PAVANA · POLICY BRIEF

Centre for Air Pollution & Environmental Health · Pahle India Foundation

Realizing NCAP's Health Promise:
Evidence and Recommendations for National Clean Air Programme Reform

NCDC has the mandate and the infrastructure. India's first Health Adaptation Plan for air pollution diseases is NCDC's own work. What is necessary is its activation.

This policy brief responds to a felt and recognized gap in India's clean air policy discourse: the absence of a synthesis of India's own evidence on the health consequences of air pollution. Every study, dataset, and institutional source cited in this brief is India-generated - drawn from Indian cohorts, Indian registries, Indian surveillance systems, and Indian research institutions. India has produced substantial primary evidence on air pollution and health; what is required is NCDC's activation of the surveillance and linkage infrastructure it already holds - connecting India's disease burden data to the ambient $PM_{2.5}$ data CPCB continuously generates.

1 India's Clean Air Progress - and the Health Opportunity Ahead

India is home to some of the most polluted cities on earth. Many cities in the Indo-Gangetic Plain including Delhi, Siwan, Greater Noida, Patna, and Lucknow rank among the world's most polluted[1]. Yet the air pollution challenge is not confined to large cities alone. Annual $PM_{2.5}$ concentrations across Indian cities consistently exceed India's own Central Pollution Control Board (CPCB) standard (40 µg/m³)[2]. In 2024, annual average concentrations of PM_{10} and $PM_{2.5}$ exceeded national ambient air quality standards (NAAQS), among cities with continuous CPCB monitoring stations, in 43 and 23 cities respectively[3]. A programme designed to protect Indian lives should also include places where most of those lives, and most of that burden, is actually located. It is against this backdrop that India's own research institutions have spent two decades documenting what this pollution does to Indian bodies and that evidence now demands a policy response.

108 of 130

NCAP cities fall short of India's NAAQS PM_{10} standard in FY 2024-25 after six years and ₹13,000+ crore of the programme

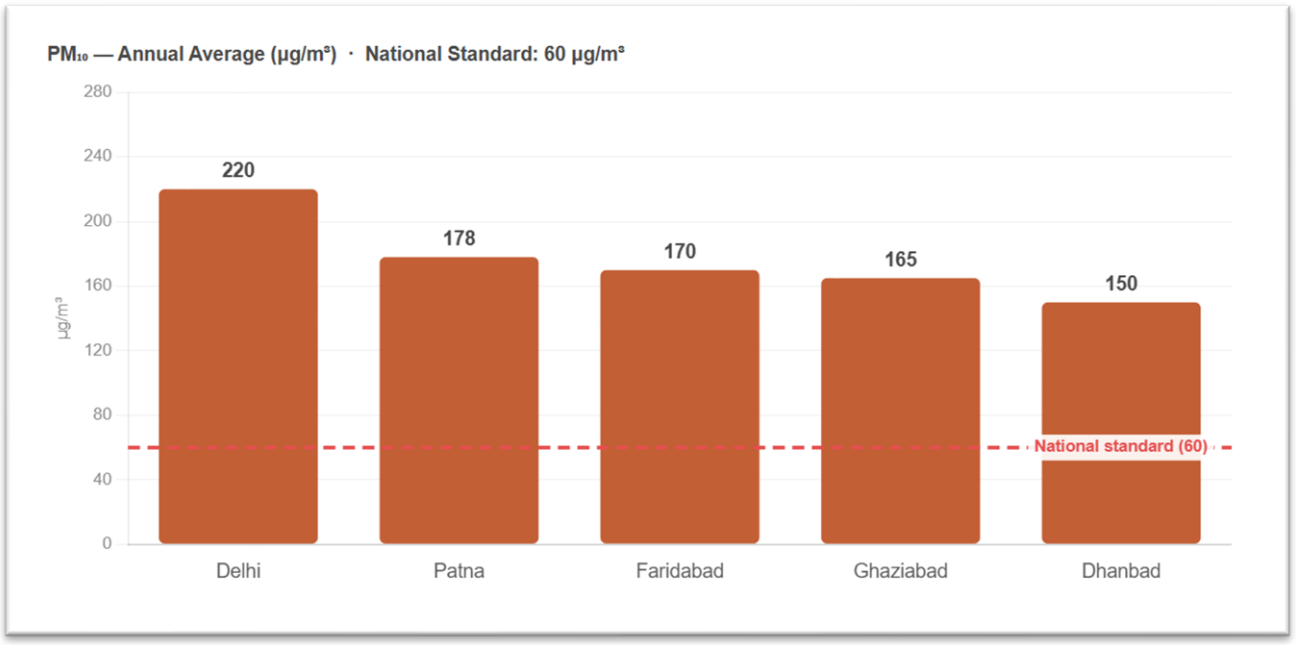
MoEFCC, Lok Sabha, December 2025[4]

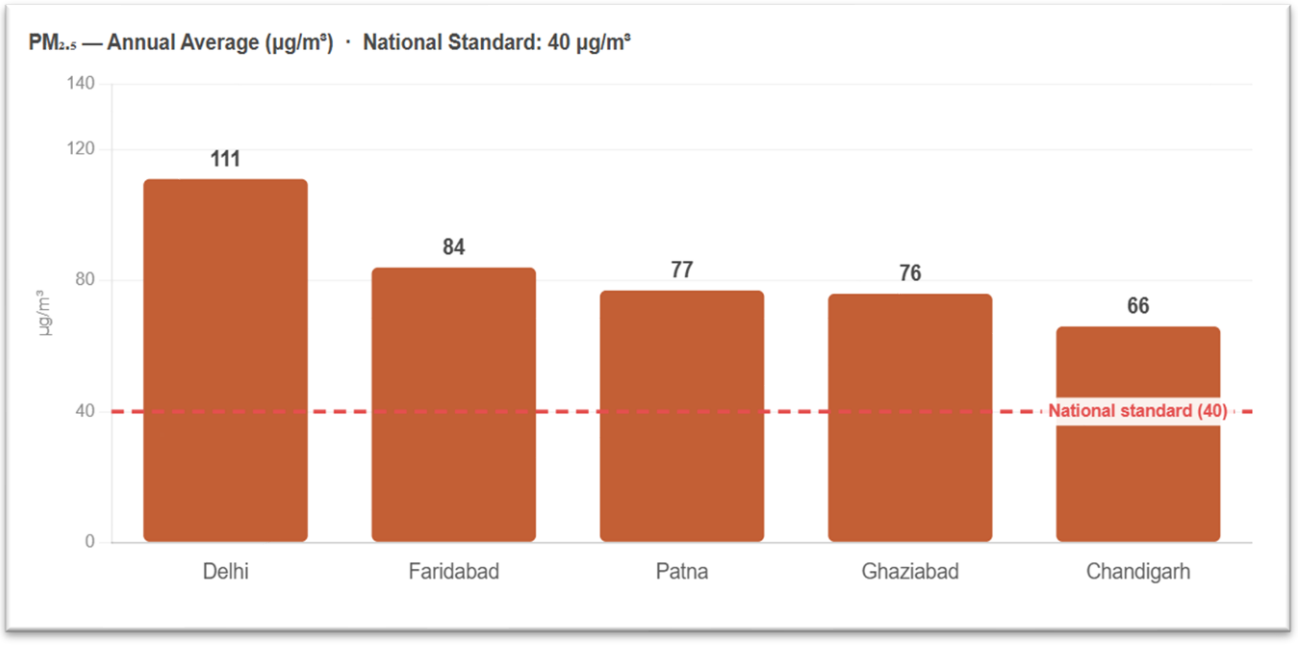
51%

of released NCAP funds utilized by 82 MoEFCC-funded cities (₹831 cr of ₹1,616 cr released) - a utilization challenge alongside the health challenge

CSE, An Agenda for Reform, July 2024[5]

Top 5 polluted cities in India by PM_{10} & $PM_{2.5}$ concentration (2024)





Source: Central Pollution Control Board (CPCB), Annual Report 2024-25, MoEFCC, Government of India[3]

Within this broader challenge, NCAP's own performance data tells a partial but important story. In FY 2024-25, 103 of 130 NCAP cities showed improvement in PM_{10} concentrations compared to the 2017-18 baseline, yet only 22 cities actually conform to India's own NAAQS[4]. While the trend is improving, 108 cities still do not meet India's own standard. More critically, NCAP targets remain pegged to PM_{10}, not $PM_{2.5}$, the finer particulate that penetrates deeper into lung tissue and carries stronger dose-response links to cardiovascular mortality. $PM_{2.5}$ penetrates the blood-brain barrier, and has documented impacts on neurological health as well. **A programme benchmarked against the less health-relevant pollutant, and scoped only to cities, is misaligned with the burden it was actually designed to address. The health consequences of this pollution are not confined to the lungs. Evidence generated through**

Government of India surveillance and research systems consistently demonstrates that air pollution affects multiple organ systems and disease categories across the life course.

> The question before NCDC is not whether it has the mandate. It does. India's first Health Adaptation Plan for air pollution diseases is NCDC's own work. The question is whether NCDC will activate the surveillance and data linkage infrastructure that plan established - publishing the data it has been collecting and connecting it to CPCB's $PM_{2.5}$ records so that the next phase of NCAP has the health outcome infrastructure it needs to know whether it is succeeding.

2 The Evidence: What Indian Research Has Established

A substantial and growing body of primary research, generated by the very institutions that underpin India's tobacco control policy, non-communicable disease (NCD) burden estimates, and maternal health guidelines, documents the health consequences of air pollution across multiple outcomes and populations. The stakes extend beyond domestic health policy. Meeting Sustainable Development Goals (SDG) is not achievable in India without substantially reducing the health burden of air pollution[6]. Air pollution is not a parallel agenda to NCDs; it is one of its primary drivers.

> The Government of India routinely relies on evidence in public health generated by institutions such as All India Institute of Medical Sciences, Indian Council of Medical Research, Public Health Foundation of India, the Indian Institutes of Technology, and Sri Ramachandra Institute of Higher Education and Research. These same institutions generate evidence on air pollution and health; hence its integration into clean air policy would be consistent with established evidence-based governance processes.

Evidence by Health Outcome and Intervention Response

Health Outcome	Key Indian Findings and Institution	Study / Source
Cardiovascular - Hypertension	$PM_{2.5}$ exposure associated with elevated systolic blood pressure and significantly higher incidence of hypertension in urban Delhi adults. Prospective cohort design; 5,342 participants. *PHFI / AIIMS-CARRS Cohort, Delhi*	Prabhakaran D et al. (2020)[7]
Metabolic - Type 2 Diabetes	22% higher incidence of type 2 diabetes per 10 µg/m³ increase in annual average $PM_{2.5}$ (HR 1.22; 95% CI 1.09-1.36) among 12,064 participants in Delhi and Chennai. Among the first prospective cohort evidence on $PM_{2.5}$ and diabetes from Indian urban populations. *PHFI - CARRS Cohort, Delhi & Chennai*	Mandal S et al. (2023)[8]
Respiratory - Children	Indoor $PM_{2.5}$ and NO_2 significantly elevated in homes of children with respiratory illness in an industrial area of Delhi. Lung function impairment documented in Ashok Vihar children; exposure- response relationship demonstrated. *Delhi-based research group*	Kumar R et al. (2007, 2008)[9,10]

Health Outcome	Key Indian Findings and Institution	Study / Source
Respiratory - Urban Slums	Indoor PM and Respirable Suspended Particulate Matter (RSPM) levels in Nizamuddin slum households in Delhi significantly elevated above reference levels; associated respiratory health effects documented among residents in poorly ventilated housing. *IIT Delhi / Delhi University*	Kulshreshtha P et al. (2008)[11]
Respiratory - Rural Women	Both obstructive and restrictive lung defects documented in women and children exposed to biomass cookstove emissions in rural Tamil Nadu. $PM_{2.5}$ identified as the primary driver. *Multi-institutional, rural Tamil Nadu*	Patel et al. (2018)[12]
Cancer - Lung	ICMR-NCDIR documents higher lung cancer incidence in India's most polluted metro cities. Lung cancer incidence has shown a significant upward trend in Indian metro cities. *National Cancer Registry Programme, Bengaluru*	Nath et al. (2022)[13]
Systemic - Vitamin D	Children aged 9-24 months in high-pollution locality in Delhi had mean serum vitamin D of 12.4 ng/ml less than half of the requirement from low-pollution area. ($p<0.001$). This demonstrates pollution's reach beyond respiratory and cardiovascular systems. *St. Stephen's Hospital, Delhi*	Agarwal KS et al. (2002)[14]
Intervention - BP & Oxidative Stress	Portable HEPA air filtration in an all-female old-age home in Rohtak, Haryana (29 participants) showed statistically significant improvement in systolic blood pressure ($p<0.001$) during active vs. sham filtration, with CRP and oxidative DNA damage as secondary outcomes. *PGIMS, Rohtak, Haryana*	Ahuja A et al. (2025)[15]
Intervention evidence Natural Experiment - Lockdown	COVID-19 lockdown (2020) caused approximately 50% $PM_{2.5}$ reductions across Delhi, Mumbai, and Kolkata documented by CPCB monitoring data and peer-reviewed analysis. This demonstrated that targeted emission controls can achieve rapid, measurable air quality improvements, providing India-specific empirical evidence that policy-driven source reduction works. *Multiple Indian universities*	Dhaka SK et al. (2020) and Mandal J et al. (2021)[16,17]

Mortality	Every 25 µg/m³ increase in $PM_{2.5}$ associated with 0.8% increase in daily non-accidental mortality in Delhi; 1.5% increase among adults aged 60 and above. Short-term exposure time-series analysis; 700,512 deaths recorded June 2010–December 2016. *PHFI / Centre for Policy Research, Delhi*	Krishna B et al. (2021)[22]

The studies presented are drawn from a broader peer-reviewed evidence base. Health Effects Institute's global burden of disease evidence portal lists 647 Indian studies, and approximately 200 peer-reviewed studies document direct human health outcome evidence from air pollution exposure in India, spanning respiratory, cardiovascular, metabolic, maternal, and child health outcomes. Please note that studies mentioned above vary in design; table is indicative of the breadth of Indian literature and is not an exhaustive list.

India's Emerging Primary Evidence Infrastructure

Two ongoing prospective cohort studies led by researchers across AIIMS Delhi, IIT Delhi, IIT Bombay, and St John Research Institute will fill the gap with gold-standard primary evidence:

APiPED - Air Pollution Impact on Pregnancy & Early Childhood Development[18]	**APEAL - Longitudinal Effects of Air Pollution on Adolescent Lungs[19]**
Enrolling 2,500 pregnant women from urban and rural Delhi NCR; following children to age 2. Directly measures $PM_{2.5}$ and PM_{10} using personal portable monitors for a sub-sample. Will generate India's first primary clinical evidence linking measured ambient $PM_{2.5}$ to maternal outcomes and early child development - birthweight, inflammation biomarkers, and neurodevelopment.	4,000 adolescents across Delhi, Mumbai, Bengaluru, and Mysuru; categorised by $PM_{2.5}$ exposure level. Uses spirometry and forced oscillation technique alongside blood biomarkers. Will produce India's first age- appropriate lung function reference values in polluted urban settings and establish trajectory of lung development under chronic $PM_{2.5}$ exposure.

Both studies are at the protocol-stage - results are several years away, but this indicates that India's research institutions are now generating the gold-standard prospective cohort evidence that current policy gaps demand. ***the next phase of NCAP should be designed to receive and act on these findings as they emerge.***

Where the Evidence Is Strongest - and Where It Thins

Well-Studied: Regions	**Under-Studied: Regions**
Delhi NCR mainly dominates the primary evidence based followed by Tamil Nadu reflecting the concentration of research infrastructure - AIIMS, PHFI, IIT Delhi, SRIHER in cities where institutional capacity is strongest. Moreover, evidence is also emerging from cities such as Mumbai, Bengaluru and Mysuru.	The Indo-Gangetic Plain cities with the worst pollution burden i.e., Patna, Kanpur, Lucknow, Ghaziabad have the least primary research coverage. This is the most critical geographic gap for policy purposes. Additionally, North-Eastern states have no or little evidence on the growing pollution level.

Critical Disease Gaps

India has no prospective cohort study linking ambient $PM_{2.5}$ to COPD incidence. For ischemic heart disease, the Million Death Study - using nationally representative SRS mortality data found a null-to-weak association[20] These gaps are significant and must not become a reason for inaction.

3 NCDC's Own Architecture - Designed for This, Not Yet Activated

NCDC is not new to air pollution and health. In 2021, NCDC acting through the National Programme on Climate Change and Human Health (NPCCHH) released India's Comprehensive Health Adaptation Plan for Diseases due to Air Pollution[21], establishing ARI sentinel surveillance at designated hospitals, AQI-graded health response protocols, and Centres of Excellence at PGIMER, AIIMS, and VP Chest Institute. NCDC also operates the Integrated Disease Surveillance Programme (IDSP)- India's primary disease surveillance system, generating weekly district-level data on respiratory illness, cardiovascular events, and other pollution-linked outcomes across all states.

That architecture is real. It is operational. And it is precisely the infrastructure that the next phase of NCAP needs to measure health outcomes. But it has a critical structural gap: the ARI sentinel surveillance established under the Health Adaptation Plan has never published its data publicly. IDSP's S-forms do not formally code respiratory illness against ambient AQI or $PM_{2.5}$ levels. No NCDC dashboard connects district-level disease burden to CPCB's $PM_{2.5}$ monitoring. NCDC designed the system India needs and what is missing is its activation.

The next phase of NCAP is the moment to close that gap. NCDC does not need new authority. It needs to activate the authority and infrastructure in the Health Adaptation Plan already conferred.

4 The Opportunity: Connecting India's Air Quality and Health Data

India does not have an evidence problem. It has an institutional design problem. India generates pollution data and health data in parallel and has no routine system to connect them.

CPCB	PM-JAY	NPCCHH ARI Sentinel Surveillance
Real-time $PM_{2.5}$ from CPCB's nationwide CAAQMS network across NCAP cities- Data collected, published, available	Hospital admissions with ICD-10 disease codes across Ayushman Bharat- Data collected, not linked to pollution	Operational since 2017 across selected sites across states but no public data reports released and no formal $PM_{2.5}$ linkage

These three systems operate in parallel. No formal mechanism connects them. NCDC has already established the institutional framework. The 2021 Comprehensive Health Adaptation Plan[21] established exactly the kind of health outcome tracking that the next phase of NCAP needs- ARI sentinel surveillance, AQI-graded response protocols, institutional capacity at three premier centres. What is missing is the formal connection: ARI sentinel surveillance data has not been linked to CPCB's district-level $PM_{2.5}$ records, no data has been published from the surveillance system, and IDSP does not formally track pollution-linked respiratory disease against ambient air quality. the next phase of NCAP is the moment to activate what NCDC has already built. NCDC does not need new authority- it needs to act on the authority and infrastructure it already has.

5 Specific Asks for NCDC

01 Publish NPCCHH ARI Sentinel Surveillance Data - Linked to CPCB $PM_{2.5}$

NCDC's NPCCHH programme has been operating ARI sentinel surveillance at designated hospitals since 2017. This data tracking acute respiratory illness cases against AQI levels at sentinel sites — has never been made public. NCDC to: (i) release existing ARI sentinel surveillance data in the public domain, formally linked to CPCB district-level $PM_{2.5}$ records; (ii) establish a rolling public dashboard updated monthly; (iii) designate at least one sentinel site per NCAP city with continuous CPCB monitoring capability. This single action operationalises the Health Adaptation Plan and gives India its first public pollution-health surveillance output.

Immediate · NCDC + CPCB

02 Expand IDSP to Formally Track Pollution - Linked Disease by District

IDSP's S-forms (syndromic surveillance) and P-forms (provisional case reporting) currently capture ARI and influenza-like illness (ILI) without reference to ambient air quality. NCDC to revise IDSP reporting protocols to: (i) mandate weekly reporting of ARI and ILI case counts against district-level AQI at IDSP units in NCAP cities; (ii) add pollution exposure fields to P-form cardiorespiratory case reports; (iii) generate monthly district-level pollution–illness correlation reports from IDSP data. This transforms existing IDSP infrastructure into India's first routine pollution-health surveillance system.

Short term · NCDC + CPCB + MoHFW (HMIS)

03 Lead the Inter-Ministerial Data Linkage Protocol as the Technical Standard

NCDC is the natural institutional lead for the health side of India's air quality–health data linkage. As the body that operates both NPCCHH and IDSP, NCDC has the technical capacity and institutional mandate to define: (i) the health datasets to be linked (IDSP, PM-JAY HMIS, NPCCHH surveillance); (ii) the data format, frequency, and spatial resolution for receiving CPCB district-level $PM_{2.5}$ records; (iii) the quality standards and validation protocols. NCDC to formalise this as a Technical Standard under the Health Adaptation Plan - providing the inter-ministerial data linkage protocol that neither MoEFCC nor CPCB can generate alone.

Immediate + Short term · NCDC + CPCB + MoEFCC

04 Expand NPCCHH Sentinel Surveillance to Cardiorespiratory ICD Codes and Cancer Registries

The current NPCCHH ARI sentinel surveillance captures respiratory illness - but $PM_{2.5}$'s documented health effects span cardiovascular disease, type 2 diabetes, Vitamin D deficiency, and lung cancer incidence. NCDC to expand the NPCCHH surveillance protocol to: (i) include ICD-10 coded cardiorespiratory admissions linked to CPCB $PM_{2.5}$ at sentinel hospitals; (ii) formally coordinate with ICMR-NCDIR National Cancer Registry Programme to track lung cancer incidence against district-level $PM_{2.5}$ in NCAP cities; (iii) publish annual Health Adaptation Plan implementation reports documenting pollution-linked disease trends at sentinel sites.

Short term · NCDC + ICMR-NCDIR + CPCB

6 Conclusion

India's challenge in addressing air pollution is not a shortage of evidence, but rather one of institutional design and policy translation. NFHS data traces its footprint in child respiratory health. ICMR-NCDIR cancer registries show its signature in lung cancer incidence in India's most polluted cities. CPCB's own monitoring network confirms that virtually all 130 NCAP cities exceed the $PM_{2.5}$ NAAQS of 40 µg/m³ and 108 cities still fall short of even the less stringent PM_{10} standard. Primary studies from AIIMS, PHFI, IIT Delhi, and other institutes independently document what this exposure does to Indian lungs, hearts, and metabolic health. ***The science is Indian. The data is Indian. The conclusion is unambiguous.***

The window to embed health outcome metrics into the next phase of NCAP is open now - and it will not remain open indefinitely. Programme architecture, inter-ministerial data protocols, and surveillance mandates are set at the design stage. A programme that launches without formal $PM_{2.5}$ to health linkage will spend years trying to retrofit what could have been built in from the start. The four asks in this brief are executable within NCDC's existing institutional mandate under NPCCHH and IDSP, require no new legislation, and carry no foreign technical dependence.

The question before NCDC is not whether it has the capacity. It built this capacity. The 2021 Comprehensive Health Adaptation Plan is NCDC's own work. The question is whether NCDC will activate what it designed - publishing its surveillance data, expanding its disease tracking protocols, and leading the inter-ministerial data linkage that transforms NCAP from a pollution-reduction programme into a health-outcome programme.

PAVANA offers three specific forms of technical support to NCDC:
(1) Developing the technical methodology for linking NPCCHH ARI sentinel data to CPCB district-level $PM_{2.5}$ records and building the public pollution-health dashboard;
(2) Designing the expanded IDSP pollution-disease surveillance protocol with standardized AQI–illness coding;
(3) Drafting the inter-ministerial data linkage Technical Standard that NCDC can formalize under the Health Adaptation Plan.

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