CAPHER-India

Collaborative for Air Pollution and Health Effects Research -India

Recommendations on the India National Ambient Air Quality Standards Revision

Based on deliberations at the Consultation– Cum – Workshop on Air Pollution and Health in India: Current Evidence to inform the India NAAQS Revision

May 29, 2023 | New Delhi, India

Organizing Partners

All India Institute of Medical Sciences, New Delhi, India
Indian Institute of Technology, Delhi, India
Health Effects Institute, USA

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Recommendations for the India NAAQS Review Committee

Drawing on the deliberations on May 29, 2023, and subsequent communication via email among members, the Collaborative for Air Pollution and Health Effects Research- India (CAPHER-India) recommends the following with regards to the revision of Indian NAAQS:

For current revision of NAAQS:

- There is considerable scientific evidence on the health effects of air pollution in India. In the last decade, several studies have been published on health effects of air pollution, especially in the context of maternal and child health.
- Stringent air quality standards**,** and enforcement and implementation is likely to yield significant public health benefits in the long-term.
- Much of this evidence has studied the impact of fine particulate matter or $PM_{2.5}$. Globally too, $PM_{2.5}$ has been found to be the most consistent predictor of disability and deaths due to air pollution. As such, $PM_{2.5}$ should be used as the target pollutant in the context of air quality policies, including the National Clean Air Programme (NCAP). Attainable but ambitious interim targets should be kept under NCAP.
- Health sector is the important stakeholder in the mitigation measures. Hence, there should be co-ordination mechanism in the NCAP and Ministry of Health at all levels.
- Target reduction should be in the form of percentage reduction of $PM_{2.5}$ at the city level.

For consideration for NAAQS revision process and future cycles:

- A robust process for revision of NAAQS in India should include a clear, documented process with opportunities for engagement for experts and the broader public.
- The process should include multistakeholder consultations to ensure appropriate evidence is used and considered.
- Time bound implementation of revised standards in should be major thrust area

Furthermore, since scientific data and evidence underpins policy decisions, CAPHER-India recommends targeted investments in:

- Research studies
    - Studies exploring association between long-term exposure to air pollution and specific health outcomes. Current evidence linking air pollution to health outcomes in India is largely based on administrative and survey data, and thus ecological in nature.
    - Studies exploring multi-pollutant interactions and impacts
- Building and strengthening multistakeholder engagement and technical capacity.
- Broader interlinkage between air quality monitoring and policy action and the health surveillance programs under the National Programme on Climate Change and Human Health.
- Data integration and access:
    - Data harmonization for health data, including hospital databases, surveillance datasets, health registries etc. as applicable;
    - Data sharing platforms should be considered for air quality data, and where relevant and applicable, for health data, especially for publicly funded research. Availability of good quality data on air quality, health outcomes and associated factors is critical for promoting research.

1. Background:

Air pollution is the largest environmental risk to human health and is linked to a range of health, economic and societal impacts. Exposure to air pollution has been linked to several non-communicable diseases, including respiratory and cardiovascular diseases, lung cancer and diabetes as well as infectious diseases. In India, air pollution was linked to 1.67 million deaths.[1]

Air quality standards play an important role in air quality management. India first introduced the National Ambient Air Quality Standards (NAAQS) in 1982, with revision in 1994, 1998 and 2009. In 2009, the standard for fine particulate matter, or $PM_{2.5}$, was introduced for the first time. At the time, the in-country health evidence was relatively limited, and it is unclear how the available health data was used for setting the standards. However, the body of evidence has grown substantially since then, and there are studies on a variety of health outcomes.

In 2021, India through Central Pollution Board, Ministry of Environment, Forest and Climate Change launched a process to revise the NAAQS. The revision process offers an opportunity to review and consider the latest health evidence, both in India and globally, to allow for a strong health basis for the revised air quality standards, and to highlight areas where the future NAAQS revision process can be improved.

2. About Consultation-cum-workshop:

The CAPHER- India consultation-cum-workshop on "Air Pollution and Health in India: Current evidence to inform the Indian NAAQS revision process" was held in New Delhi, India on May 29, 2023. The consultation was jointly organized by All India Institute of Medical Sciences (AIIMS), New Delhi and Indian Institute of Technology (IIT), Delhi and Health Effects Institute (HEI), USA. The goals of the consultation were to bring together experts on air pollution and health to review the current evidence on health effects of air pollution in India and identify key messages for consideration as the Indian NAAQS are revised. During the meeting, speakers and participants discussed the NAAQS revision process, new evidence that can be useful in determining the revised standards and opportunities for procedural improvement for future revision cycles. The meeting also drew from the global evidence on health effects

of air pollution which underpin the revisions to the World Health Organization Air Quality Guidelines (AQGs) in 2021.

The meeting was attended by nearly 70 Indian and international experts. A detailed agenda (*Annexure-I)* and a list of participants *(Annexure- II)* are included with the report.

The planning and execution was undertaken by CAPHER-India in partnership with the Health Effects Institute.

3. Overview of India's National Ambient Air Quality Standards Revision Process

Dr. Mukesh Sharma (IIT Kanpur, India) gave an overview of the 2009 National Ambient Air Quality Standards (NAAQS) and the process for the current revisions. He highlighted that India was among the first set of countries to implement a $PM_{2.5}$ standard and is now carefully considering the air quality standards for revision. He noted that the review of standards occurs typically every 10 years, and considers available evidence on health effects including both mortality and morbidity outcomes, emerging pollutants, current and new measurement technologies, as well as emission trajectory, national perception and consensus. Dr. Sharma invited the CAPHER-India network to provide recommendations and support to advance this important air quality decision.

He raised several questions including:

- *Inclusion criteria for NAAQS*- What parameters should be used to consider what pollutants can be included in the NAAQS. Currently, standards are notified for the six criteria pollutants, including PM_{10}, $PM_{2.5}$, O_3, SO_2, NO_2 and CO as well as other pollutants such as ammonia, lead, arsenic, nickel, benzo(a)pyrene, and benzene.
- Given high levels of PM_{10} in the form of dust in many parts of India, Dr. Sharma also raised the question regarding the relevance and stringency of the PM_{10} standard.

- *Monitoring methods*- Opportunities for comprehensive monitoring of pollutants included under NAAQS, and technologies and methods available to collect data nationwide

4. Review and Revision of Ambient Air Quality Standards: The Global Experience

Participants at the meeting also discussed the standard setting process in other countries and regions. There is robust evidence for both short-term and long-term health effects of air pollution, and this evidence often underpins decisions related to ambient air quality standards. However, different countries have adopted different approaches to set and revise standards. In the US, for example, standards are revised every five years and consider available scientific evidence on health effects, through the *Integrated Science Assessment*, usually led by the staff at the US Environmental Protection Agency.

In revising the Air Quality Guidelines (AQGs) in 2021[1], the World Health Organization (WHO) undertook rigorous systematic reviews to assess the evidence and the Guidelines were significantly tightened as a result.[2] The WHO AQGs are not legally binding; countries can, however, use the Guidelines to inform their ambient air quality standard setting process. For example, in addition to the guideline value for key pollutants including PM_{10}, $PM_{2.5}$, SO_2, NO_2, O_3 and CO, interim targets that can be adopted by countries.

5. Evidence on the health effects of air pollution is robust and is consistent worldwide.

The workshop also reviewed the global evidence on health effects of air pollution. Globally, nearly 7 million deaths annually are linked to air pollution;[3] a variety of organ systems have been linked with health effects of air pollution including respiratory and cardiovascular systems. For several other health outcomes, there is growing evidence of impact on health including Impaired neurocognitive development in children (e.g., learning difficulties, loss of IQ, ADHD, autism), accelerated cognitive decline (dementia) in older people, and a higher risk of suicide, depression and anxiety. Exposure to air pollution has been linked to an increased risk of COVID-19.

Ambient, or outdoor air pollution has been declared to be a carcinogenic for humans by the International Agency for Research on Cancer.[4] Based on the latest evidence, there is strong

association between exposure to $PM_{2.5}$ and mortality even below the US NAAQS and WHO AQG of 5 µg/m^3. **Thus, no level of air pollution is without risk, and stringent air quality standards can help improve population health.**

6. Indian evidence on health effects of air pollution:

In the last two decades, evidence on health effects of air pollution has grown substantially. In North America and Europe, we now have evidence of health effects even at low levels of air pollution. In high-pollution environments, e.g., China, evidence on impacts of air pollution on respiratory and cardiovascular health is largely in line with global evidence. In India, researchers have used cohorts as well as administrative, survey and hospital data to study association between air pollution and various health outcomes.

6.1 Impact on cardiovascular health-

Deaths due to ischemic heart disease are among the largest contributors to air pollution's disease burden. Air pollution is also among the top five risk factor for both ischemic heart disease and stroke in India. While the evidence on cardiovascular effects of air pollution in India is limited, it is steadily growing, and the results are largely in line with the global literature.

Exposure to air pollution is linked to a higher risk of hypertension (i.e., higher systolic and diastolic blood pressure), acute coronary syndrome (heart attacks), heart rhythm abnormalities, heart failure associated hospitalization and stroke.[5]The multi-country study (PURE) that included India as one of the study sites, observed increase in $PM_{2.5}$ levels was associated with an increase in risk of a range of major cardiovascular events including myocardial infarction, stroke, heart failure[6]. In India, an analysis using data from the ICMR National Heart Failure Registry study found an association between $PM_{2.5}$ exposure (acute and cumulative) and outcomes related to heart failure, i.e., hospitalization and mortality[7].

6.2 Impact on respiratory (lung) health-

Several studies in India have examined the associations between air pollution and respiratory health (asthma, respiratory infections, allergic rhinitis, poor lung function, COPD) both in adults and children[8,9,10,11,12,13] Findings from the various studies broadly indicate a positive

association between pollution exposure and respiratory symptoms, i.e., exposure to air pollution can increase the rise of poor lung function, or other respiratory symptoms.

Exposure to air pollution both outdoors and indoors can increase the likelihood of acute respiratory infections among children, and in some cases, this can turn fatal. For example, in Delhi, moderate to high pollution days have been reported to be associated with higher numbers of daily visits to emergency rooms for acute respiratory symptoms among children.[14]

6.3 Impact on Maternal and Child Health-

Women are often exposed to both outdoor and household air pollution, especially since households across India continue to rely on solid fuels for cooking. Exposure to air pollution among pregnant women can result in outcomes such as hypertension during pregnancy, pre-eclampsia and hematologic and endothelium dysfunction.[15] New-borns can also experience a range of health outcomes including preterm birth, low birth weight, small for gestational age and higher likelihood of infections.[16,17,18] For example, A study in Chennai, India supported by the Indian Council for Medical Research (ICMR) found that a 10 µg/m^3 increase during pregnancy was associated with a 4g (95% CI:1.08 g, 6.76 g) decrease in birthweight[14]

A case-control study[19] to examine whether exposure to ambient/ household air pollution or biomass fuel is associated with pregnancy losses, perinatal or neonatal mortality, anaemia and respiratory illness in pregnancy was conducted among 34,197 pregnant women across India, Pakistan and Bangladesh. The study reported the odds ratio for pregnancy loss was 1·03 (95% CI 1·02–1·05). For the 2000–2016, an estimated 349,681 (95% CI 152 932–489 493) pregnancy losses per year were attributed to ambient air exposure of more than 40 µg/m³, the annual $PM_{2.5}$ standard in India, accounting for 7·1% (95% CI 3·3–31·2) of the total annual pregnancy loss burden in South Asia for this period.

Several studies in India have reported higher risk for disease and deaths in children under five when they are exposed to cooking fuels at home.[20] [21]

6.4 Impact on other organ systems-

A recent study using the Longitudinal Ageing Study of India (LASI) reported that indoor air pollution is a risk factor for cognitive impairment among older adults in India.[22] Exposure to air pollution has also been linked to the prevalence of diabetes mellitus among adults.[23]

7. Use of health evidence as an input for NAAQS revision in India:

All panellist and participants concurred that health must be a critical pillar for standard setting and revisions. Based on the available data and evidence on health effects of air pollution, there was agreement that India should be ambitious as far as WHO interim targets are concerned. They agreed that there are vast public health benefits, even if India were to adopt one of the Interim Targets as the standard and enforce attainment of the standard.

The group also discussed the idea of regular synthesis of available health evidence and thought that this should be led at the ministry-level with input from experts from various disciplines. One example of such an exercise was the Report of the Steering Committee on Air Pollution and Health Related Issues led by the Ministry of Health and Family Welfare in 2015.[24]

Overall, the Ministry of Health and Family Welfare is the important stakeholder in the air quality discourse, including the revision of NAAQS, and thus should be included in the process.

Furthermore, the group discussed that the need to generate evidence regarding cost effectiveness of air pollution mitigation measures, which will involve engaging economists and other experts. In addition, India should continue to invest in research on linkages of newer health outcomes, e.g., dementia and neurodegenerative diseases, neurodevelopment in children, chronic kidney disease etc. Research should also be expanded across the country.

About CAPHER-India:

CAPHER-India is a joint collaboration between AIIMS, New Delhi and IIT Delhi and is supported by Health Effects Institute, USA. The aim of CAPHER –India is to build a dedicated network focused on air pollution and health effects research in India. It brings together teams of Indian researchers from various scientific disciplines including atmospheric chemistry, air pollution measurement and modelling, epidemiology, biostatistics, medicine, basic sciences and health policy with the objectives (i) to build partnerships among research institutions to develop and implement research studies on health effects of air pollution; (ii) to facilitate development of collaborative research proposals to fill critical evidence gaps; (iii) to conduct capacity building exercises/programs targeted at early career researchers.

Currently, CAPHER-India has 171 members across 75 institutions. Of which, 150 are in India.

The steering committee for CAPHER-India includes:

- Dr. Anand Krishnan, AIIMS, New Delhi
- Dr. Aparajita Chattopadhyay, International Institute of Population Sciences, Mumbai
- Dr. Chandra Venkataraman, Indian Institute of Technology-Bombay, Mumbai
- Dr. Kalpana Balakrishnan, Sri Ramachandra Institute of Higher Education and Research, Chennai
- Dr. Santu Ghosh, St. John's Medical College, Bengaluru

The CAPHER India secretariat is hosted at Centre of Community Medicine, AIIMS, New Delhi.

Learn more about CAPHER-India at - https://capherindia.org

CAPHER-India

Collaborative for Air Pollution and Health Effects Research-India

Consultation-cum-workshop

On

Air Pollution and Health in India: Current Evidence to Inform the India NAAQS Revision Process

Monday, May 29, 2023

09:00 A.M- 05:00 P.M IST

Venue: Tamarind Hall, India Habitat Centre, New Delhi

Time	Session	Speakers
9:00 A.M	**Registration**	
9:30 A.M 9:45 A.M	**Welcome & overview of consultation** **Overview of CAPHER-India**	Dr. Sagnik Dey (IIT Delhi) and Dr. Palak Balyan(HEI) Dr. Harshal Ramesh Salve (AIIMS, New Delhi)
10:00 AM	**Keynote address** **Need of revision of Indian National Ambient Air Quality Standards**	Dr. Prashant Gargava (Member Secretary, Central Pollution Control Board, India)
10:30 AM	**Overview of NAAQS revision process and key considerations**	Dr. Mukesh Sharma (IIT Kanpur, India)
11:00 A.M	**Tea Break**	
11:30 A.M 11:50 A.M	**Role of health evidence in preparing/revising AQ standards :Experience from around the world**	**Moderators: Dr. Ravindra Khaiwal (PGIMER Chandigarh), Ms. Anumita Roy Chowdhury (CSE, India)** Mr. Robert O'Keefe (Health Effects Institute, USA)

	Experience of revision of Air Quality Guidelines in South East Asia	Dr. Uma Rajarathnam (Enzen Global Solutions, Bangalore)
12:10 PM	**Summary of key evidence from India (15 min talk,5 min Q &A)** **Cardiovascular Health** **Respiratory Health** **Maternal & Child Health**	**Moderators: Dr. Anand Krishnan (AIIMS, New Delhi), Dr. Sagnik Dey (IIT Delhi)** Dr. Ambuj Roy (AIIMS, New Delhi) Dr. Parvaiz Ahmad Koul (Sher-i-Kashmir Institute of Medical Sciences ,Srinagar, India) Dr. Archana Patel (Lata Medical Research Foundation, Nagpur, India)
General Discussion moderated by Dr. Anand Krishnan and Dr. Sagnik Dey (20 min)		
2:00 PM	**Lunch**	
3:00PM	**Global evidence on health effects of air pollution**	**Moderator: Dr. Sundeep Salvi (PURE Foundation)** Dr. Zorana Andersen (University of Copenhagen, Denmark)
3:30 PM	**Panel discussion: Use of health evidence as an input for NAAQS revisions**	**Moderator: Dr. Pallavi Pant (Health Effects Institute, USA)** Dr. G.C.Khilnani (PSRI ,New Delhi, India) Dr. Ramya Sunder Raman (IISER, Bhopal) Mr. Manjeet Saluja (WHO-India) Dr. Rameshwar Sorokhaibham (NCDC, India) Dr. Bhargav Krishna (CPR, India)
Discussion by Participants (10 min)		
4:40PM	**Summary and next steps**	Dr. Pallavi Pant (HEI,USA) Dr. Sagnik Dey (IIT Delhi)
5:00PM	**Networking and refreshments**	

Annexure-II List of Participants in the CAPHER- India Consultation cum workshop

(In alphabetical order)

Sr. No	Name	Organization/ Institution
1.	Dr Aakash Shrivastava	National Centre for Disease Control, Government of India
2.	Dr.Abinaya Sekar	Centre for Policy Research, India
3.	Dr. Ambuj Roy	All India Institute of Medical Sciences, New Delhi
4.	Dr. Anand Krishnan	All India Institute of Medical Sciences, New Delhi
5.	Ms. Anumita Roy Chowdhury	Centre for Science and Environment, India
6.	Dr. Archana Kumawat	All India Institute of Medical Sciences, New Delhi
7.	Dr. Archana Patel	Lata Medical Research Foundation, Nagpur, India
8.	Dr. Barsa Priyadarshini Rout	HRIDAY, Delhi
9.	Dr. Bhargav Krishna	Centre for Policy Research, India
10.	Mr. Debajit Sarkar	Indian Institute of Technology, Delhi
11.	Ms.Ekta Chaudhary	Indian Institute of Technology, Delhi
12.	Dr.G.C. Khilnani	Pushpawati Singhania Research Institute (PSRI), New Delhi, India
13.	Dr Gitismita Naik	All India Institute of Medical Sciences, Kalyani
14.	Dr. Harshal Ramesh Salve	All India Institute of Medical Sciences, New Delhi
15.	Mr.Hemant Kaushal	Indian Institute of Technology, Delhi
16.	Dr. Huma Nawaz	All India Institute of Medical Sciences, New Delhi
17.	Mr. Manjeet Saluja	WHO Country office, India
19.	Dr. Mukesh Sharma	Indian Institute of Technology, Kanpur
20.	Dr. Neeti Rustagi	All India Institute of Medical Sciences Jodhpur
21.	Dr. Nivethitha N.	National Centre for Disease Control, India
22.	Dr. P. B. Rastogi	Formerly with Ministry of Environment, Forest and Climate Change, Government of India
23.	Dr. Palak Balyan	Health Effects Institute, USA
24.	Dr. Pallavi Joshi	Indian Institute of Technology, Delhi
25.	Dr. Pallavi Pant	Health Effects Institute ,USA

26.	Dr.Parth S.Mahapatra	German Agency for International Cooperation,Delhi
27.	Dr. Parvaiz A. Koul	Sher-i-Kashmir Institute of Medical Sciences, Srinagar, India
28.	Dr. Poornima Prabhakaran	Public Health Foundation of India, Delhi
29.	Ms.Pratima Gupta	Indian Institute of Technology, Delhi
30.	Dr .Prem Kumar Mony	St.John's Medical College & Research Institute ,Bangalore
31.	Mr. Rahul Kumar	All India Institute of Medical Sciences, New Delhi
32.	Dr. Rameshwar Sorokhaibham	National Centre for Disease Control, Government of India
33.	Dr. Ramya Sunder Raman	Indian Institute of Science Education and Research, Bhopal
34.	Dr. Ravindra Khaiwal	Post Graduate Institute of Medical and Research, Chandigarh
35.	Dr.Riya Biswas	All India Institute of Medical Sciences, New Delhi
36.	Mr. Robert O'Keefe	Health Effects Institute, USA
37.	Mr. Roshan Wathore	CSIR-National Environmental Engineering Institute
38.	Dr.Satendra K.Jain	National Thermal Power Corporation
39.	Dr. Sagnik Dey	Indian Institute of Technology, Delhi
40.	Dr. Sahil Goyal	Hindu Rao Hospital, Delhi
41.	Dr. Salil Bhargav	MGM Medical College,Indore
42.	Mr. Santosh Harish	Open Philanthrophy
43.	Dr.Sofiya Rao	Indian Institute of Technology, Delhi
44.	Dr. Sundeep Salvi	Pulmocare Research & Education Foundation,Pune
45.	Dr.Suprakash Mandal	All India Institute of Medical Sciences, New Delhi
46.	Ms. Surat Dewan	Dayalbagh Educational Institute,Agra
47.	Dr.Surbhi Puri	All India Institute of Medical Sciences, New Delhi
48.	Dr. Uma Rajarathnam	Enzen Global Solution, Bangalore
49.	Dr. Zorana Andersen	University of Copenhagen, Denmark

Participants of the CAPHER -India Consultation cum Workshop

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