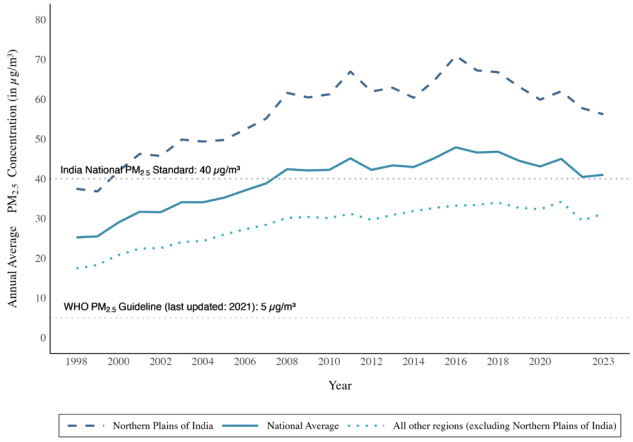
AQLI Air Quality Life Index® | India Fact Sheet

After a record decline in 2022, particulate pollution levels in India increased in 2023 (Figure 1).[1] India's annual-average $PM_{2.5}$ concentrations in 2023 stood at 41 µg/m³, and reducing these levels to meet the WHO guideline of 5 µg/m³ could add 3.5 years onto the life expectancy of an average Indian.[2]

KEY TAKE-AWAYS

- According to the latest satellite-derived $PM_{2.5}$ estimates, in 2023, particulate concentrations in India were higher than in 2022. These levels are more than 8 times higher than the WHO guideline, and reducing them to permanently meet the WHO Guideline would add 3.5 years to the average life expectancy of Indians (Figure 2).
- While particulate pollution takes 3.5 years off the life of the average Indian resident, child and maternal malnutrition takes off 1.6 years, tobacco use takes off 1.5 years, and unsafe water, sanitation, and handwashing takes off 8.4 months (Figure 3).
- All of India's 1.4 billion people live in areas where the annual average particulate pollution level exceeds the WHO guideline. This means that even people living in the cleanest regions of India could live 9.4 months longer if particulate concentrations in these regions were reduced to meet the WHO guideline.

Figure 1 · Annual average $PM_{2.5}$ concentrations in India, 1998-2023



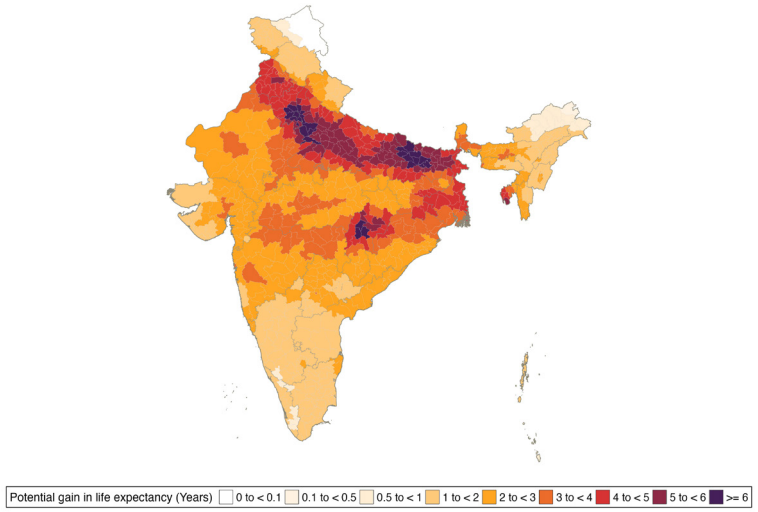
- 46 percent of the population lives in areas that exceed the country's own national annual-$PM_{2.5}$ standard of 40 µg/m³. Reducing particulate concentrations in these regions to meet India's national standard could add 1.5 years to the life expectancy of people living in these regions.
- In the most polluted region of the country—the Northern Plains—544.4 million residents or 38.9 percent of India's population could gain 5 years of life expectancy on average relative to the WHO guideline and 1.6 years relative to the national standard, if current pollution levels were reduced to meet the WHO guideline.[3]
- If all of India were to reduce particulate pollution to meet the WHO guideline, residents in Delhi—India's capital and most populous city—would see the maximum benefits with its residents gaining 8.2 years of life expectancy. Outside of Delhi and the Northern Plains of India, Rajasthan, Madhya Pradesh and Maharashtra face the highest health burden of particulate pollution. Reducing particulate pollution to meet the WHO guideline could add 3.3, 3.1 and 2.8 years respectively to the average life expectancy in these states (Figure 4).

1 This data is based on the AQLI 2023 dataset. All annual average $PM_{2.5}$ values (measured in micrograms per cubic meter: µg/m³) are population weighted.

2 Revised WHO Air Quality Guidelines. 2021

3 Northern Plains of India are defined as the following seven states and union territories: Bihar, Chandigarh, Delhi, Haryana, Punjab, Uttar Pradesh, and West Bengal. In this analysis, Northern plains of India is synonymous with North India, Northern India, and the North Indian Belt.

Figure 2.
Potential gain in life expectancy from permanently reducing $PM_{2.5}$ from 2023 concentration to the WHO guideline

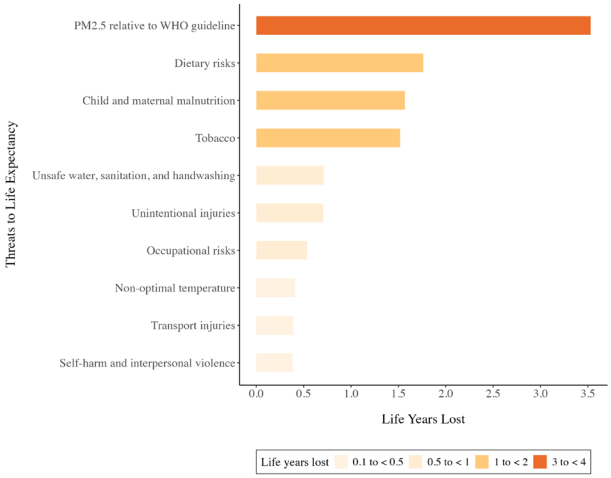


PROGRESS OF INDIA'S NATIONAL CLEAN AIR PROGRAM

In 2019, India launched its National Clean Air Programme (NCAP), with the stated goal of reducing particulate pollution by 20-30 percent nationally relative to 2017 levels by 2024. Initially the program focused on 102 cities that were not meeting India's national annual $PM_{2.5}$ standard, termed "non-attainment cities". In 2022, the Indian Government revamped its particulate pollution reduction target for NCAP, setting it to a 40 percent reduction relative to 2017 levels by 2026 for an expanded number of 131 non-attainment cities.[4] If the ambition of the revised target is met, these cities' overall annual average $PM_{2.5}$ exposure would be 21.9 µg/m³ lower than 2017 levels, adding 2.1 years onto the life of the average Indian living in these cities, and 7.9 months to the national average life expectancy.

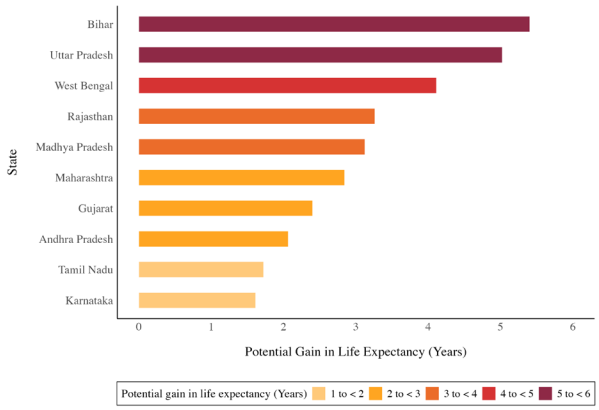
As of 2023, pollution in the districts with non-attainment cities had declined by 10.5 percent relative to 2017 (base year for the NCAP) adding 6 months to the life expectancy of 443.4 million residents, and 2 months to India's national average life expectancy.

Figure 3 · Top external health threats to life expectancy in India



Sources: Global Burden of Disease (https://vizhub.healthdata.org/gbd-results/) level-2 causes and risks data and WHO Life Tables (https://apps.who.int/gho/data/node.main.LIFECOUNTRY?lang=en) were combined with the Life table method to arrive at these results. "$PM_{2.5}$ relative to WHO Guideline" bar displays the reduction in life expectancy relative to the WHO guideline as calculated by the latest AQLI (2023 $PM_{2.5}$ concentrations) data.

Figure 4 · Potential gain in life expectancy from reducing $PM_{2.5}$ concentrations from 2023 levels to the WHO guideline in the 10 most populous states of India



4 https://indianexpress.com/article/india/centre-aims-at-40-percent-reduction-in-particulate-matter-2026-8175260/

Potential life expectancy impacts of particulate pollution reductions in all states/ UTs of India

State/UT	Population (Lakhs)	Annual Average 2023 $PM_{2.5}$ Concentration (µg/m³)	Life Expectancy Gains from reducing $PM_{2.5}$ from 2023 concentration to WHO $PM_{2.5}$ guideline of 5 µg/m³)	Life Expectancy Gains from reducing $PM_{2.5}$ from 2023 concentration to National $PM_{2.5}$ standard of 40 µg/m³
Andaman and Nicobar	3.9	14.9	1.0	0
Andhra Pradesh	545.3	26.0	2.1	0
Arunachal Pradesh	16.1	14.2	0.9	0
Assam	359	28.4	2.3	0
Bihar	1257.3	60.1	5.4	1.97
Chandigarh	12.3	44.8	3.9	0.47
Chhattisgarh	304	51.5	4.6	1.12
Dadra and Nagar Haveli	4.4	28.7	2.3	0
Daman and Diu	2.9	31.9	2.6	0
Goa	15.8	27.4	2.2	0
Gujarat	704.9	29.5	2.4	0
Haryana	297.7	58.7	5.3	1.83
Himachal Pradesh	77	24.5	1.9	0
Jammu and Kashmir	147.1	21.3	1.6	0
Jharkhand	391.7	42.1	3.6	0.2
Karnataka	695.9	21.4	1.6	0
Kerala	348.4	18.5	1.3	0
Ladakh	3.3	7.8	0.3	0
Lakshadweep	0.5	19.6	1.4	0
Madhya Pradesh	852	36.8	3.1	0
Maharashtra	1281.6	33.9	2.8	0
Manipur	33.2	25.5	2.0	0
Meghalaya	37.3	28.8	2.3	0
Mizoram	12.9	24.5	1.9	0
NCT of Delhi	188.4	88.4	8.2	4.74
Nagaland	20.3	22.5	1.7	0
Odisha	473.7	36.4	3.1	0
Puducherry	13.5	22.2	1.7	0
Punjab	310.8	49.6	4.4	0.94
Rajasthan	809	38.3	3.3	0
Sikkim	6.5	37.2	3.2	0
Tamil Nadu	823.4	22.5	1.7	0
Telangana	391.5	29.3	2.4	0
Tripura	42.2	47.1	4.1	0.7
Uttar Pradesh	2347.9	56.2	5.0	1.59
Uttarakhand	118.7	33.2	2.8	0
West Bengal	1029.9	46.9	4.1	0.68

ABOUT THE AIR QUALITY LIFE INDEX (AQLI)

The AQLI is a pollution index that translates particulate air pollution into perhaps the most important metric that exists: its impact on life expectancy. Developed by the University of Chicago's Milton Friedman Distinguished Service Professor in Economics Michael Greenstone and his team at the Energy Policy Institute at the University of Chicago (EPIC), the AQLI is rooted in research that quantifies the causal relationship between long-term human exposure to air pollution and life expectancy. The Index then combines this research with hyper-localized, satellite measurements of global particulate matter ($PM_{2.5}$), yielding unprecedented insight into the true cost of pollution in communities around the world. The Index also illustrates how air pollution policies can increase life expectancy when they meet the World Health Organization's guideline for what is considered a safe level of exposure, existing national air quality standards, or user-defined air quality levels. This information can help to inform local communities and policymakers about the importance of air pollution policies in concrete terms.

Methodology: The life expectancy calculations made by the AQLI are based on a pair of peer-reviewed studies, Chen et al. (2013) and Ebenstein et al. (2017), co-authored by Michael Greenstone, that exploit a unique natural experiment in China. By comparing two subgroups of the population that experienced prolonged exposure to different levels of particulate air pollution, the studies were able to plausibly isolate the effect of particulate air pollution from other factors that affect health. Ebenstein et al. (2017) found that sustained exposure to an additional 10 µg/m³ of PM_{10} reduces life expectancy by 0.64 years. In terms of $PM_{2.5}$, this translates to the relationship that an additional 10 µg/m³ of $PM_{2.5}$ reduces life expectancy by 0.98 years. This metric is then combined with sea-salt and mineral dust removed satellite-derived $PM_{2.5}$ data. All 2023 annual average $PM_{2.5}$ values are population-weighted, and AQLI's source of population data is https://landscan.ornl.gov/. We are grateful to the Atmospheric Composition Analysis Group, based at Washington University in St. Louis, for providing us with the satellite data. The original dataset can be found here: https://sites.wustl.edu/acag/datasets/surface-pm2-5/. To learn more deeply about the methodology used by the AQLI, visit: aqli.epic.uchicago.edu/about/methodology.