Situational Analysis Report on Non-Communicable Diseases and Air Pollution in India

March 2023
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Non-Communicable Diseases and Air Pollution in India

March 2023
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIIMS</td>
<td>All India Institute of Medical Sciences</td>
</tr>
<tr>
<td>AQI</td>
<td>Air Quality Index</td>
</tr>
<tr>
<td>BP</td>
<td>Blood pressure</td>
</tr>
<tr>
<td>BS-VI</td>
<td>Bharat Stage VI</td>
</tr>
<tr>
<td>CAP</td>
<td>Comprehensive Action Plan</td>
</tr>
<tr>
<td>CAPHER</td>
<td>Collaborative for Air Pollution and Health Effects Research</td>
</tr>
<tr>
<td>CCAC</td>
<td>Climate and Clean Air Coalition</td>
</tr>
<tr>
<td>C&amp;D</td>
<td>Construction &amp; Demolition</td>
</tr>
<tr>
<td>CEH</td>
<td>Centre for Environmental Health</td>
</tr>
<tr>
<td>CoE</td>
<td>Centers of Excellence</td>
</tr>
<tr>
<td>CHAIR</td>
<td>Consortium for Climate, Health and Air pollution Research</td>
</tr>
<tr>
<td>CONCH</td>
<td>CONsortium for Climate and Health, South Asia</td>
</tr>
<tr>
<td>COPD</td>
<td>Chronic obstructive pulmonary disease</td>
</tr>
<tr>
<td>COP</td>
<td>Conference of the Parties</td>
</tr>
<tr>
<td>CPCB</td>
<td>Central Pollution Control Board</td>
</tr>
<tr>
<td>CPF</td>
<td>Country Partnership Framework</td>
</tr>
<tr>
<td>CRD</td>
<td>Chronic respiratory diseases</td>
</tr>
<tr>
<td>CSCAF 3.0</td>
<td>ClimateSmart Cities Assessment Framework 3.0</td>
</tr>
<tr>
<td>CSE</td>
<td>Centre for Science and Environment</td>
</tr>
<tr>
<td>CSO</td>
<td>Civil Society Organisation</td>
</tr>
<tr>
<td>CVD</td>
<td>Cardiovascular diseases</td>
</tr>
<tr>
<td>DALYs</td>
<td>Disability-adjusted life years</td>
</tr>
<tr>
<td>DFCA</td>
<td>Doctors for Clean Air</td>
</tr>
<tr>
<td>EPCA</td>
<td>Environment Pollution (Prevention and Control) Authority</td>
</tr>
<tr>
<td>GBD 2019</td>
<td>Global Burden of Disease study 2019</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GEOHealth</td>
<td>Global Environmental and Occupational Health</td>
</tr>
<tr>
<td>GoI</td>
<td>Government of India</td>
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<tr>
<td>GRAP</td>
<td>Graded Response Action Plan</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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</tr>
<tr>
<td>HIA</td>
<td>Healthy India Alliance</td>
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<tr>
<td>HWCH</td>
<td>Health Care Without Harm</td>
</tr>
<tr>
<td>IHD</td>
<td>Ischaemic Heart Disease</td>
</tr>
<tr>
<td>LCF</td>
<td>Lung Care Foundation</td>
</tr>
<tr>
<td>LMICs</td>
<td>Low and Middle Income Countries</td>
</tr>
<tr>
<td>LRI</td>
<td>Lower Respiratory Infections</td>
</tr>
<tr>
<td>MoEFCC</td>
<td>Ministry of Environment, Forest and Climate Change</td>
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<tr>
<td>MoHFW</td>
<td>Ministry of Health and Family Welfare</td>
</tr>
<tr>
<td>MoHUA</td>
<td>Ministry of Housing and Urban Affairs</td>
</tr>
<tr>
<td>NAAQM</td>
<td>National Ambient Air Quality Monitoring</td>
</tr>
<tr>
<td>NAAQS</td>
<td>National Ambient Air Quality Standards</td>
</tr>
<tr>
<td>NAMP</td>
<td>National Air Quality Monitoring Programme</td>
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<tr>
<td>NCAP</td>
<td>National Clean Air Programme</td>
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<tr>
<td>NCD</td>
<td>Non-Communicable Disease</td>
</tr>
<tr>
<td>NEERI</td>
<td>National Environmental Engineering Research Institute</td>
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<tr>
<td>NEMMP</td>
<td>National Electric Mobility Mission Plan</td>
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<tr>
<td>NHM</td>
<td>National Health Mission</td>
</tr>
<tr>
<td>NKN</td>
<td>National Knowledge Network</td>
</tr>
<tr>
<td>NMAP</td>
<td>National Multisectoral Action Plan for Prevention and Control of Common NCDs</td>
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<tr>
<td>NPCCHH</td>
<td>National Programme for Climate Change and Human Health</td>
</tr>
<tr>
<td>PAHAL</td>
<td>Pratyaksh Hanstantrit Labh</td>
</tr>
<tr>
<td>PCC</td>
<td>Pollution Control Committees</td>
</tr>
<tr>
<td>PGIMER</td>
<td>Postgraduate Institute of Medical Education and Research</td>
</tr>
<tr>
<td>PHFI</td>
<td>Public Health Foundation of India</td>
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<tr>
<td>PM</td>
<td>Particulate Matter</td>
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<tr>
<td>Acronym</td>
<td>Full Form</td>
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</tr>
<tr>
<td>PMUY</td>
<td>Pradhan Mantri Ujjwala Yojana</td>
</tr>
<tr>
<td>PURE</td>
<td>Pulmocare Research and Education Foundation</td>
</tr>
<tr>
<td>RSPM</td>
<td>Respirable Suspended Particulate Matter</td>
</tr>
<tr>
<td>SATAT</td>
<td>Sustainable Alternative Towards Affordable Transportation</td>
</tr>
<tr>
<td>SDGs</td>
<td>Sustainable Development Goals</td>
</tr>
<tr>
<td>Sida</td>
<td>Swedish International Development Cooperation Agency</td>
</tr>
<tr>
<td>SLCPs</td>
<td>Short-Lived Climate Pollutants</td>
</tr>
<tr>
<td>SPCBs</td>
<td>State Pollution Control Boards</td>
</tr>
<tr>
<td>SPM</td>
<td>Suspended particulate matter</td>
</tr>
<tr>
<td>T2D</td>
<td>Type 2 Diabetes</td>
</tr>
<tr>
<td>UHC</td>
<td>Universal Health Coverage</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
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<tr>
<td>UNEA</td>
<td>United Nations Environment Assembly</td>
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<tr>
<td>UNEP</td>
<td>United Nations Environment Programme</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
</tr>
<tr>
<td>UN HLM</td>
<td>United Nations High Level Meeting</td>
</tr>
<tr>
<td>UTs</td>
<td>Union Territories</td>
</tr>
<tr>
<td>VPCI</td>
<td>Vallabhbhai Patel Chest Institute</td>
</tr>
<tr>
<td>WBG</td>
<td>World Bank Group</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
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</table>
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Acknowledgements

This Situational Analysis Report on Non-Communicable Diseases and Air Pollution has been developed by Healthy India Alliance/India NCD Alliance (HIA). This report is supported by the NCD Alliance’s Advocacy Institute NCD Prevention Accelerator Programme, as part of the NCD Alliance’s partnership with the Swedish International Development Cooperation Agency. This Report highlights the current policy and programmatic landscape in India, with respect to multi-sectoral and multi-stakeholder action on air pollution mitigation as a key component of NCD prevention and control.

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The Report was peer reviewed by Dr Vignesh Dwarakanathan, Senior Resident, Centre for Community Medicine, All India Institute of Medical Sciences, New Delhi.

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1. Introduction

Worldwide, air pollution is considered as one of the most serious risk factors which severely impacts the global population, and particularly the vulnerable populations including women, children, elderly and people living with chronic health conditions. According to the World Health Organization (WHO), 6.7 million premature deaths annually are attributed to combined effects of ambient (outdoor) air pollution and household (indoor) air pollution. In 2019, air pollution contributed to 11.7% of deaths globally. 1.67 million deaths were attributable to air pollution in India in 2019, accounting for 17.8% of the total deaths in the country. In 2021, 12 of the 15 most polluted cities in the Central and South Asia Region were in India. India was ranked eighth in the list of world’s most polluted countries in 2022 with 39 out of 50 most polluted cities of the world being in India. In 2022, the annual average of particulate matter 2.5 (PM 2.5) level in India was 53.3 μg/m³ which was nearly 10 times higher than the annual PM 2.5 concentration of 5 μg/m³ limit as per WHO guidelines.

Air pollution has been labelled as “silent killer” by The WHO because of its wide-ranging damage to almost all organs of the human body. Before 2018, the 4X4 approach for Non-Communicable Disease (NCD) included cardiovascular diseases (CVD); chronic respiratory diseases (CRD); cancers and diabetes as the major four NCDs. Unhealthy diet, tobacco use, alcohol consumption and physical inactivity were considered as the four major NCD risk factors. The Declaration of the third United Nations High Level Meeting (UN HLM) on NCDs, in September 2018 had highlighted critical areas of national, regional and global action on NCDs, with a lens on the 2025 global NCD targets (25% relative reduction in premature mortality from NCDs by 2025) and the 2030 Sustainable Development Goals (SDGs) (Reduce by one third premature mortality from NCDs through prevention and treatment and promote mental health and well-being by 2030). A shift from a limited focus on 4X4 action to a more comprehensive 5X5 approach was adopted after the UN HLM which incorporated environmental risk factors, including indoor and outdoor air pollution among major NCD risk factors and mental health as the fifth major NCD.

With an aim to reduce the preventable burden of morbidity, mortality and disability due to NCDs, the Global Action Plan for the Prevention and Control of NCDs (2013–2020) had put forth nine global NCD targets to be attained by 2025. Through the National Action Plan and Monitoring Framework for the Prevention and Control of NCDs in India (2013), India was the first country to adopt the global NCD targets to its national context. Along with the nine national NCD targets, India set a tenth target to reduce exposure to indoor air pollution by 50% relative reduction in household use of solid fuels as primary source of energy for cooking by 2025. As a follow up to the Monitoring Framework, the National Multisectoral Action Plan for Prevention and Control of Common NCDs (2017-2022) (NMAP) outlines actions by various sectors and stakeholders to achieve the overall targets in order to reduce premature NCD mortality. In response to the growing NCD burden (74% of all the global deaths and 65% of deaths in India in 2019) and to achieve SDG targets related to NCDs and air pollution, addressing air pollution as a major risk factor for NCDs is need of the hour.
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Framework element</th>
<th>Outcome</th>
<th>2020 targets</th>
<th>2025 targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Premature mortality from NCDs</td>
<td>Relative reduction in overall mortality from cardiovascular disease, cancer, diabetes, or chronic respiratory disease</td>
<td>10%</td>
<td>25%</td>
</tr>
<tr>
<td>2.</td>
<td>Alcohol use</td>
<td>Relative reduction in alcohol use</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>3.</td>
<td>Obesity and diabetes</td>
<td>Halt the rise in obesity and diabetes prevalence</td>
<td>No mid-term target set</td>
<td>Halt the rise in obesity and diabetes prevalence</td>
</tr>
<tr>
<td>4.</td>
<td>Physical inactivity</td>
<td>Relative reduction in prevalence of insufficient physical activity</td>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>5.</td>
<td>Raised blood pressure</td>
<td>Relative reduction in prevalence of raised blood pressure</td>
<td>10%</td>
<td>25%</td>
</tr>
<tr>
<td>6.</td>
<td>Salt/sodium intake</td>
<td>Relative reduction in mean population intake of salt, with aim of achieving recommended level of less than 5gms per day</td>
<td>20%</td>
<td>30%</td>
</tr>
<tr>
<td>7.</td>
<td>Tobacco use</td>
<td>Relative reduction in prevalence of current tobacco use</td>
<td>15%</td>
<td>30%</td>
</tr>
<tr>
<td>8.</td>
<td>Household indoor air pollution</td>
<td>Relative reduction in household use of solid fuels as a primary source of energy for cooking</td>
<td>25%</td>
<td>50%</td>
</tr>
<tr>
<td>9.</td>
<td>Drug therapy to prevent heart attacks and strokes</td>
<td>Eligible people receiving drug therapy and counselling (including glycemic control) to prevent heart attacks and strokes</td>
<td>30%</td>
<td>50%</td>
</tr>
<tr>
<td>10.</td>
<td>Essential NCD medicines and basic technologies to treat major NCDs</td>
<td>Availability and affordability of quality, safe and efficacious essential NCD medicines including generics, and basic technologies in both public and private facilities</td>
<td>60%</td>
<td>80%</td>
</tr>
</tbody>
</table>
India’s commitments to reduce the burden of air pollution is well reflected through several administrative and regulatory measures incorporated by Government of India (GoI). To achieve the SDG 3.9.1 i.e., to substantially reduce the number of deaths and illnesses attributed to ambient and indoor air pollution many flagship programmes and policies have been implemented by the Government.

**Key initiatives include:**

- National Air Quality Monitoring Programme (NAMP)- Launched by Central Pollution Control Board (CPCB)
- National Clean Air Programme (NCAP)- Launched by the Ministry of Environment, Forest and Climate Change (MoEFCC)
- National Programme for Climate Change and Human Health (NPCCHH)- Launched by The Ministry of Health and Family Welfare (MoHFW)

A comprehensive national response to mitigate air pollution warrants that it should be addressed not just as an environmental health or climate change issue but also as a threat to public health and development. This can only be achieved through integrated actions by multiple stakeholders in both these sectors including relevant ministries of GoI, researchers, civil society, people living with and affected by NCDs and air pollution and communities/citizens at large. Within the comprehensive approach to Universal Health Coverage (UHC), it is necessary to acknowledge the need to change the narrative around air pollution to enable a more comprehensive response. There is an urgent need to highlight air pollution as a complex risk factor not just for CRDs but for all the major NCDs, including CVDs, diabetes, cancers and mental health conditions.

This Situational Analysis Report on Non-Communicable Diseases and Air Pollution has been developed as a part of the Healthy India Alliance/India NCD Alliance’s (HIA) NCD Prevention Accelerator Programme (2021-2023) supported by the NCD Alliance and Swedish International Development Cooperation Agency (Sida). The goal of the programme is to augment civil society engagement for prioritising multi-stakeholder action for mitigation of air pollution as a risk factor for NCDs in India. The intent of this Report is to build a narrative around air pollution as a complex risk factor across all NCDs in addition to being a threat to the climate and environment. This Report highlights the current policy and programmatic landscape in India, with respect to multi-sectoral and multi-stakeholder action on air pollution mitigation. It also provides recommendations to scale up multi-pronged efforts to address air pollution as a public health and environmental challenge in India.
2. Methodology

A comprehensive Situational Analysis was undertaken to examine the toll of air pollution in India. It focussed on evidence to establish air pollution as a serious threat to health with a particular focus on NCDs; policy and programmatic response to address NCDs both from an environmental and public health perspective and; document views of key stakeholders and the general public on the interlinkages between air pollution and NCDs. The Situational Analysis comprised of two major components:

1) **Desk Review**: This was conducted to document current developments in addressing air pollution as a public health priority in India, with a specific focus on NCDs. The review focussed on the burden of air pollution in India, its health, socioeconomic and environmental impact and key stakeholder efforts to address air pollution. Sources reviewed included- scientific publications, policy and programmatic documents, reports, white papers and briefs available in public domain.

2) **Stakeholder Dialogues**: These dialogues were conducted as interactions with six respondents including experts working on air pollution and/or NCDs, researchers, CSO representatives, youth and people living with NCDs affected by air pollution. The intent was to garner their insights on challenges and opportunities for prioritising air pollution as a key area of multi-sectoral and multi-stakeholder action with a focus on NCD prevention and control.

A narrative synthesis of each of these two components of the Situational Analysis is provided in the following sections of this report. The salient outcomes of each of these segments were distilled to propose recommendations to amplify a 360\(^0\) response to prioritise air pollution mitigation as a critical factor to further strengthen NCD prevention and control in India.
Air Pollution: An environmental crisis that manifests as a hazard to public health

Air pollution is defined as contamination of the indoor or outdoor environment due to presence of toxic chemical, physical or biological agents at levels that pose a health risk.\textsuperscript{14} Air pollution is ranked fourth among the leading risk factors for global mortality.\textsuperscript{15} The exposure to the indoor and the outdoor air pollutants contributes substantially to an individual’s risk for morbidity and mortality. According to WHO, the pollutants which are of major public health concern include PM 10 and PM 2.5, carbon monoxide (CO), ozone (O\textsubscript{3}), nitrogen dioxide (NO\textsubscript{2}), lead (Pb) and sulphur dioxide (SO\textsubscript{2}).\textsuperscript{16} Both short-term and long-term exposure to these pollutants results in various health hazards and thus, is a major public health concern.

Table 2: Sources of air pollutants\textsuperscript{17}

<table>
<thead>
<tr>
<th>Pollutants</th>
<th>Outdoor source</th>
<th>Indoor source</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM particles (diameter between 2.5 μm and 10 μm)</td>
<td>Pollen, wind-blown dust from erosion, agricultural spaces, roadways and mining areas.</td>
<td>Combustion of solid fuels and usage of inefficient stoves or space heaters in poorly ventilated residential areas.</td>
</tr>
<tr>
<td>PM 2.5 (Finer particles)</td>
<td>Combustion of fuels in power generation facilities, and industries or vehicles.</td>
<td></td>
</tr>
<tr>
<td>NO\textsubscript{2}</td>
<td>High temperature combustion of fuels used for heating, transportation, industry and power generation purposes.</td>
<td>Fireplaces, furnaces, gas stoves and ovens.</td>
</tr>
<tr>
<td>O\textsubscript{3}</td>
<td>Major component of smog. Formed from photochemical reactions with pollutants such volatile organic compounds, CO and nitrogen oxides (NO\textsubscript{x}) emitted from vehicles, and industry.</td>
<td>Two main sources of indoor ozone include outdoor atmosphere and indoor ozone produced by electrical devices.\textsuperscript{18}</td>
</tr>
<tr>
<td>CO</td>
<td>Motor vehicles, open fires, incomplete combustion of fuels like petrol, coal, natural gas.</td>
<td>Incomplete combustion of carbonaceous fuels such as wood, petrol, coal, natural gas and kerosene in simple stoves, wick lamps, furnaces, fireplaces.</td>
</tr>
<tr>
<td>SO\textsubscript{2}</td>
<td>Combustion of fossil fuels for industries and power generation.</td>
<td>Combustion of fossil fuels for domestic heating.</td>
</tr>
<tr>
<td>Pb and Pb particulate compounds</td>
<td>Vehicle exhaust of fuel with lead.</td>
<td>Contaminated dust from products such as paints, ceramics, pipes and plumbing materials, solders, gasoline, batteries, ammunition, and cosmetics.</td>
</tr>
</tbody>
</table>
Air Pollution exposure and burden

Global Scenario

According to the IQAir World Air Quality Report 2022, a total of 118 (90%) out of 131 countries and regions (Data collected from more than 30,000 air quality monitoring stations across 7,323 locations in 131 countries) exceeded the WHO annual PM2.5 guideline value of 5 μg/m³. Out of the 296 regional cities representing Southeast Asia region in the Report, only 8 satisfied the WHO PM 2.5 guideline limit of 5 μg/m³, leaving total of 288 cities that exceeded WHO-recommended PM 2.5 concentrations.

Air pollution has remained a major threat over the years. According to the Global Burden of Disease study 2019 (GBD 2019), 2.92 million deaths or 11.3% of all female deaths and 3.75 million deaths or 12.2% of all male deaths, in 2019, were caused due to air pollution. Disability-adjusted life years (DALYs) for a disease/health condition/risk factor are the sum of the years of life lost to due to premature mortality and the years lived with a disability due to the disease or health condition. In 2019, long-term exposures to ambient PM 2.5 contributed to 118 million DALYs, accounting for 55% of DALYs globally. In 2019, indoor air pollution resulted in 91.5 million DALYs.

Indian Scenario

The IQAir World Air Quality report 2022 highlighted that 60 percent of cities in India experienced annual PM 2.5 levels of at least seven times higher than the WHO guideline. According to GBD 2019, 0.98 million deaths were attributable to ambient particulate matter pollution, 0.61 million to household air pollution, and 0.17 million to ambient ozone pollution. 11.5% of the total DALYs in India, in 2019, were attributable to air pollution, the majority of which were due to outdoor particulate matter pollution (6.7%) and then indoor air pollution (4.5%).

Linkages between NCDs and Air Pollution

Exposure to air pollution increases the risk for NCDs manifold, posing serious threat to global health. The small sized pollutants are able to penetrate the blood stream and cause systemic inflammation in almost all organs of the body. These particles can cross the blood-gas barrier from lungs and enter the blood stream. Thus, the pollutants can affect each and every organ in the body and complicate or exacerbate many adverse health conditions. Beyond the lungs and heart, air pollution has been identified as a risk factor for cancers, stroke, diabetes, neurological development issues in children and neurological problems in adults. WHO estimated that globally 37% of outdoor air pollution-related premature deaths were due to ischaemic heart disease (IHD) and stroke in 2019. Exposure to outdoor air pollution also resulted in 18% premature deaths due to chronic obstructive pulmonary disease (COPD), 23% due to acute lower respiratory infections (LRI) and 11% of deaths due to cancer within the respiratory tract. Globally, the household air pollution caused 32% of IHD, 23% of stroke, 21% of LRI, 19% of COPD and 6% of lung cancer.
There is substantial evidence from research studies establishing the linkages of major NCDs and air pollution. The adverse effects of air pollution depend on factors like individual’s susceptibility, dosage of exposure, age, and pre-existing medical conditions (primarily NCDs). The major NCDs caused or aggravated by air pollution are:

**CVDs:** Globally, there is substantial evidence that exposure to fine PM 2.5 increases the risk of CVDs. A 10 μg/m³ increase in long-term PM 2.5 exposure was associated with an increased risk of 23% for IHD mortality, 24% for cerebrovascular mortality, 13% for stroke and 8% for myocardial infarction (MI).\(^{25,26}\) Given that high blood pressure (BP) is an important risk factor for CVDs, there is evidence suggesting strong association between high levels of outdoor air pollution, higher systolic blood pressure (BP), and incident hypertension.\(^{27}\) According to the GBD study (2019) in India, 29.2% of deaths due to IHD and 16.2% due to stroke were caused due to air pollution.\(^{4}\)

**COPD:** There is evidence on linkages of COPD with air pollution at global level. Exposure to indoor air pollution due to solid biomass fuels resulted in increased risk of COPD by 2.65 times and chronic bronchitis by 2.89 times as compared to non-biomass fuels.\(^{28}\) A 10-μg/m³ increase in PM 2.5 concentration was associated 0.96% increase in COPD mortality.\(^{29}\) An increase of NO₂ concentration (by 12% per 10 μg/m³ NO₂) contributed to increased morbidity associated with COPD hospitalisation.\(^{30}\) In India, 32.5% of deaths due to COPD were attributable to air pollution in 2019.\(^{4}\)
Asthma: As per studies, NO\textsubscript{2} concentration increased the risk for asthma patients to be hospitalised on the day of exposure by 10% per 10 μg/m\textsuperscript{3} NO\textsubscript{2} increase.\textsuperscript{31} Globally, it has been estimated that 4.0 million new paediatric asthma cases could be attributed to NO\textsubscript{2} pollution annually.\textsuperscript{32} Research studies in Indian context are majorly focussed on linkages of indoor air pollution with asthma. Indoor suspended particulate matter (SPM) level was found significantly higher in the asthmatic children's houses in India.\textsuperscript{33} Adult women living in households using biomass and solid fuels have a significantly higher risk of asthma than those living in households using cleaner fuels.\textsuperscript{34}

Cancers: There is global evidence suggesting the association between incidence of cancers or mortality due to cancers with exposure to certain air pollutants. Research studies highlighted 9% increase in risk for lung cancer incidence or mortality with 10 μg/m\textsuperscript{3} increase in PM 2.5 concentrations.\textsuperscript{35} PM2.5 was associated with increased risk of mortality for many other types of cancers (along with lung cancer) like cancer of the upper digestive tract, pancreatic cancer and breast cancer in females.\textsuperscript{36} In India, 1.7% of deaths due to lung cancer in 2019 were attributed to exposure to pollutants.\textsuperscript{4}

Diabetes: Research at global level provided positive association and linkages between higher air pollution levels and greater diabetes-caused mortality. Exposure to PM 2.5, PM 10, and NO\textsubscript{x} has been attributed to Type 2 Diabetes (T2D) prevalence.\textsuperscript{37} 10 μg/m\textsuperscript{3} increase in PM2.5 was associated with a 25% higher risk of T2D.\textsuperscript{38} In India, 3.8% of deaths due to diabetes in 2019 were caused by air pollution.\textsuperscript{4}

Mental Health Conditions: Studies at global level revealed that exposure to NO\textsubscript{2}, NO\textsubscript{x}, PM2.5 and PM10 were associated with 32%, 31%, 7% and 9% increased risk for community mental health services events.\textsuperscript{39}

Parkinson's disease: Research at global level revealed that highest levels of NO\textsubscript{2}, commonly released by vehicles and power plants, were 40% more likely to have the Parkinson's disease, compared with people who had the lowest levels of exposure.\textsuperscript{40,41}

Earlier air pollution earlier was perceived to be harmful for lungs but evidence on its correlation with other NCDs like mental disorders, CVDs, cancers and diabetes are emerging.

COVID 19 and Air Pollution

During the COVID-19 pandemic, increased number of cases were recorded in the most polluted regions worldwide.\textsuperscript{42} Exposure to air pollution weakened the immune system and increased the individual’s susceptibility of contracting the infection.

- Epidemiologists explained that air pollution can affect the COVID-19 pandemic in three ways: increasing transmission, increasing susceptibility, and worsening the severity of the infection.
- Evidence suggested that long-term exposure to certain pollutants like PM 2.5, NO\textsubscript{2} and SO\textsubscript{2} led to respiratory inflammation and series of respiratory complications which exacerbated COVID-19 infection.\textsuperscript{43}

Chronic exposure to air pollution and compromised respiratory and immune system are highly potent risks in accelerating the transmission and fatality of COVID-19.

WHO MANIFESTO FOR A HEALTHY RECOVERY FROM COVID-19 44 provides an overview of actionable points to ensure an inclusive, resilient and green recovery. Two key actionable points to curb down air pollution include:

1. Developing coherent multi-sectoral policies and actions across transport, industry, power generation, waste and wastewater management, agriculture, housing and land use sectors for preventing air pollution.
2. Developing and implementing policies to ensure clean fuels and technologies for cooking, heating and lighting in households.
Economic Impact of Air Pollution

Global
Coupled with the adverse health consequences exposure to air pollution can also lead to economic burden on individuals, families and countries. Individuals exposed to pollutants suffer from the adverse impacts of air pollution and are more likely to take days off work resulting in reduced productivity. Air pollution imposed heavy economic burden both on global economy as well as growth of LMICs. The economic burden was due to premature deaths, lost earnings, and increased healthcare expenditures which constrained productivity. The single most important indicator to capture this economic impact is Gross Domestic Product (GDP) which measures the output generated within the borders of a country during a certain period. According to a World Bank study on economic impact of air pollution exposure (using GBD 2019 data), the global economic welfare loss as a result of mortality and morbidity caused due to exposure to PM 2.5 in 2019 was US$8.1 trillion, equivalent to 6.1% of global GDP. The economic loss was 10.3% of total GDP in South Asia.

India
The catastrophic burden of mortality and morbidity due to air pollution resulted in substantial adverse economic impact from loss of output in India. The financial loss that resulted from premature deaths and morbidity due to air pollution was approximately US$28.8 billion and US$8.0 billion, respectively in 2019. This total loss of US$36.8 billion was 1.36% of India's GDP.

Programmatic and Policy Response to Air Pollution

Global
The global threat of air pollution was recognised by the United Nations Environment Assembly (UNEA) and Resolution 1/7: Strengthening the Role of the United Nations Environment Programme (UNEP) in Promoting Air Quality was adopted in June 2014.

Following this UNEP developed Air Pollution Series Actions on Air Quality: A Global Summary of Policies and Programmes to Reduce Air Pollution. This new report in 2021 is developed by UNEP as an update after the 2016 report Actions on Air Quality which provided an overview of actions undertaken by countries around the world. The new report presented an overview of the actions taken by Governments of 194 countries to promote better air quality.

Figure 2 shows the global progress towards adoption of key actions that can significantly improve air quality.
Some key findings of this Report were:\(^{48}\)

- Many countries throughout the world had incentives or policies promoting cleaner production, energy efficiency and pollution control for industries.
- The policies to reduce emissions from the on-road transportation sector remained critical in majority of the countries.
- Many countries were meeting the Euro 4/IV vehicle emission standard which is environment friendly.
- The number of countries that regulated open waste burning had increased significantly but still a majority remain without any strict laws in place.
- In terms of household air pollution, globally, it was seen that there was an increased availability of cleaner fuels and an estimated global reduction in the burden of disease associated with the indoor air pollution.
- There was limited evidence of incentives to promote sustainable agricultural practices among the countries.
- More than a quarter of countries had a national air quality management strategy and about two thirds were found to have ambient air quality standards.
- Along with progress, this report also highlighted significant gaps in adopting key policies and actions that were known to reduce air pollution. The gaps included: difficulty in staff retention, capacity gaps, and affordability and maintenance challenges of air quality monitoring equipment. Countries were also facing larger, systemic challenges such as financing gaps resulting in inability to invest in data analysis, and a limited of enforcement capacity when policies and actions are adopted.
UN Framework Convention on Climate Change (UNFCCC)

The 26th session of the Conference of the Parties (COP 26) to the UNFCCC was held in 2021 and COP 27 was held in 2022.

COP26 of the UN Framework Convention on Climate Change (UNFCCC) brought together 120 world leaders and over 40,000 participants and highlighted the urgent need for dedicated action towards air pollution and climate health. COP 26 mostly focused on countries commitments to build climate resilient and sustainable health systems. Representatives from various countries pledged to prioritise health in their efforts to protect people from the impact of climate change, but the implementation of this strategy has been limited so far.49

At COP 27, leaders and representatives from more than 40 Climate and Clean Air Coalition (CCAC) countries came together along with other stakeholders from intergovernmental organizations, businesses, scientific institutions and CSOs and announced collaborative efforts and reaffirmed their commitment to tackle the short-lived climate pollutants (SLCPs).50 During COP 27, the United Nations Human Rights Council stressed on human rights obligations, standards and principles. The adverse impact of climate change on human rights was highlighted and the urgent need to respect human rights in all climate change action was emphasised upon at COP 27.51

India

The most important nodal agencies actively working on mitigation of air pollution from India includes Ministry of Environment, Forest and Climate Change (MoEFCC), Ministry of Health and Family Welfare (MoHFW), Central Pollution Control Board (CPCB), and National Centre for Disease Control (NCDC).

The Air Act of 198152 has been crucial in developing a framework for regulation of air pollution in India. CPCB developed the ‘National Ambient Air Quality Standards’(NAAQS) in 1982 for twelve parameters, including SOx, NOx, particulate matter, lead, CO, and ozone. State Pollution Control Boards (SPCBs) enforced the NAAQS in respective states. NAAQS was revised in 2009 and 12 pollutants were included in the new list.53 Periodic revision of NAAQS is undertaken and the re-establishment of these standards are planned in the near future. CPCB executed the first nationwide programme for monitoring of the pollutants under National Ambient Air Quality Monitoring (NAAQM) in 1984 with 7 monitoring stations.52 Following this, the National Air Quality Index was established in 2014 and officially launched in 2015. It is a tool for effective communication of air quality status to people in terms which are easy to understand. It helps in transforming the available complex air quality data on the various pollutants into a single number (index value), nomenclature and colour. There are six Air Quality Index (AQI) categories, namely Good, Satisfactory, Moderately Polluted, Poor, Very Poor, and Severe. SAMEER mobile application was developed by CPCB which is quite handy in providing hourly information about AQI levels for more than 100 cities across the country.54 SAFAR-India (System of Air Quality and Weather Forecasting And Research) is another mobile application introduced by the Ministry of Earth Sciences (MoES) to measure the air quality of metropolitan cities like Delhi, Pune, Mumbai and Ahmedabad. SAFAR not only monitors air quality, but also forecasts the quality of air.55
Air Pollution Mitigation Programmes in India

**National Air Quality Monitoring Programme (NAMP)**

**Year of Launch:** NAAQM launched in the year 1984 later renamed as NAMP

**Nodal Ministry/Agencies:** CPCB, SPCBs, Pollution Control Committees (PCC), National Environmental Engineering Research Institute (NEERI), Nagpur

**Overview**

- Main objectives of the NAMP are to determine status and trends of ambient air quality and to keep a check on whether the prescribed ambient air quality standards are violated or not.
- Network of NAMP, consists of 883 operating stations covering 379 cities/towns in 28 States and 7 Union Territories of the country.
- Among these monitoring network only 27 are located in rural hamlets.
- Non-attainment cities who violate the air quality standards are identified under this programme.
- Four air pollutants i.e., SO$_2$, NO$_2$ and Respirable Suspended Particulate Matter (RSPM / PM10) and PM 2.5 are monitored at regular locations.
- CO, Ammonia (NH$_3$), Pb, O$_3$, Benzene (C$_6$H$_6$), Benzo(a)pyrene (BaP), Arsenic (As) and Nickel (Ni) were monitored at specific locations and are slowly being added to the monitoring network under NAMP.
- Monitoring of regular parameters is carried out for 24 hours (4-hourly sampling for gaseous pollutants and 8-hourly sampling for PM) with a frequency of twice a week, to generate 104 observations in a year.

**National Clean Air Programme (NCAP)**

**Year of Launch:** Launched by the MoEFCC in 2019

**Nodal Ministry/Agencies:** MoEFCC, CPCB, SPCB, Ministry of Road Transport and Highways (MoRTH), Ministry of Power, Ministry of Petroleum and Natural Gas, Ministry of New and Renewable Energy, Ministry of Heavy Industry, Ministry of Housing and Urban Affairs, Ministry of Agriculture, Ministry of Finance, Ministry of Health and Family Welfare, NITI Aayog, experts from the industry, academia, and civil society

**Overview**

- Major objectives of this programme are to ensure stringent implementation of mitigation measures for prevention, and control of air pollution and to augment public awareness and capacity building measures on air pollution.
- NCAP has set a goal to improve the air quality across India by targeting 132 "non-attainment" cities where NAAQS were not being met.
- In 2019, 84 cities were tasked with reducing toxic particulate matter levels (PM 2.5 and PM10) by 20%-30% by 2024.
- MoEFCC had set a new target under NCAP programme aiming 40% reduction in annual levels of dangerous fine PM 2.5 air pollution by 2026.
- Under the NCAP, the ambient air quality network was further strengthened and currently there are 1243 stations in 465 cities/towns.
- Collaborative multi-stakeholder approach and multi-sectoral coordination between the relevant central ministries, state governments and local bodies is one of the key strategies highlighted under this programme.
- The NCAP tracker is available online which compiles and analyses information on air quality and budget allocation. This data is publicly available or provided by GoI.
- Portal for Regulation of Air-pollution in Non-Attainment cities (PRANA), is a web-portal for monitoring the implementation of NCAP. It supports tracking of physical and financial status of city air action plan implementation. This portal also disseminates information on air quality management efforts under NCAP to the general population.
National Programme for Climate Change and Human Health (NPCCHH)

Year of Launch: Launched by MoHFW in 2019 under National Health Mission (NHM)

Nodal Ministry/Agencies: NCDC, Centers of Excellence (CoE)- All India Institute of Medical Sciences (AIIMS), New Delhi, Postgraduate Institute of Medical Education and Research (PGI), Chandigarh, Vallabhbhai Patel Chest Institute (VPCI) were identified as the centres to work on air pollution. Public Health Foundation of India (PHFI) is the CoE for Health Adaptation on Green and Climate Resilient Healthcare Facilities.

Overview

- Major objectives under this programme includes creating general awareness among vulnerable communities like children, women and marginalised population, healthcare providers and policy makers regarding impacts of climate change on human health.
- Other objectives include, strengthening capacity of healthcare system, health preparedness and response, and performing situational analysis at national/state/district/below district levels and strengthening research capacity to fill the evidence gap on climate change impact on human health.
- Key activities of the programme include development of IEC material on health impacts of climate variability and change and developing and strengthening of the monitoring and surveillance systems for climate sensitive diseases.

ClimateSMART Cities Assessment Framework

Year of Launch: Launched by Ministry of Housing and Urban Affairs (MoHUA) in 2019

Nodal Ministry/Agencies: MoHUA

Overview

- The objective of this framework is to enable Indian cities to assess their preparedness to tackle climate change and help them with a roadmap to achieve sustainable climate actions on the ground.
- “ClimateSMART Cities Assessment Framework” served as a tool for the cities to assess their current situation in combating climate change.
- In the first phase, the assessment established a baseline for 96 cities that participated. The second phase of the assessment was conducted for 126 cities in 2020.
- The ClimateSMART Cities Assessment Framework 3.0 (CSCAF 3.0) will further allow cities to learn from their performance in the previous assessment and help them scale up contextual best practices.
  - CSCAF 3.0 is broadly categorised into 5 themes with 28 indicators and includes air quality as one of the themes.
  - Level of Air Pollution (Monitoring) is one of the important indicators under CSCAF 3.0 to assesses the existing city level air quality monitoring mechanism and availability of air quality data in public domain.
  - Cities are meant to be assessed based on their pollutants monitoring, air pollution reduction strategies, implementation and compliance to national standards.
  - The total score for the indicator is 100 cities will be marked with scores ranging from 0 to 100.
  - The assessment framework 3.0 thus attempts to address both the mitigation and adaptation measures of climate change issues and the weightage for each theme has also been given in accordance with its relation to mitigation or adaptation potential.
Policies and Programmes addressing Indoor Air Pollution

India is home to more than 24 crore households out of which about 10 crore households are still deprived of Liquefied Petroleum Gas (LPG) as cooking fuel and use solid fuels like coal, firewood, dung cakes, etc for cooking.\(^{58}\) Evidence suggests that exposure to smoke from burning of such fuels adversely affected the health of women and children causing several health issues like acute LRIs,\(^ {59}\) and increases risk of having a stunted baby or low birth weight baby.\(^ {60}\) Three important programmes launched by GoI to safeguard the health of women and children by providing them with clean cooking fuel are:

**PAHAL (Pratyaksh Hanstantrit Labh) Gas Scheme** \(^ {61}\)

**Year of Launch:** 2013

**Nodal Ministry/Agency:** Ministry of Petroleum and Natural Gas

**Overview**

- PAHAL scheme was initially rolled out in 291 districts in India starting from 2013.
- The modified scheme was re-launched in 54 districts in 2014 in the 1st phase and was launched in the rest of the country in 2015.
- The scheme aims to benefit LPG consumers by directly transferring the subsidy amount to their respective bank account in order to enable the consumers to access affordable LPG connections without any issue.

**Unnat Chulha Abhiyan** \(^ {62}\)

**Year of Launch:** 2014

**Nodal Ministry/Agency:** Ministry of New and Renewable Energy

**Overview:**

- The objective of the programme is to develop and deploy improved biomass cookstoves for providing cleaner cooking energy solutions in rural, semi-urban and urban areas using solid fuel for cooking.
- The programme also aims to support awareness and marketing campaigns and creating enabling environment for mass production of processed biomass fuel.

**Pradhan Mantri Ujjwala Yojana (PMUY)** \(^ {63}\)

**Year of Launch:** 2016

**Nodal Ministry/Agency:** Ministry of Petroleum and Natural Gas

**Overview:**

- PMUY aims to minimize health issues arising from the use of unclean fossil fuel and to control indoor pollution.
- The scheme envisaged the distribution of 50 million LPG connections to women below the poverty line.
### Selected National Standards, Policies, Frameworks and Rules focusing on Air Pollution

<table>
<thead>
<tr>
<th>Policy/Programme</th>
<th>Nodal Ministry/Agency</th>
<th>Details</th>
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<tbody>
<tr>
<td>Construction &amp; Demolition (C&amp;D) Waste Management Rules (2016)</td>
<td>MoEFCC</td>
<td>Rules were meant to ensure that every waste generator shall keep the C&amp;D waste within the premise or deposit at collection centre made by the local body or handover it to the authorised processing facilities.</td>
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<tr>
<td>SATAT (Sustainable Alternative Towards Affordable Transportation) Scheme (2018)</td>
<td>Ministry of Petroleum and Natural Gas</td>
<td>Aims to promote Compressed Biogas (CBG) as an alternative, green transport fuel across the country. This scheme currently targets production of 15 MMT (million tons) of CBG by 2023, from 5000 plants.</td>
</tr>
<tr>
<td>National Biofuel Policy (2018)</td>
<td>Ministry of New and Renewable Energy</td>
<td>Goal of this policy is to ensure that a minimum level of biofuels are readily available in the market as a substitute for petrol and diesel for transport and aim to achieve 20% blending of biofuels with fossil-based fuels by 2030.</td>
</tr>
<tr>
<td>BS-VI Leapfrog (2020)</td>
<td>Ministry of Road Transport and Highways of India</td>
<td>India has implemented Bharat Stage VI (BS-VI) emissions standards nationwide in 2020, directly from BS-IV emissions standards which aims to reduce vehicular emission by at least 60-90%.</td>
</tr>
<tr>
<td>National Electric Mobility Mission Plan (NEMMP) (2020)</td>
<td>Ministry of Heavy Industries and Public Enterprises</td>
<td>The mission plan provided the vision and the roadmap for the faster adoption of electric vehicles and their manufacturing in India which will result in reduction of the pollution levels.</td>
</tr>
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A Steering Committee on Air Pollution and Health Related Issues was constituted by MoHFW, GoI in January 2014, with a view to frame an action plan for mitigating the adverse health impacts of indoor and outdoor air pollution. The report provided the role of key government ministries to address the health impacts of air pollution. |
Sub-national Standards, Policies and Rules focusing on Air Pollution

Forty-Two Action Points

- The CPCB has issued a comprehensive set of directions under Section 18 (1)(b) of Air (Prevention and Control of Pollution) Act, 1986, for the implementation of 42 action points to mitigate air pollution in the major cities, including Delhi and NCR.
- 42 action points were issued initially for implementation in NCR and then was subsequently extended to state boards for the implementation in other non-attainment cities.


- To curb the air pollution and maintaining the air quality in National Capital Region of Delhi, a Graded Response Action Plan has been prepared for implementation under different AQI categories namely, Moderate & Poor, Very Poor, and Severe along with a new category of “Severe+ or Emergency”.
- For proper implementation of GRAP action and coordination is required among Delhi Pollution Control Committee (DPCC), state pollution control boards of Haryana, Rajasthan and Uttar Pradesh.
- In instances, where the concentration of particulate matter reaches the dangerous levels, the Government can impose tough regulations like prohibition of construction activities in certain areas, closing of schools or banning of crackers etc.


- Comprehensive Action Plan was drafted by Environment Pollution (Prevention and Control) Authority (EPCA) for Delhi and NCR in consultation with the CPCB and the DPCC of the Delhi government.
- Comprehensive action plan aims to identify the short-term priority actions, as well as the long-term goals to present a pollution source-wise action plan. CAP works to combat air pollution in collaboration with the GRAP which comes into effect when air quality degrades.

Odd Even scheme in Delhi (2017)

- The odd-even scheme was introduced by the Delhi Government to mitigate the issue of rising pollution.
- According to the scheme, all private vehicles, except two-wheelers will be allowed to run across the city based on their registration numbers (odd or even).

Agricultural mechanisation for in-situ management of crop residue (Punjab, Uttar Pradesh, Haryana, Delhi NCR 2018)

- In Indo-Gangetic plains of the states of Punjab, Haryana and Uttar Pradesh, paddy stubble burning is the most common reason for air pollution.
- To support the Governments, a Central Sector Scheme on ‘Promotion of Agricultural Mechanization for In-Situ Management of Crop Residue in the States of Punjab, Haryana, Uttar Pradesh and NCT of Delhi’ is being implemented from 2018-19.
- Under this scheme financial assistance is provided, where 50% of the cost of machinery is provided to the farmers for purchase of crop residue management machinery and financial assistance at 80% of the project cost is provided to the cooperative societies of farmers [Farmers Producers Organisation (FPOs)] and other such organisations.
Happy Seeder Agricultural Technology

- This emerged as the most profitable residue management practice subsidised for farmers by the Punjab and Haryana Government.
- However, certain barriers still exist such as lack of knowledge among farmers regarding the new solutions like Happy Seeder, lack of awareness on adverse impact of burning and uncertainty about sustainability and use of new technologies.

Other initiatives in India to mitigate air pollution:

- India has joined the Climate and Clean Air Coalition (CCAC), becoming the 65th country to join the partnership, in 2019. India will work with Coalition countries to adopt cleaner energy sustainable production and consumption patterns and environment-friendly transport, agriculture, industry and waste management to promote clean air.
- Country Partnership Framework (CPF), India- CPF, India was developed as a result of strong collaboration between the World Bank Group (WBG) and India. The programme is introducing tools to support state and regional air quality management approaches. The World Bank is also supporting the National Knowledge Network (NKN) in establishing a training programme to enhance the capacity and skills of citizens to take on new jobs in air pollution management.

COP 26 and COP 27 provided an opportunity for India to engage in discussions with other countries and benefit from a number of available strategies on climate change. India participated at COP 26 and COP 27 with an aim to align Indian goals to tackle the burden of climate change with global commitments.

COP 26

- India declared ‘five elixirs’, at the COP 26 climate summit.
- India will bring its non-fossil energy capacity to 500 GW by 2030.
- India will bring its economy’s carbon intensity down to 45 per cent by 2030.
- India will fulfil 50 per cent of its energy requirement through renewable energy by 2030.
- India will reduce 1 billion tonnes of carbon emissions from the total projected emissions by 2030.
- To become carbon neutral and achieve net-zero emissions by 2070.

COP 27

- Unveiling of the MoEFCC-UNDP Compendium “Prayaas Se Prabhaav Tak - From Mindless Consumption to Mindful Utilization.”
- MoEFCC and United Nations Development Programme (UNDP) jointly launched “In Our LiFEtime” campaign to encourage youth between the ages of 18 to 23 years to become message bearers of sustainable lifestyles.
- India has insisted on higher global climate finance target by 2024. India highlighted that robust climate actions require financial, technological, and capacity building support from developed countries.
Civil Society Coalitions and Research Consortia: Key Stakeholders for action on NCDs and Air Pollution in India

There are a number of key organisations and consortia in India that are working in the area of air pollution. Many of these focus specifically on air pollution as a public health and NCDs issue. The expansive scope of work ranges from multi-dimensional research; capacity building of key stakeholders; sensitisation of communities, policy makers, programme planners/implementers; policy and programmatic action; communications and outreach and; multi-stakeholder engagement. Over the past few years, many of these organisations have been working collaboratively to build bridges between the NCDs/public health sector and the environmental health/climate change sector to identify and operationalise synergistic strategies and steer common goals to ameliorate the health, economic, social and developmental toll of air pollution.

Selected organisations/consortia/coalitions working on Air Pollution in India

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Description</th>
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<tbody>
<tr>
<td>Centre for Environmental Health (CEH), Public Health Foundation of India (PHFI)</td>
<td>CEH is based at the PHFI in partnership with the Tata Institute of Social Sciences (TISS), Mumbai. CEH aims to understand and address the environmental health burden of disease in India. The centre aims towards building capacity, promoting research, advocacy and communication on environmental health.</td>
</tr>
<tr>
<td>Collaborative for Air Pollution and Health Effects Research—India (CAPHER- India)</td>
<td>CAPHER is a national research network focused on air pollution and health effects research in India. CAPHER is coordinated by the All India Institute for Medical Sciences (AIIMS-Delhi), in collaboration with the Indian Institute of Technology-Delhi (IIT-Delhi). The CAPHER network brings together health and environment researchers, representatives from various scientific disciplines including atmospheric chemistry, air pollution measurement and modeling, epidemiology, biostatistics, medicine, basic sciences and health policy.</td>
</tr>
<tr>
<td>Clean Air Fund, India</td>
<td>Clean Air Fund, India aims to support air quality monitoring and management initiatives in the country. The organisation works towards building capacity on air quality data collection and engaging community in air pollution mitigation activities. Clean Air Fund empowered the healthcare professionals and amplified the health voices in the clean air movement.</td>
</tr>
<tr>
<td>Clean Air Asia</td>
<td>Clean Air Asia engage with Indian cities for better air quality management. The organisation provides scientific input to city governments for better air quality, particularly in the context of facilitating Clean Air Action Plans (CAAPs) and education/communication for cleaner air.</td>
</tr>
<tr>
<td>Care for Air</td>
<td>The organisation develops and implements awareness-building campaigns to broaden society’s understanding about the causes and effects of air pollution and the dangers to individual health. It brings together members from various backgrounds including journalism, business, education, medicine, public health, atmospheric science, and legal practice.</td>
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</tbody>
</table>
Pulmocare Research and Education Foundation (PURE)*

The PURE Foundation aims towards respiratory research, education and advocacy. PURE Foundation has many research studies on the damage to human health due to increasing air pollution in India. The goal of PURE is to strengthen capacity building and knowledge dissemination in respiratory care for healthcare providers, policy makers and other potential stakeholders.

Lung Care Foundation (LCF) *

Lung Care Foundation aim to improve the overall lung health by preventing all lung diseases through education, research and by providing affordable and accessible clinical care to all. Massive awareness campaigns were organised by LCF about ill-effects of air pollution and lung health. LCF in partnership with Health Care Without Harm, launched ‘Doctors for Clean Air’ (DFCA), bringing together more healthcare professionals representing every state of the country to pledge to be advocates for Clean Air i.e. Clean Air Champions by highlighting the health ill-effects of Air Pollution.

Health Care Without Harm (HCWH)

HCWH works to transform health care worldwide so that it reduces its environmental footprint, becomes a community anchor for sustainability, and a leader in the global movement for environmental health and justice.

HCWH supported by Clean Air Fund is building a network of health workers in India who can act as clean air champions for patients, policy makers and the wider public.

CONsortium for Climate and Health, South Asia (CONCH)*

CONCH was launched by CEH, PHFI and the Centre for Chronic Disease Control (CCDC). The Consortium aims to provide a platform to jointly work, learn and build capacities to address climate change and health through research, training, remediation, communications and sharing of best practices for mitigation and adaptation in the South Asia Region. CONCH will also work to enhance advocacy for climate change and health through engagement of health sector representatives with peers and with other sectors.

Consortium for Climate, Health and Air pollution Research in India (CHAIR-India)*

CHAIR-India was established by CEH, PHFI in collaboration with the CCDC, Karolinska Institutet (KI), Harvard T. H. Chan School of Public health (HSPH), Boston University School of Public Health (BUSPH), University of Copenhagen (KU) and Ben Gurion University of the Negev (BGU). CHAIR- India convened researchers working on health and environment to address the research gaps in health effects of air pollution in India. Exposure scientists and health researchers from across India came together to explore the scope for collaborative work to enhance the evidence base for the health effects of air pollution in India.

Clean Air Collective

Clean Air Collective is a pan-India network of organisations/individuals/citizens groups/institutions/CSOs etc formed with an objective of complementing each other’s work and amplifying all the voices coming from different parts of the country demanding their fundamental right that is clean air.

Centre for Science and Environment (CSE)*

CSE works extensively towards addressing the air pollution burden in India through their research work and disseminating the results through publications. CSE’s efforts are specifically designed to create awareness about the problems and propose sustainable solutions. Research at CSE consists of in-depth learning about an environmental problem and then finding answers to effectively tackle the same.
Need for a Multi-pronged Approach to Mitigate Air Pollution as a Major Risk Factor for NCDs

The synthesis of this Desk Review highlighted that the multi-dimensional challenge of air pollution in India warrants a multi-stakeholder and multi-sectoral approach towards its mitigation. Air pollution is a trans-boundary issue, and its alleviation requires coordinated multi-partner efforts across the national, sub-national and grassroots levels. It is essential to position air pollution not just as an environment or a climate change issue but also a critical public health issue given that it is a lethal risk factor for one of the gravest public health challenges – NCDs. Multiple ministries and departments of the National and State Governments need to act towards a common goal of clean air. Some key sectors include health, environment, transportation, power, petroleum, rural and urban development, agriculture, finance and others. These arms of the Government must be supported by other key stakeholders such as: CSOs, people with lived experience (living with one or more NCDs), communities adversely impacted by air pollution, youth, research scientists, economists, and the private sector.

Global Environmental and Occupational Health (GEOHealth)*

The GEOHealth project supported is by the Fogarty International Centre, US National Institutes of Health, is a partnership between the PHFI, CCDC and the Harvard T.H. Chan School of Public Health. The GEOHealth programme aims to accelerate scientific infrastructure development, support research and evidence generation on relationship between air pollution and cardio-metabolic risk factors and diseases in India. The project also aims to build a critical core of environmental health researchers in India that will help to further strengthen the evidence base for health-centric policymaking across sectors.

Healthy India Alliance (India NCD Alliance) (HIA)*

HIA is a coalition of 26 multi-disciplinary CSOs aiming to augment national and sub-national civil society action on NCDs, through multi-sectoral and multi-stakeholder partnerships. HIA aims to augment meaningful engagement of civil society and people with lived experience for prioritising multi-stakeholder action for mitigation of air pollution as a risk factor for NCDs.
4. Stakeholder Dialogues

Six Stakeholder Dialogues were conducted with experts working on air pollution and/or NCDs, researchers, CSO representatives, youth and people living with NCDs affected by air pollution. The intent was to garner their insights on challenges and opportunities for prioritising air pollution as a key area of multi-sectoral and multi-stakeholder action, with a focus on NCD prevention and control. The outcomes of these stakeholder dialogues are summarised in this section.

Salient Findings

Key barriers for effective air pollution mitigation strategies elicited from these Stakeholder Dialogues included:

1. Geographic and regional disparity in addressing air pollution, often as a North India-centric issue.
2. Limited attention accorded to air pollution as a public health/NCDs issue with the dominant narrative being around an atmospheric or climate change issue.
3. Air pollution being considered as a risk factor predominantly for respiratory diseases, with inadequate understanding of its strong linkage with other NCDs such as CVDs, diabetes, cancers, mental health conditions and other chronic conditions.
4. Requirement for updation of source apportionment studies based on which air pollution mitigation policies and programmes are developed.
5. Insufficient involvement of communities and people with lived experience affected by air pollution, in measures to curb air pollution and address associated NCD risk.
6. Need for cohesive multi-sectoral and multi-stakeholder coordination and action to address air pollution mitigation as an imperative for effective NCD prevention and control.

Key findings are summarised:

Sources of air pollution (Outdoor and Indoor)

Outdoor (ambient) air pollution is attributable to vehicular, industrial and agricultural sector emissions. Indoor air pollution results from multiple sources like burning of solid fuels such as crop waste, dung, wood, charcoal and coal for cooking and heating, mainly in rural households. Inadequate ventilation can possibly increase indoor pollutant levels. Emerging evidence was highlighted on how burning of mosquito coils and incense sticks substantially contribute to indoor air pollution.

“The air pollution levels in India are the highest in the world and posing a great threat to India’s health and economy.”

CSO representative
Urban-Rural and geographic disparity in addressing air pollution

The stakeholders unanimously opined that there exists an urban-rural disparity in addressing air pollution in India. Deteriorating indoor and outdoor air quality in rural areas of India remains a neglected issue. Air quality monitors under the NAMP, do not cover rural areas, and are disproportionately located throughout India with major centres around Northern India. Real time air quality monitors are less in number and are majorly located in Tier 1 or Tier 2 cities. Even though air pollution is a trans-boundary issue, it is often misinterpreted as a North India-centric issue. The stakeholders strongly stated that air pollution needs to be considered as a pan-India challenge, and not a region-specific issue.

Limited recognition of air pollution as a major risk factor for NCDs

Most stakeholders opined that the narrative around linkages of air pollution and broader NCDs in India needs to be strengthened further. CSOs, researchers, policy makers, media, people affected by air pollution and the community as a whole, need to champion the cause of air pollution mitigation within overall strategies and interventions for NCD prevention and control in the country.

“Air pollution has been recognised as a problem, but its effect on NCDs is an area that needs to be explored.”

UNDP representative

Even though there is growing evidence around air pollution as a predominant risk factor for NCDs, it still focuses majorly on respiratory health. Evidence is emerging on air pollution and its effect on mental health, CVDs, diabetes, cancers and other short- and long-term health conditions, globally as well as in Indian context. Recent research also established PM 2.5 as a risk factor for low birth weight and adverse pregnancy outcomes in the Indian context. However, there is an urgent need to expand the body of research so as to ensure that these research outcomes establish air pollution mitigation as an imperative for NCD prevention and control in the country. This will ensure that NCD policy making, programming and health promotion interventions are evidence-informed and designed to address air pollution as a major risk factor for the burgeoning burden of NCDs in India.

“Air pollution is largely seen as a problem leading to respiratory diseases. There is a lot of evidence which is emerging that air pollution impacts cholesterol, blood pressure and obviously, Maternal and Child Health and birth weight.”

Researcher

Need to update source apportionment studies to better inform policies and programmes

Source apportionment studies are the studies meant to derive information about primary and secondary pollution sources and the amount they contribute to air pollution levels. Source apportionment studies on which policies and programmes of air pollution in India are based needs to be updated after 2016. Any strategies adopted by various agencies based on older estimates would be less effective given the current rising burden of air pollution across the country. This underscores the need for new source apportionment studies in India. Stakeholders also highlighted the need for a comprehensive evidence-based ‘cause list’ mentioning key causes of air pollution.
Another point that the stakeholders reiterated was limited research on the consequences of air pollution with respect to economic losses and agricultural sensitivities to air pollution affecting crop yield and quality.

“Source apportionment studies, based on which policy decisions are taken in India, in my opinion they are kind of old. We must update the data to ensure that policies are effective.”

Researcher

Existing programmes and policies to mitigate air pollution

In order to combat the issue of air pollution, India is taking many significant steps. The stakeholders highlighted the national programmes like NCAP and NPCCHH. They also highlighted the ClimateSMART Cities Assessment Framework launched by Ministry of Housing and Urban Affairs (MoHUA) to guide cities to be greener and more resilient to adverse impacts of air pollution and climate change. Further strengthening the city specific implementation plans under NCAP and making them more robust to meet annual average ambient air quality standards throughout the country was recommended.

The stakeholders appreciated efforts taken by National Centre for Disease Control (NCDC) as the nodal agency for NPCCHH. They also highlighted nationally reputed institutes under NPCCHH, that have been identified to provide technical expertise in specific health-related domains and are known as Centres of Excellence (CoE). Some of these include: AIIMS New Delhi, PHFI, PGI Chandigarh, VP Chest Institute and National Institute of Mental Health and Neurosciences.

Discussions around burden of indoor air pollution and programmes in India pertaining the same highlighted the Pradhan Mantri Ujjwala Yojana and Unnat Chulha Abhiyan. The need to further strengthen service delivery and effective implementation were emphasised.

Ensuring sustainability of these programmes in effectively contributing to reduction in the level of air pollution burden was also underscored. The respondents share few sustainable policies directly targeting air pollution, including the National Policy on Biofuels by the Ministry of New and Renewable Energy which aims at mainstreaming biofuels in India.

“Currently there are few policies for air pollution which are focused on sustainability. There is a need to look at long-term impact.”

UNDP Representative

Current status and need for multi-stakeholder and multi-sectoral coordination towards addressing air pollution

All stakeholders opined the need for synergistic multi-stakeholder and multi-sectoral coordination. They highlighted the key need to break vertical silos and adopt an integrated horizontal approach across sectors and partners, as a key measure to ensure more effective programme implementation and progress towards the collective goal of clean air for all.

“There is a need to have multi-stakeholder and multi-sectoral dialogues in our country for strengthening the impact of actions on air pollution.”

Researcher
Since the onus of implementing programmes addressing the burden of air pollution lies with various stakeholders, scaling-up collaboration among them was reiterated. The stakeholders unanimously agreed that this multi-faceted challenge of air pollution requires a unified sustainable strategy which has the buy-in from all stakeholders including key Government ministries, researchers, CSOs and the community.

The role of public sector stakeholders including city councils, mayors, city administrative departments, municipal corporations, regional and local governments, and regulatory bodies was stressed. The role of the private sector through collaborations with public sector was also highlighted. Private sector players include industrial groups, commercial companies who have major impact on air quality management, and informal sectors groups need to be actively engaged.

**Meaningful involvement of people with lived experience and civil society**

The stakeholders stressed on meaningful involvement of groups who are potentially more vulnerable than others to air pollution. These groups include: women, children, senior citizens and people living with NCDs, particularly those impacted by air pollution. The respondents of the Stakeholder Dialogues unanimously agreed that active community involvement needs to be embedded into decision-making processes revolving around air quality.

> **Public is one of the major players while formulating air pollution measures.**  
> 
> *CSO representative*

It was opined that there is a need to involve people who are directly affected by air pollution mitigation policies, while policies are being formulated so that community experience can inform policy making. It is important that policy formation around air pollution adopts a bottoms-up approach by taking into consideration the voices from communities bearing the maximum brunt of air pollution.

> **The best way to make an effective policy will be to engage communities through discussions so that policy makers can understand what do people want from the policy, so that they can frame a strong policy.**  
> 
> *Youth representative*

The proactive involvement of CSOs working in the space of NCDs and/or air pollution as well as vulnerable communities affected by air pollution in multi-stakeholder strategy formulation and policy implementation was strongly supported by the respondents.

> **Unless we have a proper stakeholder engagement or dialogue with all the stakeholders for whom these policies, decisions or implementations or actions are passed, there will always be a mistrust.**  
> 
> *Youth representative*

It was pointed out that there is sub-optimal engagement of vulnerable groups in decision making processes around health and/or air pollution, even though they are the most affected, such as youth. Youth bear the burden of greater exposure to air pollution at a younger age which can have severe health repercussions in adulthood and old age. Respondents highlighted that it is important to have voices of young people at forefront to tackle the air pollution crisis.
Role of civil society

The Stakeholder Dialogues revealed the important bridging role of CSOs working on NCDs and/or air pollution. They can foster links between key stakeholders including the Government, researchers, media and the community at large. CSOs can be involved in air pollution and NCD policy making processes, public sensitisation campaigns and garnering public support to ensure policy compliance.

“CSOs are concerned about air pollution and climate change and can make a deep impact. I think we should utilise them properly in a way by taking their help in identifying the non-compliance for air pollution efforts.”

Researcher

One critical role of CSOs is towards enhancing public sensitisation regarding the diverse health effects of air pollution, in order to increase public demand for better air quality. CSOs working with selected vulnerable communities like children, adolescents, people with lived experiences and geriatric population should be integrally involved in air pollution mitigation efforts. By keeping the line of communication open between CSOs and implementers of clean air action programmes, effective onground implementation of strategies can be ensured.

“The role of CSOs is very important because they bring the perspective of what the effects of air pollution are, how can they be measured and how can they be addressed.”

UNDP representative

Barriers in actions towards addressing air pollution

It was pointed out that one of the key barriers around air pollution mitigation was the sporadic seasonal focus on air pollution as compared to a sustained approach long-term approach. This often leads to piecemeal and short-term strategies to curtail air pollution when it is at its peak. A sustained long-term strategy to address the underlying causes of air pollution and its health, economic, social effects.

“Most of the responses to air pollution are focusing on October to January peak period. So, you cannot really address a problem which is year-round by doing something only in the peak time.”

UNDP representative

Another major challenge revealed towards effective mitigation of air pollution was the uncertainty of data specifically for urban and rural pollution distribution. Large-scale evidence for levels of air pollution in rural areas is limited given that majority of the air quality monitors are localised in urban areas of the country.

There are existing programmes in place to mitigate air pollution, but certain implementation related challenges were highlighted. Even though programmes are in place to target indoor air pollution, affordability and availability issues affect the sustainability of using cleaner fuels. For proper implementation of air pollution programmes and policies, accountability studies are important to evaluate their effectiveness. Stakeholders mentioned the inadequacy of air pollution accountability studies in India. Even though certain efforts like reducing vehicular, power plant or industrial emissions are taken, the outcome of these measures cannot be measured as emission data is not regularly updated.
5. Recommendations

This Situational Analysis has underscored that unchecked exposure to indoor and outdoor (ambient) air pollution and the burgeoning burden of NCDs are among the most critical environmental and public health challenges faced across the globe and in India. It is clear that a comprehensive national response to NCDs is incomplete without robust air pollution mitigation across the country. However, there is a need to build a pan-India narrative around air pollution not just as an environmental issue for a few regions but, as a public health challenge that affects people across the length and breadth of the country. It is also essential to operationalise a long-term, sustained and multi-component strategy for air pollution mitigation and not just sporadic seasonal measures. Key recommendations that emerged from the Situational Analysis are summarised.

Synergistic goals and targets on curbing air pollution within the SDGs, NCAP and National NCD targets.\textsuperscript{9,10,12} (Image source- HRIDAY)
Prioritising multi-stakeholder and multi-sectoral coordination to address air pollution as an urgent NCD and public health issue

- Advancing inter-ministerial and inter-departmental coordination between key sectors including, environment; health; transportation; urban affairs; rural affairs; finance; power; petroleum and natural gas.
- Establishing synergy and integration between key NCD and air pollution centric programmes of the Government, including NAMP (MoEFCC), NCAP (MoEFCC), NPCCHH (MoHFW), ClimateSMART Cities Assessment Framework (MoHUA).
- Channelising efforts of key NCD prevention and control stakeholders towards achieving the national NCD target of 50% relative reduction in household use of solid fuels as a primary source of energy for cooking.
- Implementing synergistic measures to attain the goals and targets on curbing air pollution within the SDGs, national NCAP goal and national NCD targets.
- Garnering multi-stakeholder support for expanding the national NCD target to encompass both indoor and outdoor (ambient) air pollution.
- Convening multi-stakeholder taskforces, at the national and sub-national levels comprising of experts in NCDs/public health and air pollution/atmospheric sciences, including representatives from the Government; UN partners; research scientists; medical professionals; urban local bodies; civil society; people with lived experience/people living with NCDs affected by air pollution; youth; communication and health promotion specialists and; the community at large.
- Monitoring sources of air pollution through community-led action including industrial pollution, construction sites, crop residue burning, vehicular emissions, household practices and others.
- Integrating the expertise people living with NCDs affected by air pollution as key stakeholders in decision making processes.
- Empowering youth as champions of clean air norms to garner buy-in from key stakeholders.

Strengthening the evidence base for multiple pathways linking NCDs and air pollution

- Expanding the local evidence base linking the adverse health outcomes of exposure to indoor and outdoor (ambient) air pollution to major NCD including CVDs, diabetes, cancers (apart from lung cancer) and mental health conditions.
- Generating robust research evidence on the negative consequences of air pollution leading to economic and agricultural losses and further exacerbating vulnerabilities and socioeconomic disparities among marginalised populations.
- Updating source apportionment studies to strengthen evidence-based policy formulation and enforcement as well as programme planning and implementation.
- Creating an evidence-informed ‘cause list’ documenting key causes of air pollution.
- Rolling-out a health surveillance-based system to quantify the health benefits of air pollution mitigation strategies and vice-versa, the health risks (including NCDs) of unchecked exposure to air pollution.
• Developing an integrated vulnerability assessment framework to further strengthen health-risk mitigation and air quality management policies and programmes.

• Conducting mixed methods (qualitative and quantitative) research to understand behavioural and psychosocial determinants linked to air pollution and their impact on NCD risk.

**Capacity building of key stakeholders to advance robust action on NCDs and air pollution**

• Strengthening research capacity through cross-pollination and knowledge sharing between NCD/public health researchers and air pollution scientists, to foster integration in policies and programmatic interventions.

• Sensitising medical associations and professionals beyond pulmonologists, including cardiologists, endocrinologists, neurologists, psychiatrists, gynaecologists, paediatricians, community medicine specialists and others, to render advice on precautions for minimising health impact of air pollution exposure.

• Honing capacity of multi-disciplinary CSOs to partake evidence-based action at the upstream (partnering with national, sub-national and local governments) and downstream (mobilisation of stakeholders working on ground and in the grassroots) levels, for adopting an integrated approach to address NCDs and air pollution.

• Leveraging the proficiency of people living with NCDs impacted by air pollution and young people, as key voices for air pollution mitigation, towards preventing, managing and controlling NCDs.

• Mobilising communities at large to generate demand and support for behaviours, practices, norms and policies which build a public narrative around air pollution as a NCD issue.

**Role of CSOs**

• Enabling multi-stakeholder dialogue between Government, researchers, technical experts, UN partners, urban local bodies, youth, people living with NCDs and vulnerable communities, towards joint action on air pollution and NCDs.

• Providing inputs on agenda setting to ensure that research evidence and community voices are considered during policy making.

• Unlocking and disseminating existing evidence on air pollution mitigation as a NCD prevention and control strategy to decision makers, fellow CSOs, people living with NCDs and the larger community.

• Undertaking multi-disciplinary research, including implementation science research, to identify best practices and cost-effective interventions that can be scaled-up as an integrated response to NCDs and air pollution.

• Acting as watch dogs to monitor compliance with existing policy regulations from various ministries and departments of the Government.

• Facilitating public support and multi-stakeholder buy-in for robust policy formulation and enforcement.

• Fostering meaningful involvement of people living with NCDs and those impacted by air pollution, as key stakeholders in ensuring that mitigation measures are sensitive to community needs and priorities.

• Targeting outreach of policy and programmatic measures to grassroots and vulnerable communities.

• Harnessing opportunities for resource mobilisation to support collaborative air pollution alleviation and NCD prevention and control initiatives including research, capacity building, evaluation, communication and health promotion.
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