AQLI Air Quality Life Index® | China Fact Sheet

Particulate pollution ($PM_{2.5}$) slightly increased by 3 percent in 2023—the first such increase since 2014, when the country began a “war against pollution”. These levels are more than 5 times higher than the World Health Organization guideline of 5 µg/m^3.[1, 2] The average Chinese resident could live 2.2 years longer if particulate levels met the WHO guideline (Figure 1).

KEY TAKE-AWAYS

- Particulate pollution is the second greatest external health threat to life expectancy in the country, next only to tobacco. While particulate pollution takes 2.2 years off the life of an average Chinese resident, threats like dietary risks and transport injuries take off 1.7 years and 0.4 years off, respectively (Figure 2).
- Nearly all (99.9 percent) of China’s 1.42 billion people live in areas where the annual average particulate pollution level exceeds the WHO guideline. 14.1 percent of the population live in areas that exceed the national standard of 35 µg/m³. An average resident could live 3 months longer—or 57.1 million life years—if these regions met the national standard, to China’s population.
- In China’s most polluted provinces—Tianjin and Hebei—residents could gain 3.2 and 2.9 years of life expectancy, respectively, if pollution levels met the WHO guideline.
- The Beijing-Tianjin-Hebei (BTH) region, home to 7.7 percent of China’s population, is the most polluted region in Mainland China. If pollution levels in this region were reduced to meet the WHO guideline, an average resident could live 2.9 years longer.
- In Guangdong, the most populous province in China, residents could potentially gain 1.6 years of life expectancy if the $PM_{2.5}$ levels were reduced to meet the WHO guideline (Figure 3).
- In China’s most polluted prefecture of Kashgar in Xinjiang Uyghur Province, an average resident could live 4 years longer if the $PM_{2.5}$ levels met the WHO guideline.

Figure 1 · Potential gain in life expectancy from permanently reducing $PM_{2.5}$ from the 2023 concentration to the WHO guideline

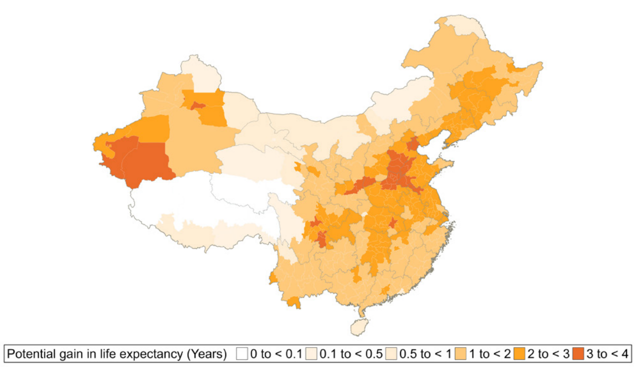
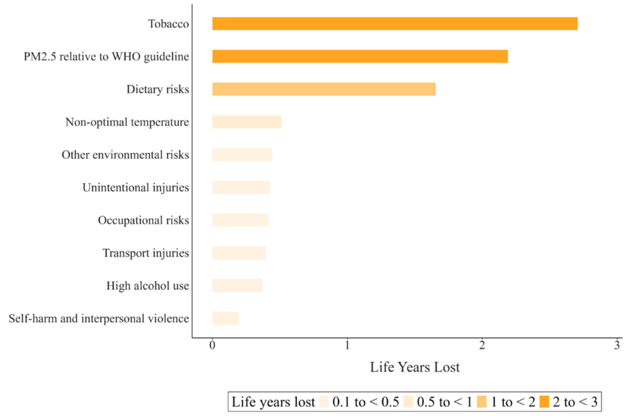


Figure 2 · Top 10 external threats to life expectancy in China



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.

1 This data is based on the data used in AQLI Annual Update 2025 and considers $PM_{2.5}$ concentrations for 2023. All annual average $PM_{2.5}$ values (measured in micrograms per cubic meter: µg/m^3) are population weighted and exclude the dust fraction from natural dust and sea-salt.

2 World Health Organization. WHO Global Air Quality Guidelines: Particulate Matter ($PM_{2.5}$ and PM_{10}), Ozone, Nitrogen Dioxide, Sulfur Dioxide and Carbon Monoxide. Geneva: World Health Organization, 2021. https://iris.who.int/bitstream/handle/10665/345329/9789240034228-eng.pdf?sequence=1

POLICY PROGRESS TOWARDS CLEAN AIR

Despite the slight increase in pollution from 2022 to 2023, pollution has declined by 40.8 percent since 2014, when the government declared a “war against pollution”. As a result of this improvement in air quality, driven by robust policy measures, an average Chinese resident could live 1.8 years longer (Figure 4).

China released its third air pollution control plan in November 2023. The plan aims at reducing $PM_{2.5}$ concentrations at the prefecture level by 10 percent by 2025, compared to the 2020 concentrations. To meet this target, the $PM_{2.5}$ level for the Beijing-Tianjin-Hebei (BTH) region would need to decrease by 20 percent, and in the Fenwei Plain by 15 percent by 2025.[3] As of 2023, 22 percent of China’s prefectures have already reduced their $PM_{2.5}$ concentrations by 10 percent or more relative to 2020. $PM_{2.5}$ concentrations in the BTH regions are 7.4 percent lower than they were in 2020, and in Fenwei Plain, the $PM_{2.5}$ concentrations are lower by 8.8 percent relative to 2020.

Figure 3 · Potential gain in life expectancy from reducing $PM_{2.5}$ concentrations from 2023 levels to the WHO guideline in the 10 most populous provinces of China

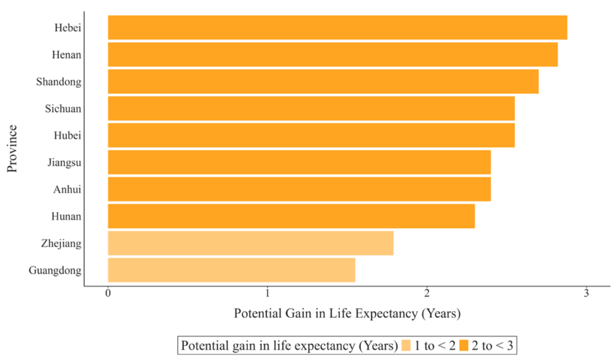
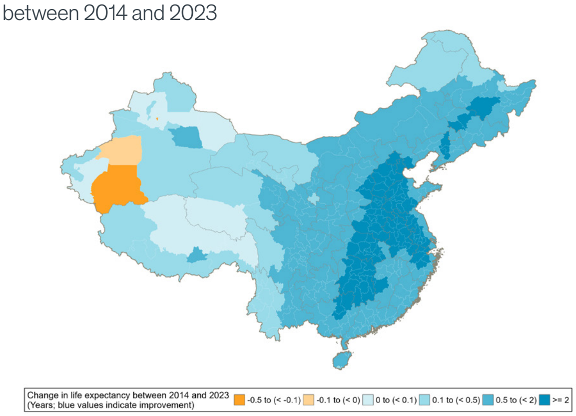


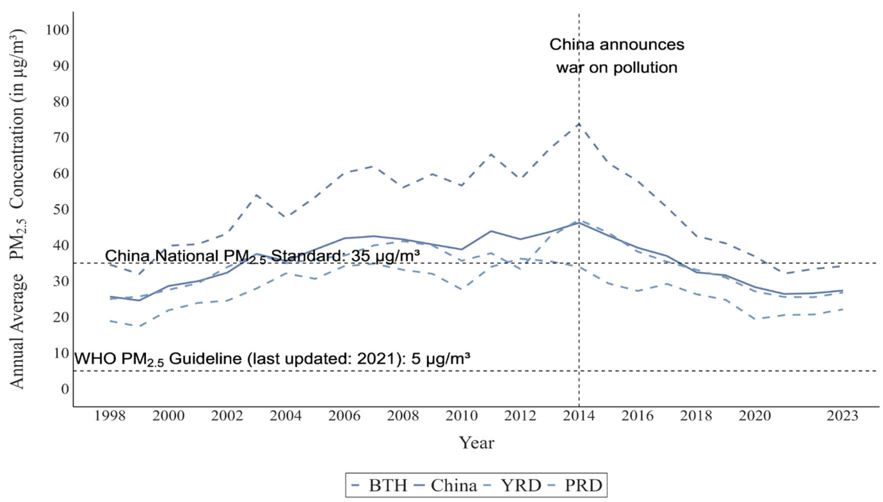
Figure 4 · Improvements in life expectancy due to reduced pollution between 2014 and 2023



Note: Virtually all Chinese residents are projected to see their life expectancy improve (blue) due to recent reductions in particulate pollution since 2014, if those reductions persist.

Figure 5.

Annual average $PM_{2.5}$ concentrations in major regions in Mainland China, 1998-2023[4]



3 Fenwei Plain is defined as the following prefectures: Xi’an, Baoji, Xianyang, Weinan, Tongchuan in Shaanxi province; Jinzhong, Luliang, Linfen, Yuncheng in Shanxi province; Luoyang, Sanmenxia in Henan province. Source: Liu, S.; Ju, T.; Pan, B.; Li, M.; Peng, S. 2022 “Aerosol Analysis of China’s Fenwei Plain from 2012 to 2020 Based on OMI Satellite Data.” Atmosphere 13(10): 1728. https://www.mdpi.com/2073-4433/13/10/1728

4 PRD stands for Pearl River Delta, and it includes the dense network of cities that covers nine prefectures of the province of Guangdong, namely Dongguan, Foshan, Guangzhou, Huizhou, Jiangmen, Shenzhen, Zhaoqing, Zhongshan and Zhuhai and the Special Administrative Regions of Hong Kong and Macau. YRD stands for Yangtze River Delta, and it includes Shanghai, Jiangsu and Zhejiang. BTH stands for Beijing-Tianjin-Hebei. It is important to note that our definition of the YRD region includes all regions in the Jiangsu and Zhejiang provinces. Others may define the YRD region differently than how we have defined it in this report.

Potential life expectancy impacts of particulate pollution reductions in the 25 most populous prefectures of China

Prefecture	Population (Millions)	$PM_{2.5}$ concentration 2023 (μg/m³)	Life Expectancy Gains from reducing $PM_{2.5}$ from 2014 concentrations to 2023 concentrations (years)	Life Expectancy Gains from reducing $PM_{2.5}$ concentrations from 2023 Concentration to the WHO Guideline of 5 μg/m³ (years)	Life Expectancy Gains from reducing $PM_{2.5}$ concentrations from 2023 Concentration to the National Standard of 35 μg/m³ (years)
Chongqing	30.6	30.3	1.8	2.5	0
Shanghai	24.4	25.8	1.6	2	0
Beijing	20.8	30.9	3.8	2.5	0
Chengdu	14.2	39.8	1.5	3.4	0.5
Tianjin	13.7	37.8	3.3	3.2	0.3
Guangzhou	13.4	26.4	1.2	2.1	0
Baoding	11.8	32.6	5.5	2.7	0
Harbin	11.3	32	2.5	2.6	0
Suzhou	11.1	27.2	2.2	2.2	0
Nanyang	10.9	30.5	2.2	2.5	0
Shijiazhuang	10.8	42.6	5.1	3.7	0.8
Shenzhen	10.8	20.1	1.1	1.5	0
Linyi	10.6	31.6	2.2	2.6	0
Wuhan	10.3	37	3.1	3.1	0.2
Handan	9.7	38	3.9	3.2	0.3
Weifang	9.7	32	1.9	2.6	0
Zhoukou	9.5	34.3	2.2	2.9	0
Wenzhou	9.5	23.8	1.1	1.8	0
Hangzhou	9.4	26.6	2.4	2.1	0
Zhengzhou	9.1	36	3	3	0.1
Xi'an	9.1	39.7	1.6	3.4	0.5
Xuzhou	9.1	36.8	2.1	3.1	0.2
Qingdao	9.1	26.6	1.7	2.1	0
Ganzhou	8.9	18.6	1.6	1.3	0
Heze	8.8	36.5	2.3	3.1	0.1

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.