AQLI Air Quality Life Index®

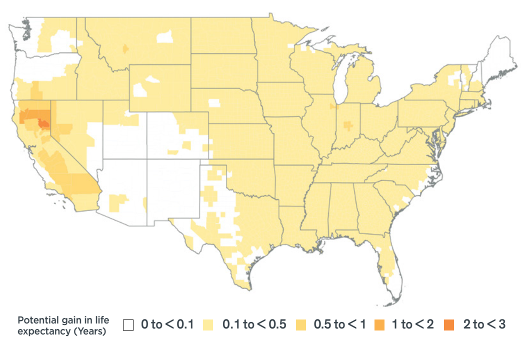
United States Fact Sheet

Since the Clean Air Act was enacted in 1970, particulate pollution ($PM_{2.5}$) in the United States has declined by 64.9 percent—extending the life expectancy of an average American by 1.4 years.[1] The country's average pollution has been in compliance with its national air quality standard (12 µg/m³) since 2001 (See figure 4). Despite this success, the latest scientific evidence on the impact of pollution at even the low levels that exist in much of the United States reveals that 96 percent of the population are living in areas with unsafe levels of pollution. While there is potential for further progress, the United States still has low levels of particulate pollution compared to many other parts of the world—making the health impacts from reducing particulate pollution small in comparison.

KEY TAKEAWAYS

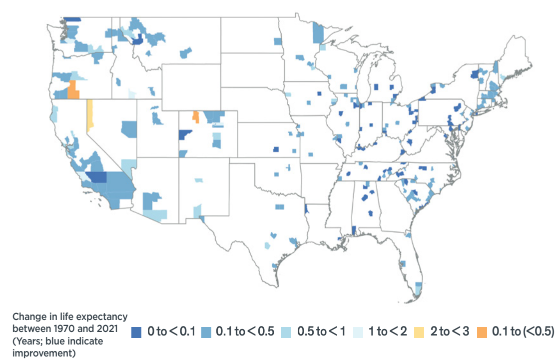
- Particulate pollution shortens the average Americans' life expectancy by 3.6 months or a total of 99.2 million life years relative to what it would be if the World Health Organization (WHO) guideline of 5 µg/m³ was met.
- In terms of threats to life expectancy, particulate pollution in the US ranks higher than diseases and illnesses like HIV/AIDS and child and maternal malnutrition.
- The largest benefits from improved pollution in the United States are concentrated along the West Coast where more frequent wildfires have increased pollution in recent years. Residents of California's Central Valley are now consistently exposed to average particulate pollution levels above both the WHO guideline and the nation's own air quality standard of 12 µg/m³.
- In 2021, 20 out of the top 30 most polluted counties in the United States were in the state of California. In Plumas County—the most polluted county in the country—residents would gain 2.1 years of life expectancy if the region met the WHO guideline.
- While on average California is the most polluted state, it is closely followed by Illinois and Indiana. In these states, an average resident is losing 4.8 and 6 months, respectively, as a result of breathing air that does not comply with the WHO guideline.

Figure 1 · Potential gain in life expectancy from permanently reducing $PM_{2.5}$ from 2021 concentration to the WHO guideline



Note: This map excludes the states of Alaska and Hawaii due to space limitations, but, all underlying country-wide calculations and comparisons include these regions.

Figure 2 · Improvements in life expectancy due to reduced pollution in 235 counties in the United States between 1970 and 2021



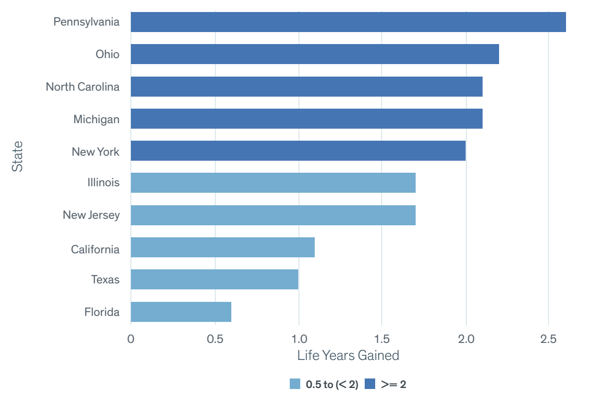
Note: This comparison can only be made for the 237 US counties for which 1970 $PM_{2.5}$ concentrations could be estimated from available data. Only three counties (in orange) are losing life years due to particulate pollution increasing in 2021 compared to 1970. The three counties are: Routt (Colorado), Washoe (Nevada) and Klamath (Oregon). The two counties of Anchorage (Alaska) and Honolulu (Hawaii) were excluded in this figure due to limited space. However, they also experienced declines in particulate pollution in 2021 relative to 1970 resulting in gains of 7.4 months and 3.6 months, respectively. For further information, see the Technical Appendix available at https://aqli.epic.uchicago.edu/policy-impacts/united-states-clean-air-act/.

1 Our 1970 US estimates are based on only 237 US counties for which 1970 $PM_{2.5}$ concentrations could be approximated. It should be noted that not all states include counties with data available from 1970. Here we are comparing 1970s imputed $PM_{2.5}$ data for those 237 counties with 2021 $PM_{2.5}$ data, which are available for all 3,136 US counties. For further information, see the Technical Appendix available at https://aqli.epic.uchicago.edu/policy-impacts/united-states-clean-air-act/.

POLICY IMPACTS

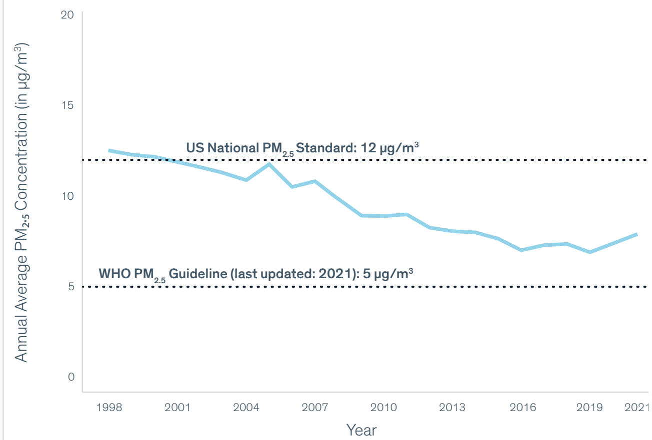
While much of the United States now falls above the WHO's guideline for what is considered a safe level of pollution, pollution levels have vastly improved since 1970. For those living in the former smog capital of Los Angeles, particulate pollution has declined by 57 percent, extending life expectancy for the average Angeleno by 1.5 years. Since 1970, pollution has declined in 234 out of the 237 counties for which $PM_{2.5}$ data is available. The greatest decline in pollution was in Ohio's Jefferson county where pollution decreased by 87.4 percent. This decline in pollution has extended the life expectancy for the average resident by 5.9 years.[2] In Kentucky's Campbell county, the reduction in pollution over this period has extended average life expectancy by 4.8 years.

Figure 3 · Change in life expectancy due to change in $PM_{2.5}$ concentration in some of the most populous US states between 1970 and 2021



Note: This figure shows the increase in life expectancy due to a decrease in pollution since 1970 in some of the most populous states for which it was possible to impute 1970s $PM_{2.5}$ levels. See Footnote 1 for more details.

Figure 4 · Annual average $PM_{2.5}$ concentration in the United States, 1998-2021



2 Greatest reduction within the 237 counties for which 1970 $PM_{2.5}$ data was imputable.

Potential life expectancy impacts of particulate pollution reductions for all U.S.

State	Population (millions)	$PM_{2.5}$ concentration, 1970 (μg/m³)	$PM_{2.5}$ concentration, 2021 (μg/m³)	Years of life expectancy gained due to decrease in $PM_{2.5}$, 1970-2021	Years of life expectancy gain through reducing $PM_{2.5}$ from 2021 concentration to WHO guideline
Alabama	5	38.5	7.9	3	0.3
Alaska	0.7	9.2	3.2	0.6	0
Arizona	7.1	16	6.5	0.9	0.1
Arkansas	3	NA	8.1	NA	0.3
California	39.5	20.9	9.7	1.1	0.5
Colorado	5.8	13.9	6.8	0.7	0.2
Connecticut	3.6	19.2	7.2	1.2	0.2
Delaware	1	36.3	7.8	2.8	0.3
District of Columbia	0.9	38.5	7.9	3	0.3
Florida	21.3	12.4	6.4	0.6	0.1
Georgia	10.7	NA	8.1	NA	0.3
Hawaii	1.4	4.9	1.9	0.3	0
Idaho	1.9	17.6	8.3	0.9	0.3
Illinois	12.8	26.9	9.4	1.7	0.4
Indiana	6.8	35	9.6	2.5	0.5
Iowa	3.2	20.7	8.3	1.2	0.3
Kansas	2.9	22.9	8.3	1.4	0.3
Kentucky	4.5	45.8	8.6	3.6	0.4
Louisiana	4.6	32.8	7.7	2.5	0.3
Maine	1.3	7.3	5.3	0.2	0
Maryland	6	31.7	7.8	2.3	0.3
Massachusetts	7	21.2	6.8	1.4	0.2
Michigan	9.9	29.6	8.6	2.1	0.4
Minnesota	5.7	13.9	7.8	0.6	0.3
Mississippi	2.9	NA	7.8	NA	0.3
Missouri	6.1	23.9	8.2	1.5	0.3
Montana	1.1	19	8.2	1.1	0.3
Nebraska	2	NA	8	NA	0.3
Nevada	3.2	9.5	7	0.2	0.2
New Hampshire	1.4	18.5	6.3	1.2	0.1
New Jersey	9.2	24.9	7.5	1.7	0.2
New Mexico	2.1	9.2	5.2	0.4	0
New York	20	28.3	7.4	2	0.2
North Carolina	10.5	29	7.4	2.1	0.2
North Dakota	0.8	13.4	7.2	0.6	0.2
Ohio	11.8	31.4	8.9	2.2	0.4
Oklahoma	3.9	19.2	8.4	1.1	0.3
Oregon	4.2	15.8	5.3	1	0
Pennsylvania	13	35	8.8	2.6	0.4
Rhode Island	1.1	22.8	7.4	1.5	0.2
South Carolina	5.1	23.8	6.9	1.7	0.2
South Dakota	0.9	NA	7.9	NA	0.3
Tennessee	7	35	8	2.6	0.3
Texas	29.5	17.6	7.5	1	0.2
Utah	3.4	15.5	7.3	0.8	0.2
Vermont	0.6	22.4	6.1	1.6	0.1
Virginia	8.6	27.9	7.1	2	0.2
Washington	7.6	12.1	4.8	0.7	0
West Virginia	1.8	33.7	7.5	2.6	0.2
Wisconsin	5.8	23.9	8.5	1.5	0.3
Wyoming	0.6	NA	6.8	NA	0.2

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 2021 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.

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