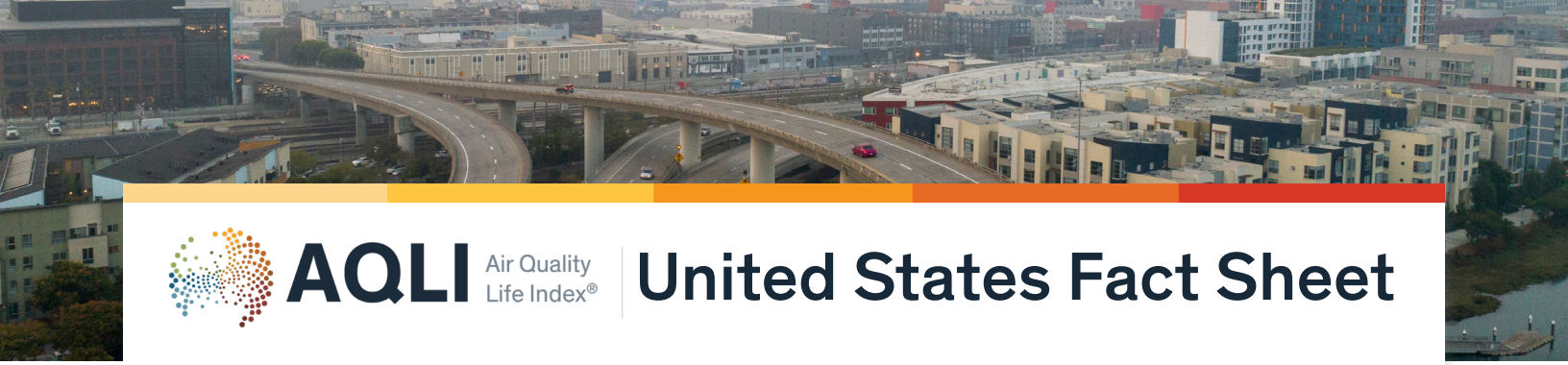


AQLI Air Quality Life Index®

United States Fact Sheet

Since the Clean Air Act was enacted in 1970, particulate pollution ($PM_{2.5}$) has declined by 67.2 percent—extending the life expectancy of an average American by 1.5 years (Figure 1).[1] Responding to the latest scientific evidence on the health impact of lower levels of air pollution , the United States recently revised their national annual standard for $PM_{2.5}$ from 12 µg/m^3 to 9 µg/m^3. With this revision implemented, only 13 out of the 3,142 counties in the United States (home to approximately 5 percent of the county's population) are not meeting this standard. If these counties were to meet the country's new standard, the total life expectancy in the US would go up by 1.9 million years.

KEY TAKE-AWAYS

- According to the latest satellite-derived data on particulate pollution, the annual-average $PM_{2.5}$ concentration in the United States was 6.9 µg/m^3 in 2022. Sustained exposure to this level of particulate pollution could shorten the average Americans' life expectancy by 2.2 months or a total of 62.6 million life years relative to what it would be if the World Health Organization (WHO) guideline of 5 µg/m^3 was met.
- While only 5.1 percent of the country's population lives in regions that don't meet the country's revised standard, 93.8 percent of the population lives in regions that don't meet the WHO guideline.
- Despite air pollution having a relatively smaller impact in the United States compared to some other countries, the health burden of particulate pollution is five times that of HIV/AIDS and four times that of nutritional deficiencies.
- The largest benefits from improved air quality 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 9 µg/m^3. The life expectancy of residents of Central Valley will improve by 3 months if the particulate pollution meets theWHO guidelines—adding 2.8 million life years to US's total life expectancy (Figure 2).
- In 2022, while Fairbanks North Star County in Alaska was the most polluted county in the United States, 9 out of the top 10 most polluted counties in the United States were in the state of California. In Kern County—the second most polluted county in the country—residents would gain 7 months of life expectancy if the region met the WHO guideline.
- While California is the most polluted state, it is closely followed by Illinois and Indiana. In these states, an average resident is losing 3.6 months—amounting to 4.4 million life years, as a result of breathing air that does not comply with the WHO guideline (Figure 3).

POLICY IMPACTS

While 6.2 percent of the United States now falls above the WHO 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).

1 Our 1970 US estimates are based on only 237 US counties for which 1970 PM2.5 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 PM2.5 data for those 237 counties with 2022 PM2.5 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/.

2 Greatest reduction within the 237 counties for which 1970 PM2.5 data was imputable.

Figure 1 · Change in life expectancy due to change in $PM_{2.5}$ concentration in 235 counties in the United States between 1970 and 2022. Only one county (in orange) is losing life years due to particulate pollution increasing in 2022 compared to 1970.[3]

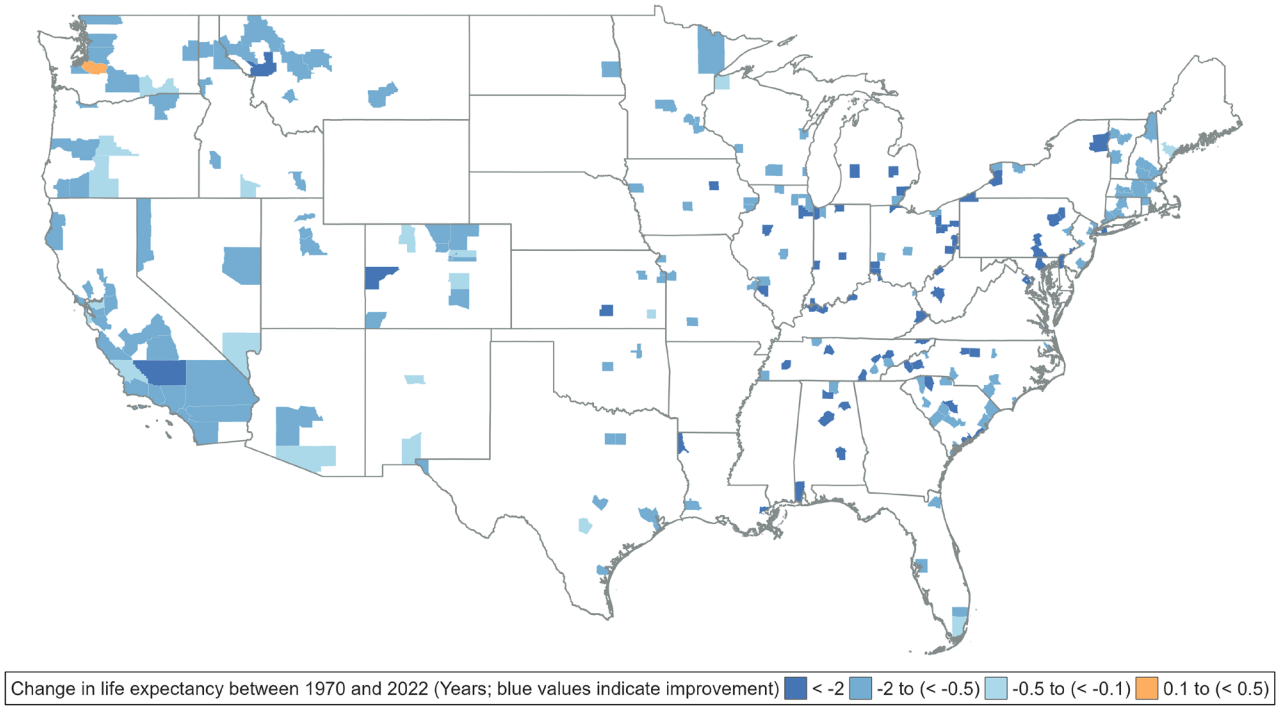


Figure 2 · Potential gain in life expectancy from permanently reducing $PM_{2.5}$ from 2022 concentration to the WHO guideline[4]

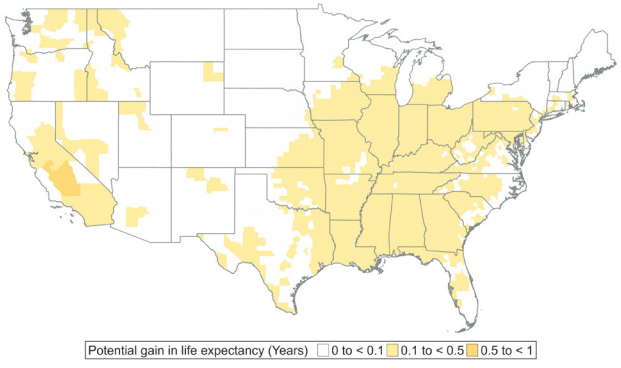
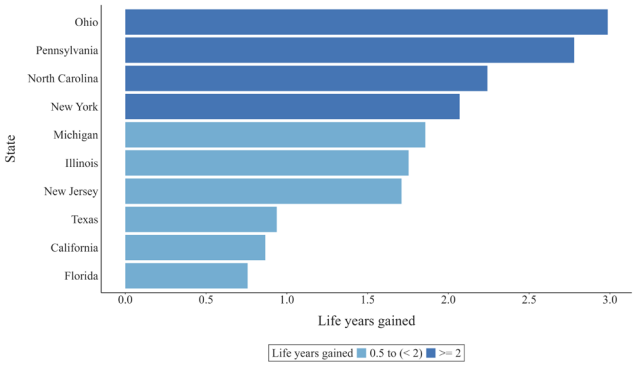


Figure 3 ·Change in life expectancy due to change in $PM_{2.5}$ concentration in some of the most populous US states between 1970 and 2022[5]



3 This comparison can only be made for the 237 US counties for which 1970 PM2.5 concentrations could be estimated from avaiable data. 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 2022 relative to 1970 resulting in gains of 7.2 months and 3.1 months respectively.. For further information, see the Technical Appendix available at https://aqli.epic.uchicago.edu/policy-impacts/united-states-clean-air-act/.

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

5 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 PM2.5 levels. See Footnote 1 for more details.

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

State	Population (millions)	$PM_{2.5}$ Concentration, 1970 (ïg/mł)	$PM_{2.5}$ Concentration, 2022 (ïg/mł)	Years of Life Expectancy Gained due to Decrease in $PM_{2.5}$, 1970-2022	Years of Life Expectancy Gain through Reducing $PM_{2.5}$ from 2022 Concentration to WHO Guideline
Alabama	5.1	38.6	7.3	3.1	0.2
Alaska	0.7	9.2	4.4	0.5	0
Arizona	7.5	15.8	6.1	1	0.1
Arkansas	3.1	NA	7.3	NA	0.2
California	39.4	21	8.4	1.2	0.3
Colorado	5.9	14	5.1	0.9	0
Connecticut	3.6	19.6	6.2	1.3	0.1
Delaware	1	35.8	6.5	2.9	0.1
District of Columbia	0.9	39.5	7	3.2	0.2
Florida	22.2	12.5	6.1	0.6	0.1
Georgia	11.1	NA	7.5	NA	0.2
Hawaii	1.4	4.9	2.2	0.3	0
Idaho	2	17.9	6.7	1.1	0.2
Illinois	12.7	26.9	8.3	1.8	0.3
Indiana	6.9	35.1	8.2	2.6	0.3
Iowa	3.2	20.8	6.6	1.4	0.2
Kansas	3	22.7	6.9	1.5	0.2
Kentucky	4.6	46.5	7.3	3.8	0.2
Louisiana	4.6	28.6	7.6	2.1	0.3
Maine	1.4	7.4	4.4	0.3	0
Maryland	6	31.9	6.7	2.5	0.2
Massachusetts	7	21.4	6.1	1.5	0.1
Michigan	10.1	29.6	7.4	2.2	0.2
Minnesota	5.8	13.9	5.9	0.8	0.1
Mississippi	3	NA	7.4	NA	0.2
Missouri	6.3	23.7	7.2	1.6	0.2
Montana	1.1	19.4	5.7	1.3	0.1
Nebraska	2	NA	5.7	NA	0.1
Nevada	3.2	9.4	5.3	0.4	0
New Hampshire	1.4	18.6	5.5	1.3	0
New Jersey	9.3	24.9	6.4	1.8	0.1
New Mexico	2.1	8.9	4.9	0.4	0
New York	19.7	28.2	6.5	2.1	0.1
North Carolina	10.8	29	6.7	2.2	0.2
North Dakota	0.8	12.9	5	0.8	0
Ohio	11.9	31.5	7.5	2.4	0.2
Oklahoma	4.1	19	7.1	1.2	0.2
Oregon	4.3	15.6	6	0.9	0.1
Pennsylvania	13.1	34.3	7.4	2.6	0.2
Rhode Island	1.1	22.9	6.2	1.6	0.1
South Carolina	5.3	24	6.6	1.7	0.2
South Dakota	0.9	NA	5.2	NA	0
Tennessee	7.1	35.2	7.2	2.7	0.2
Texas	30.4	17.8	6.9	1.1	0.2
Utah	3.4	15.5	6.2	0.9	0.1
Vermont	0.7	22.4	5.2	1.7	0
Virginia	8.7	28.2	6.3	2.1	0.1
Washington	7.8	12.1	5.9	0.6	0.1
West Virginia	1.8	33.4	6.5	2.6	0.1
Wisconsin	5.9	23.7	6.7	1.7	0.2
Wyoming	0.6	NA	4.7	NA	0

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 PM10 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 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.