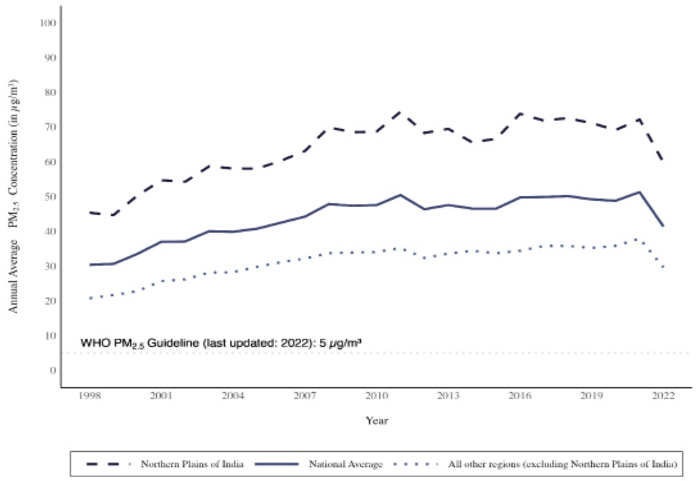
AQLI Air Quality Life Index® | India Fact Sheet

After a decade of experiencing particulate pollution levels averaging at approximately 49 µg/m³—more than nine times the WHO guideline of 5 µg/m³—particulate concentrations in India dropped to 41.4 µg/m³ in 2022 (Figure 1). If these reductions are sustained, an average Indian is likely to live 9 months longer compared to what they would have if they were exposed to levels similar to the last decade. Further, if pollution in India met the WHO guideline, Indian citizens could gain an additional 3.6 years onto their life expectancy (Figure 2).

KEY TAKE-AWAYS

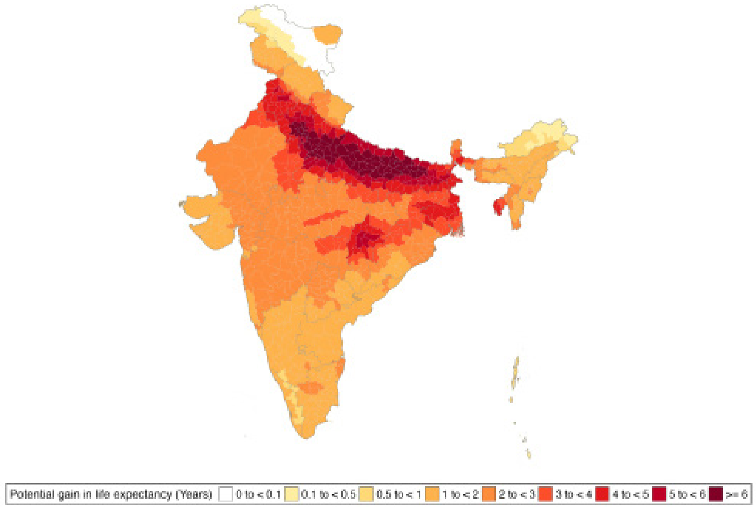
- According to the latest satellite-derived $PM_{2.5}$ estimates, particulate pollution in India dropped from 51.3 in 2021 to 41.4 µg/m³ in 2022, adding 1 year to India's average life expectancy. Despite the decline in pollution, all of India's 1.4 billion people live in areas where the annual average particulate pollution level exceeds the WHO guideline. 42.6 percent of the population live in areas that exceed the country's own national air quality standard of 40 µg/m³.
- 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 7.8 years of life expectancy. In North 24 Parganas—the country's second most populous district—residents would gain 3.6 years of life expectancy (Figure 3).
- While particulate pollution takes 3.6 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 4).
- In the most polluted region of the country—the Northern Plains—540.7 million residents or 38.9 percent of India's population are on track to lose 5.4 years of life expectancy on average relative to the WHO guideline and 1.9 years relative to the national standard, if current pollution levels persist.[1]
- The highest declines in particulate pollution in 2022 were observed in the Purulia and Bankura districts in West Bengal and the Dhanbad district in Jharkhand, with pollution concentrations declining by more than 20 µg/m³ in all three districts. If these reductions are sustained, an average resident of these districts could live 2.3, 2.2 and 2 years longer, respectively.

Figure 1.
Annual average PM2.5 concentrations in India, 1998-2022



1 We define the Northern Plains of India 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 2022 concentration to the WHO guideline



POLICY IMPACTS

In 2019, India launched its National Clean Air Programme (NCAP), signaling its desire to reduce particulate pollution. NCAP originally aimed to reduce particulate pollution by 20-30 percent nationally relative to 2017 levels by 2024 and 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 announced its revamped particulate pollution reduction target for NCAP, setting it to a 40 percent reduction relative to 2017 levels for an expanded number of 131 non-attainment cities by 2025-26.[2] 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. This would add 2.1 years onto the life of the average Indian living in these specific 131 cities. If a similar target were to be set and met nationwide, an average Indian would live 7.9 months longer. As of 2022, pollution in the districts with non-attainment cities had declined by 18.8 percent relative to 2017 (base year for the NCAP) adding 10.8 months to the life expectancy of 446.7 million residents, and 4 months to India's national average life expectancy. While we cannot conclusively determine what reduced India's particulate concentrations in 2022, recent evidence from India suggests that meteorological factors - above normal rainfall and reduced number of inversions - amplified the impact of emission controls in the residential and transport sectors.

Figure 3 · Potential gain in life expectancy from reducing PM2.5 concentrations from 2022 levels to the WHO guideline in the 10 most populous states of India

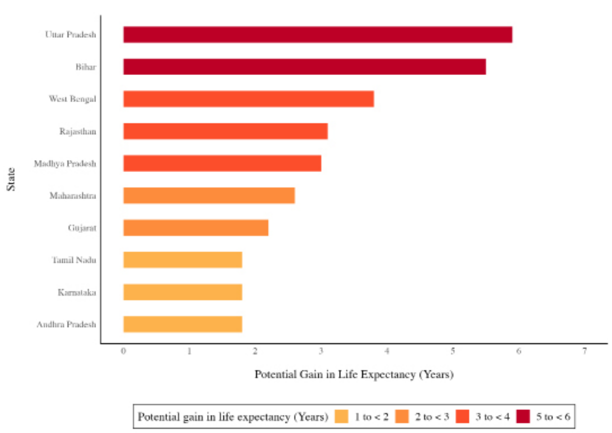
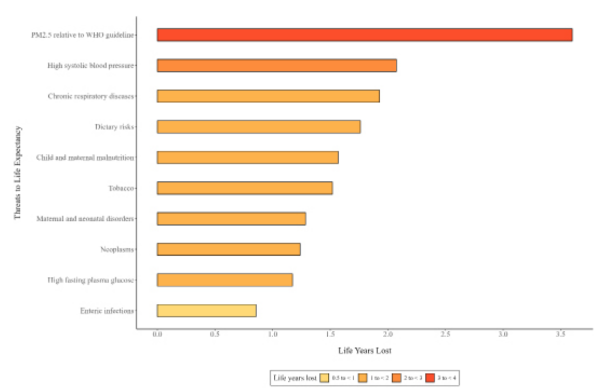


Figure 4 ·Top 10 threats to life expectancy in India



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. "PM2.5 relative to WHO Guideline" bar displays the reduction in life expectancy relative to the WHO guideline as calculated by latest AQLI (2022) data.

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2 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 2022 $PM_{2.5}$ Concentration ($\mu g/m^3$)	Life Expectancy Gains from reducing $PM_{2.5}$ from 2022 concentration to WHO $PM_{2.5}$ guideline of 5 $\mu g/m^3$)	Life Expectancy Gains from reducing $PM_{2.5}$ from 2022 concentration to National $PM_{2.5}$ guideline of 40 $\mu g/m^3$
Andaman and Nicobar	3.9	14.2	0.9	0
Andhra Pradesh	541.4	23.6	1.8	0
Arunachal Pradesh	15.9	12	0.7	0
Assam	356.6	22.4	1.7	0
Bihar	1249.1	61.6	5.5	2.1
Chandigarh	12.1	42.5	3.7	0.2
Chhattisgarh	301.9	47.2	4.1	0.7
Dadra and Nagar Haveli	4.3	21.6	1.6	0
Daman and Diu	3	24.2	1.9	0
Goa	15.6	24.9	2	0
Gujarat	700.1	27.1	2.2	0
Haryana	295.7	58.5	5.2	1.8
Himachal Pradesh	76.4	24.7	1.9	0
Jammu and Kashmir	146.1	20	1.5	0
Jharkhand	388.8	41.5	3.6	0.1
Karnataka	691.4	23	1.8	0
Kerala	345.9	17.1	1.2	0
Ladakh	3.3	6.9	0.2	0
Lakshadweep	0.5	16	1.1	0
Madhya Pradesh	846.2	35.9	3	0
Maharashtra	1273	31.8	2.6	0
Manipur	33	23.2	1.8	0
Meghalaya	37	21.9	1.7	0
Mizoram	12.9	23.3	1.8	0
NCT of Delhi	187.1	84.3	7.8	4.3
Nagaland	20.1	19.9	1.5	0
Odisha	470.4	30	2.5	0
Puducherry	13.5	20.8	1.5	0
Punjab	308.8	51.6	4.6	1.1
Rajasthan	803.6	36.8	3.1	0
Sikkim	6.4	37.2	3.2	0
Tamil Nadu	817.8	23.6	1.8	0
Telangana	389	27.7	2.2	0
Tripura	41.7	45.7	4	0.6
Uttar Pradesh	2332	65.5	5.9	2.5
Uttarakhand	117.8	35.7	3	0
West Bengal	1022.8	43.4	3.8	0.3

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 $\mu g/m^3$ of PM10 reduces life expectancy by 0.64 years. In terms of $PM_{2.5}$, this translates to the relationship that an additional 10 $\mu g/m^3$ 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 PM2.5 data. All 2022 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 the 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.