra

In recent years, we have more and more evidence of how air pollution is impacting our heart health. In our own study, we found pollution to be the biggest trigger of cardiovascular diseases. These range from heart attacks, stroke and heart failure to arrhythmia or irregular heartbeats.

So what happens when pollutants enter the body? The most dangerous among them is PM2.5, which is less than 2.5 microns (a red blood cell measures eight microns) and can get into the bloodstream easily. It causes inflammation of the lining of the blood vessel, weakening and damaging it, increasing the risk of rupture. With the blood clotting around such tears, these can cause blockages, triggering a heart attack. PM2.5

can even lead to abnormal calcium levels in the heart, which can interfere with heartbeats and trigger a sudden cardiac arrest. It can increase blood pressure (BP).

Over the long term, PM2.5 can cause biological changes in cells, including thickened blood vessels and pulmonary oxidative stress or lung damage. It can also increase the risk of premature death, especially for people with chronic heart or lung disease. PM2.5 exposure is linked to an increased risk of hospitalisation for cardiovascular conditions and strokes. A Harvard study earlier this year found that a three-year average exposure to PM2.5 was associated with an increased risk of a first hospital admission for all cardiovascular conditions, particularly ischemic heart disease, cerebrovascular disease, heart failure and arrhythmia.

In fact, long-term exposure to PM2.5 can increase both low-density lipoprotein (LDL) or bad cholesterol and triglycerides, according to a study by the Public Health Foundation of India (PHFI) and AIIMS. This can thicken the blood, making it difficult for the heart to pump it and elevating blood pressure.

Long-term exposure to PM2.5 in mice has been associated with left ventricular remodelling or changes in shape and size of the left ventricle (lower chamber of the heart), scarring of heart

tissue, stiffening of the heart's muscles, which prevents the ventricles from filling completely and can cause blood to back up in the organs.

A meta-review has shown that the cardiovascular risk goes up significantly with PM2.5 exposure, going up to 50 ug/m3. In India and China, outdoor PM2.5 is rarely below 84.

What of PM10 particles? These are so small that they can penetrate deep into the lungs and act like a gas. Those with existing heart or lung conditions may complain of wheezing, chest tightness, or difficulty breathing. PM10 can disrupt fibrinolysis, a process which prevents blood clots from becoming obstructive and vasodilation, a process which widens blood vessels. Constricted blood vessels and bigger blood clots can trigger a heart attack.

The young, the old, and people with existing medical conditions are most likely to be adversely affected by exposure to pollutants. So mask up outdoors, only exercise in gyms with purifiers, eat clean, hydrate and keep indoors till the smog lifts.

(Dr Chandra is Principal Director, Interventional Cardiology, Fortis Escorts Heart Institute, New Delhi)

– Dr Aditya Gupta

I have noticed a significant increase in patients with dementia from known high-pollution areas. My patients bear out all that studies have shown till now. There's now a growing body of evidence linking long-term exposure to air pollution with an increased risk of developing dementia and Alzheimer's disease.

What pollution studies have shown so far?

Older adults living in areas with higher levels of air pollution often perform worse on cognitive tests compared to those in cleaner areas. Fine particulate matter like PM2.5 and nitrogen oxides have shown a strong association with

negative brain health outcomes. Exposure can lead to accelerated cognitive decline, with studies finding that a higher concentration of certain pollutants is linked to worse performance in areas like verbal learning and memory.

The link between polluted air and dementia, stroke and cognitive decline is no longer just a side effect of pollution that we can ignore; it is now a reality.

How air pollution impacts brain health

Tiny particles, particularly fine particulate matter (PM2.5), can penetrate deep into our lungs and then seep into the bloodstream. Some of these particles are so tiny that they also permeate the blood-brain barrier, the natural filter designed to protect our brain from substances that might harm it. Once in the brain, these pollutants can cause inflammation and oxidative stress, which harm nerve cells and disrupt communication among different brain regions.

The nose is another entrance. Pollutants can go straight into the brain through the olfactory nerve, which is recognised as a part of the nose that carries our sense of smell. This can lead to local inflammation in brain regions associated with memory and cognition, resulting over time in changes that are associated with diseases like Alzheimer’s and Parkinson’s.

The brain is a fragile organ that absolutely depends on ongoing oxygen and nutrient delivery. When air pollutants make their way to blood vessels, they can lead to diminished blood flow to the brain and deprivation of oxygen and other essential nutrients. These can cause mild declines in memory, attention and decision making over time. People often get symptoms like fatigue, irritability and difficulty concentrating or focusing in polluted cities, but you could also think of these as indicators that the brain system is losing some of its efficiency.

Long-term exposure to dirty air also seems to quicken brain ageing. The constant state of inflammation and stress triggered by pollutants damages nerves and the white matter of the brain. These minute changes can quietly build over the years until they reach recognisable cognitive decline or dementia.

All age groups are at risk

The neurological effects of air pollution are particularly worrisome, as they can affect all age groups. Children who are exposed to polluted conditions may have delayed cognitive development and academic decline, while older adults may be at greater risk of memory dysfunction and neurodegenerative diseases. Even healthy middle-aged individuals can experience subtle cognitive fatigue and decreased productivity when exposed to pollution for long periods of time.

In addition to individual health, this poses a societal problem. Populations residing in high-density polluted urban areas (especially populations who have limited access to healthcare) may be at an increased risk. Air quality has thus become a neurological and social determinant of health.

Although it is challenging to eliminate environmental effects, there are steps we can take to safeguard ourselves. For example, we could use air purification systems in our homes, avoid exercising outdoors when pollution levels are at their highest, wear N95 masks in the most polluted areas, and supplement our diets with antioxidant-rich foods to help mitigate some of the inflammatory load in the brain. In addition to pollution, addressing blood pressure, diabetes, and stress helps keep the brain resilient to pollution damage.

In my opinion, clean air should be regarded not only as an environmental right but as a necessity for the human nervous system. Our brains are incredibly sensitive to our air supply. Though the processes may be slow, silent, and invisible, they are real. Protecting brain health begins with environmental health.

(Dr Gupta is Director, Neurosurgery & Cyberknife, Artemis Hospital, Gurugram)

Exercise routines to strengthen your lungs

– ***Dr Mickey Mehta***

Given the challenge posed by air pollution, we need to stimulate our lungs through exercise to improve their functioning. Your heart and lungs work harder when you're exercising to provide the extra oxygen your muscles need. Regular exercise strengthens your heart and lungs in the same way that it does your muscles. Your body becomes more adept at delivering oxygen to the working muscles and the bloodstream as your level of physical fitness increases. Over time, this is one of the reasons you are less likely to feel shortness of breath while exercising.

The diaphragm and the muscles between the

ribs, which cooperate to power inhalation and exhalation, are two other muscles that can be strengthened by certain forms of exercise. So engaging in both aerobic exercises and muscle-strengthening workouts can enhance the health of your lungs. It all starts with gentle aerobic exercises such as walking and spot jogging. Then you can take to the following routines.

Jumping Jacks: Jumping jacks, which involve softly bouncing over the ground and gently landing back down, are an excellent cardiovascular workout. An improved cardiovascular health eases overall respiratory function.

Swimming and water workouts: Swimming in an indoor pool has an impact on lung volume measurements because swimmers' diaphragm and other respiratory muscles must expand to a greater pressure during the respiratory cycle. This can improve the function of these muscles and change the elasticity of the lung, chest wall or ventilatory muscles. Compared to runners, swimmers have better lung capacity.

Easy hacks: Climbing up the stairs helps you process oxygen better. Twisting and bending — forward, backwards, and sideways — and doing soft lunges with low intensity, all done with

gradual breathing, make for a good lung workout.

Pilates: Pilates strengthens the diaphragm and other muscles involved in breathing, which improve both inhaling and exhaling. Routines build core strength and spinal alignment, which in turn reduce slouching and allow the lungs to expand more fully. By coordinating movement with deep breathing, Pilates exercises have been shown to improve key pulmonary parameters such as forced vital capacity (FVC), peak expiratory flow rate (PEFR) and maximum voluntary ventilation (MVV).

Breathing routines: Inhale and exhale through the nose, and when extremely exhausted, inhale through the nose and exhale through the mouth with proper recoveries in between if you are panting.

Pranayama routines like Kapalbhati and Anulom Vilom can increase lung capacity and oxygen intake. Practising these for only 5-10 minutes a day will give a burst of energy and freshness. I would also recommend double breathing, which oxygenates the blood and energises the body. Stand comfortably with feet apart. Begin with inhaling through the nose with a short, sharp inhalation followed by a long breath. Exhale

twice through the mouth with a short, then long exhalation. While breathing in, stand tall with your spine erect, and while exhaling, squat a little.

Yoga is best for strengthening and flexing the heart and lung muscles. Practise chest-opening asanas like Setu Bandhasana, Bhujangasana, Ustrasana, and upward stretching Tadasana.

Make sure to combine exercise with the right diet and sleep to make sure that you get the full benefits.

(Dr Mehta is a holistic health expert)

Cutting air pollution by 30% can lower heart disease, diabetes, anaemia, says study

– *Nikhil Ghanekar*

Slashing pollution levels across the country by up to 30% can substantially reduce the burden of ailments such as heart disease, diabetes, anaemia and low birth weight among women and children, said a new assessment released Tuesday by IIT-Delhi and Climate Trends, a research-based consulting and capacity building initiative.

Data on disease prevalence from the National Family Health Survey–5, Indian epidemiological studies on air pollution's impact on health, and air quality data were used by IIT-D and Climate Trends to launch a 'health benefit assessment dashboard', which projects the co-benefits of

reducing air pollution on disease prevalence across 641 districts.

Since the dashboard was created using 2011 district boundaries, only 641 districts were included. For the particulate matter (PM) 2.5 pollution values, IIT-D used satellite data.

After the assessment assumed a uniform 30% reduction in PM 2.5 pollution across these districts, it showed that heart disease prevalence among women could decline by 3%-10% if air pollution was slashed in line with the National Clean Air Programme (NCAP) targets — reduce PM 10 levels by up to 40% or achieve national ambient air quality standards by 2025-26. The most pronounced improvements would be seen in Assam, Jammu & Kashmir, and Nagaland.

“The largest co-benefits are concentrated in northern and eastern states, where high levels of air pollution and large populations create an especially urgent case for action. Yet even in states and UTs with lower baseline prevalence or smaller populations, meaningful health improvements are observed,” the study said.

Baseline prevalence refers to the prevalence of diseases across the country as per NFHS-5 data

Though NCAP covers only 131 cities, the assessment used the targets outlined in it as a

reference point to project the benefits of cleaner air on health burden across the districts.

The assessment showed that overall reductions in diabetes prevalence are projected to range between 8% and 25% with the highest benefits in Delhi, UP, Bihar, Assam and Haryana.

On hypertension, the assessment showed that the disease could decline meaningfully in the range of 2% to 8% if air pollution declined. “The largest improvements are found in Punjab, Haryana, Delhi, Assam, Bihar and Uttar Pradesh,” the assessment showed.

Among children, the analysis highlighted that cleaner air could lead to a decline in the prevalence of lower respiratory infections, low birth weight and anaemia. The benefits, the analysis said, could be most pronounced in regions with high baseline prevalence and severe air pollution, such as the Indo-Gangetic plains and eastern states.

“These findings underscore the urgent need to prioritise air quality interventions, as cleaner air not only improves the environment but also translates directly into measurable and widespread public health gains,” the assessment said.

– Bhavreen Kandhari

Who organised this?" someone asked at India Gate yesterday, as hundreds of parents, citizens and youth stood together in the thick November air. The truth was — no one did. There was no banner, no political flag, no NGO logo fluttering in the haze. It was the most spontaneous kind of protest; one born of exhaustion, anxiety, and love. Parents came because their children could not breathe. Journalists came because they felt the same pain. Citizens came because the silence of the state had become unbearable. What united them was not ideology but the common experience of living in a city where every breath feels uncertain — where children, elders, and even the healthiest among us are

slowly losing a fight we never chose.

Over the past few weeks, Delhi's air has again turned poisonous. Official numbers describe it as "very poor", but we all know the language of denial. The monitors flash missing data points; average readings stay just low enough to avoid triggering stricter Graded Response Action Plan (GRAP) levels. It feels almost deliberate — as if keeping the numbers down can somehow keep the anger down. But parents and citizens can see the haze with their eyes and feel it in their lungs. You cannot manipulate the air you breathe.

This has become the story of Delhi — a city where we measure our mornings by the Air Quality Index and our evenings by the colour of the sky. Each winter, authorities announce "emergency" measures; smog guns, road sprinkling, artificial rain experiments. The rituals repeat, the crisis deepens. The illusion of improvement has replaced the courage of real action.

At India Gate, the frustration was palpable, but so was a sense of moral clarity. This is not just an environmental crisis — it is a public health emergency. Yet, health continues to be the missing pillar in our pollution response. Where are the advisories from the health ministry? If the air is as harmful as a virus outbreak, why is it not treated like one?

Every paediatrician in this city will tell us that respiratory illnesses are now endemic. What parents at India Gate demanded was not radical — it was rational. They called for an Independent Air Quality and Public Health Commission: Autonomous, expert-led, and answerable to Parliament, not political cycles. A body that sets and enforces clean air standards, monitors transparently, and communicates honestly. They demanded real-time, audited data, open to citizens and researchers alike — because when data disappears, accountability disappears with it. They urged the creation of a national health advisory system, led by the Ministry of Health and Family Welfare in coordination with the Central Pollution Control Board. Alerts should reach citizens via SMS, television, radio, digital boards, schools, hospitals, buses, and trains. We need an app — a public alert platform, an "Aarogya Setu for Air" — to guide citizens in real time: When to mask, when to keep children indoors, how to protect the elderly. And above all, they demanded accountability for public funds. Every rupee spent in the name of clean air must be traceable, audited, and tied to real outcomes — not to self-congratulatory reports or photo opportunities.

But what unfolded later in the day was disheartening. As dusk fell, the same citizens who came peacefully were met with detentions and police aggression. Such actions erode trust

— not just in the enforcing authorities, but in the state itself. This is not just counterproductive — it is corrosive.

Clean air should not depend on wind direction, luck, or data gaps. It should be guaranteed by design — through governance that is transparent, health-centred, and continuous. Parents should not have to choose between sending their children to school and protecting their lungs. Clean air is not a privilege or a plea; it is the first vaccine every child deserves.

What began at India Gate without an organiser may yet become something larger — a movement grounded in love, guided by evidence, and fuelled by courage. When parents stand for the air their children breathe, they are not breaking peace; they are defending it. The right to life begins with the right to breathe.

(The writer is an advocate for clean air and environmental rights.)

Why air pollution isn't a public health priority

– Purvi Patel

Like clockwork, the NCR has slipped into the same cycle of neglect, retreating indoors, wearing masks infrequently, and hoping the pollution disappears. But air pollution is not a seasonal inconvenience. It is a year-round health problem that refuses to become a public-health priority. Action on air pollution remains stuck between "environmental" and "biological" realms due to its primary source, fossil fuel combustion. As a health hazard, pollution presents a dual visibility challenge — its origins are hidden and its health effects cannot be enumerated.

Coal power plants, industrial clusters, diesel fleets

and brick kilns operate out of sight, continuously releasing particulate matter (PM) and toxic gases, which shape the baseline emissions that every city breathes. Despite rapid growth in renewables, coal still powers over 74 per cent of India's electricity generation. In North India, cold temperatures and local terrain trap pollutants close to the ground. AQI values help us measure concentrations, but not toxicity or local health risk.

On the health side, air pollution does not cause a single dramatic, easily identifiable disease. Irritation and inflammation from short-term exposure can mimic seasonal coughs, colds, and infections, and exacerbate respiratory and heart diseases. Long-term PM2.5 exposure not only extends non-communicable diseases (NCD) but is now linked to new-onset hypertension, diabetes, neurological changes in healthy individuals, and rising lung cancer in non-smokers and a reduction in life expectancy by up to eight years in northern India. Because it is only one among many NCD risk factors and cannot be controlled like salt or alcohol individually, it remains ignored.

Exposure is the hardest to assess. Unlike Covid, which can be avoided through distancing, air pollution in India is largely unavoidable. Nearly everyone breathes PM2.5 far above the WHO's 5 $\mu g/m^3$ guideline. To link it to an illness, what matters is the dose and duration, which is

impossible to measure in patients.

Pollutants, as non-living particles, lack antigens and do not replicate like bacteria or viruses. So, our immune system cannot build antibodies or memory to make us “immune”. As such, vaccines or medicines that can be deployed en masse during health emergencies do not exist for pollution. Because pollution affects multiple organs and systems, it is not possible to precisely quantify the extent to which polluted air causes any specific illness or death in an individual. This is often used as an excuse. What we can measure are disease burdens and trends in the population. The State of Global Air 2025 report estimated over two million pollution-attributable deaths in India in 2023. However, contention over data ownership can still delay action. Recent nationwide and multi-city studies in The Lancet Planetary Health have shown that for every 10 $\mu g/m^3$ increase in PM2.5, annual mortality rises by 8.6 per cent and daily mortality by 1.4 per cent.

India’s health data remains scarce and underutilised. A significant barrier is the uneven adoption of Electronic Health Records (EHR). Unlike the mature EHR systems in Western countries, which enable query-based surveillance and near-real-time analysis, our public health surveillance operates independently of EHRs and relies heavily on manual data entry. This deprives the health sector of the decisive role it

should play in holding other sectors accountable for population health, whether in air pollution, climate change or development projects.

The National Outdoor Air and Disease Surveillance tracks daily aggregates of respiratory emergencies and admissions from selected tertiary hospitals in cities under the National Clean Air Programme. However, in its early stage, it captures only acute respiratory illnesses, lacks advanced analytical capabilities, and has yet to generate credible evidence. Ironically, the very institutions that warn citizens about pollution do not consistently report cases to the national system. These limitations weaken its ability to estimate thresholds or issue health-impact-based early warnings.

Together, these gaps create a serious disconnect between the sectors that generate pollution, regulate it, monitor health impacts, and the public. We then rely on reactive afterthoughts like artificial rain, water cannons, more monitors, or antioxidant foods, while accumulating serious health damage year after year, drowning in the smog of our own consumption, and remaining blind to systemic gaps.

(The writer is former senior consultant, National Programme on Climate Change and Human Health, National Centre for Disease Control)

– Vikram Chopra

I run an autotech company in India. My livelihood comes from people buying and driving cars. Mobility is the backbone of my business. Yet here I am, publicly asking the government to restrict cars, restrict diesel, restrict anything that pumps poison into the sky. When someone like me starts arguing for fewer cars on the road, you should understand how desperate things have become.

I am not writing this as a CEO. I am writing this as a father and a son. I have a five-year-old who should be playing outdoors but instead asks why the sky looks dirty again. I have 80-year-old

parents who hesitate to step outside because the air stings their throats. This is not a theory. This is not politics. This is my family's lungs on the line. And the truth is painful to say out loud: Delhi is suffocating because it refuses to do anything that makes daily life slightly uncomfortable.

We already know what cleans Delhi's air because we have tested the solutions. Odd–even rule in January 2016 cut PM2.5 by roughly 14–16 per cent as per reports. We saw it work in real time but instead of refining or scaling it, we scrapped it because people found it annoying.

In 2020, the lockdown revealed the full truth. When traffic, construction and industrial activity stopped, PM2.5 and PM10 didn't just fall. They crashed by 40–60 per cent. NO2 levels dropped sharply. The AQI at many NCR hotspots shifted from mostly "poor" pre-lockdown to "good" or "satisfactory" during lockdown.

Every winter since, the same pattern repeats. Every time GRAP restrictions, construction halts, diesel limits and older vehicle bans actually kick in, the AQI often starts to ease. And every time they're relaxed early, the pollution spikes right back. Anyone pretending this is a complex mystery is just looking for an excuse to avoid doing the obvious.

What makes me angry is that Delhi has also ignored every proven global intervention that could have prevented this annual disaster. Congestion pricing could have reduced peak traffic. Seasonal diesel restrictions could have stopped winter from becoming a mass respiratory event. Real-time emissions monitoring at construction sites would have forced compliance instead of letting violators treat fines as pocket change. Satellite-linked payments could have given farmers a real reason to stop burning stubble. A functioning public transport system could have made owning a car a lifestyle choice instead of a survival requirement.

None of these ideas are new. What they require is courage and that is exactly what we lack.

This city behaves as if clean air and comfort can coexist. They cannot. Not with the way we consume, drive, build and burn. Delhi wants to breathe clean air without giving up a single convenience. That entitlement is the real pollutant. The weather is not doing this to us. We are doing this to ourselves.

And this is where I stop being polite. If restricting cars helps, restrict them. If diesel needs to disappear for four months, do it. If odd-even works, bring it back. If construction sites violate norms, shut them down that day, not after a dozen warnings. If any industry is a chronic offender,

regulate it like a health emergency instead of negotiating with it like a fragile stakeholder.

People can get angry at me for saying this. But I would rather have people angry at me than have my child living with an air purifier for the rest of his life. My son and my parents do not get replacement lungs when Delhi fails to act. Neither do yours. That's the part nobody wants to confront. If Delhi keeps choosing comfort over action, then we should admit the truth: We are choosing poisoned air over responsibility. We are choosing to cough, wheeze and age faster because doing the right thing is annoying. And in a decade, when the city is living inside sealed rooms with air purifiers strapped to every surface, we will pretend we didn't see this coming.

Delhi does not need awareness, it needs discipline. We need a government that's willing to be disliked for the right reasons and citizens willing to be disrupted before the city becomes unlivable for everyone we love.

I am done whispering this. Delhi is choking and we are running out of breath to debate it.

(The writer is founder and CEO, Cars24)

How Delhi's green lung once saved me

– Kaushik Das Gupta

Among my abiding childhood memories are that of drives in kali-peeli (black and yellow) taxis after asthma attacks. Not very far from my home in Rajinder Nagar, where Central Delhi met West Delhi, rows of Ambassador and Fiat cabs used to queue up, their drivers reclining, chatting, or sipping tea, waiting for business — from my parents, for instance. My father would hold my hands as I slumped into the vehicle's fraying rexine seats.

Inhalers and corticosteroids were some years from being part of the asthma treatment protocol in India. Cough syrups and tablets rarely brought relief. But my parents seemed to know a way out.

They rolled down the Ambassador's windows. As the car turned left and then right towards a broad road flanked on one side by foliage that seemed to extend far beyond sight, I felt that the air had joined my parents in comforting me. A sense of calm returned to my lungs. By the time the vehicle had taken the second or the third round of the road leading to Buddha Jayanti Park, I would doze off, free of the pain, and exhausted by what seemed like hours of short breath.

This was my asthma treatment almost three or four times every year. On days when the allergens were a little less taxing, I could sense the car slowing to let a troop of monkeys pass or allow a batch of headloaders carrying firewood to cross the road. At other times, I could strain my ears to hear the anecdotes and stories my parents were recounting, apparently to take my mind off the pain. Once, between the wheezing, I learnt of the terrible incident a few years back, when two adolescents had been abducted from the area we were passing by and then killed.

The episodes of breathing difficulty were also my first intimate encounters with the Delhi Ridge — the bronchodilator Delhi gave me when doctors and pharmacies could not.

Later, I learnt that my slice of the Ridge was the central sliver of the several thousands of

hectares of discontinuous forests that follow the path of the Aravalli Mountain range in Delhi and parts of Haryana. From influencing rainfall and temperature to recharging aquifers, from providing fuelwood to cordoning off the city from dust and absorbing pollutants, this millennia-old ecosystem has played a critical role in the lives of Delhi's residents.

With my lungs becoming resilient in adolescence, this salve for asthma attacks fell off my mental map. I did not care to make connections, even when I went for a Social Science education in a university cradled in the southern part of the Ridge. At times, I did make sketchy associations between the nilgais that would sometimes visit the campus with the foliage and fauna I encountered on my taxi rides about 10-12 years back, but perhaps I was too caught up with Marxism, Subaltern Studies, the Cambridge School or The Nationalist School, Structuralism or Post Colonialism. I did not make the connection even when, as a student of history, I learnt that the 14th-century ruler Firoze Shah Tughlak had built a hunting lodge in a different part of the ridge or that the East India Company forces camped had there during the 1857 revolt.

The Delhi Ridge had, by then, shrunk by about 10 per cent to what it had been when it was my asthma medicine.

A few years later, on my way to work at Jai Singh Road in Central Delhi, I would often pass by the road skirting the Ridge. But this was a different road, governed by phrases like “peak-hour traffic”. The chartered bus that I took to work seemed to crawl along with other buses, cars, two-wheelers, and three-wheelers. There were scarcely any monkeys and no people carrying firewood.

In the mid-1990s, in response to a Save the Ridge movement, the government clamped down on “encroachers”. But the Ridge continued to shrink. As sociologist Amita Baviskar and historian Thomas Crowley have written, the criminalisation of livelihood-related activities has only driven many of them underground. At the same time, urban amenities and construction activities have chipped away at Delhi’s green lung. Today, it’s almost half of what it was in the early 1980s.

My asthma attacks returned as I stepped into middle age. Three years ago, after a particularly nasty episode, a little after the Covid lockdown had eased, a friend drove me along the painkilling road of my childhood. The roads were sparse, much like during my rides in the kali peeli. My lungs felt soothed.

Let’s, however, not take the analogy too far. Forty years ago, using a cab was a luxury even for a comfortably placed middle-class family like

mine. For the better part of the last 15 years, I have used a car to commute — its tailpipe, a contributor to the city's now infamous pollution load. My parents had to walk half a kilometre to fetch a cab. I use an app that brings a ride to my doorstep almost every day.

In my childhood, the city played less of a role in my asthma. A rough comparison: I was the only one in my class of 30 who had the ailment; today, one in three children has it. When I often blame Delhi's polluted air for my breathing difficulties today, I also recollect that the city had once blessed me with a green lung. Perhaps I did not own or care for it enough to do justice to my privilege, education and lived experiences.