AQLI Air Quality Life Index®

Pakistan Fact Sheet

Pakistan is the world's fourth most polluted country. Fine particulate air pollution ($PM_{2.5}$) shortens the average Pakistani resident's life expectancy by 3.9 years, relative to what it would be if the World Health Organization (WHO) guideline of 5 µg/m³ was met.[1] Some areas of Pakistan fare much worse than average, with air pollution shortening lives by almost 7 years in the country's most polluted regions like Lahore, Sheikhupura, Kasur and Peshawar.

KEY TAKEAWAYS

- All of Pakistan's 238 million people live in areas where the annual average particulate pollution level exceeds the WHO guideline; 98.3 percent of the population live in areas that exceed the country's own national air quality standard of 15 µg/m³.
- Measured in terms of life expectancy, particulate pollution is the second greatest threat to human health in Pakistan (behind cardiovascular diseases), taking 3.9 years off the life of the average Pakistani. In contrast, child and maternal malnutrition, and maternal and neonatal disorders reduce average life expectancy by 2.7 years.
- Particulate pollution has increased over time. From 1998 to 2021, average annual particulate pollution increased by 49.9 percent, further reducing life expectancy by 1.5 years.
- In the most polluted provinces of the country—Punjab, Islamabad Capital Territory and Khyber Pakhtunkhwa—165.5 million residents or 69.5 percent of Pakistan's population are on track to lose between 3.7 to 4.6 years of life expectancy on average relative to the WHO guideline and between 2.7 to 3.6 years relative to the national standard if the current pollution levels persist.
- If Pakistan were to reduce particulate pollution to meet the WHO guideline, residents in Karachi—Pakistan's most populous city—would gain 2.7 years of life expectancy.[2] In Lahore—the country's second most populous city—residents would gain 7.5 years of life expectancy. In Pakistan's capital city of Islamabad, residents would gain 4.5 years.

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

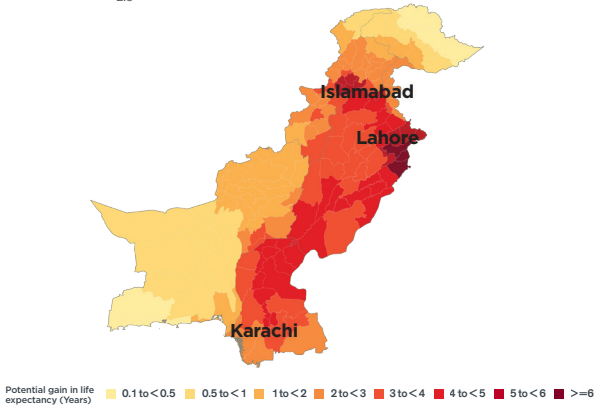
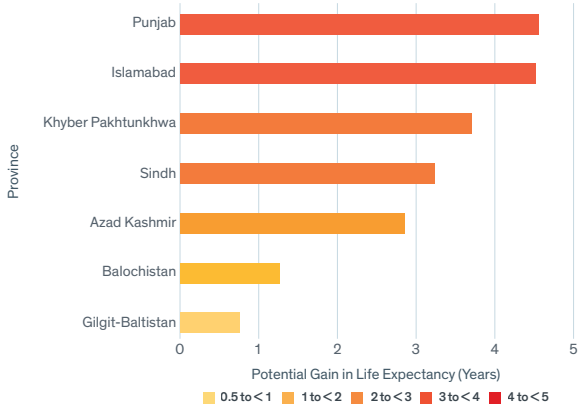


Figure 2 · Potential gain in life expectancy from reducing $PM_{2.5}$ from 2021 levels to the WHO guideline in all provinces of Pakistan



1 This data is based on the AQLI 2021 dataset. All annual average $PM_{2.5}$ values (measured in micrograms per cubic meter: µg/m³) are population weighted.

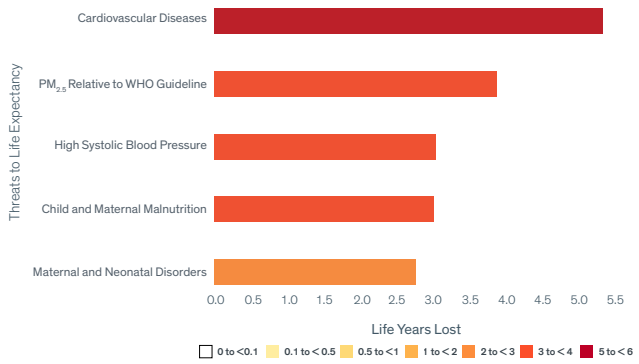
2 We define Karachi as the following six regions to Central Karachi, East Karachi, Korangi Karachi, Malir Karachi, South Karachi and West Karachi.

Embargoed until Tuesday, August 29 at 12am ET

Potential life expectancy impacts of particulate pollution reductions in the 25 most populous districts of Pakistan

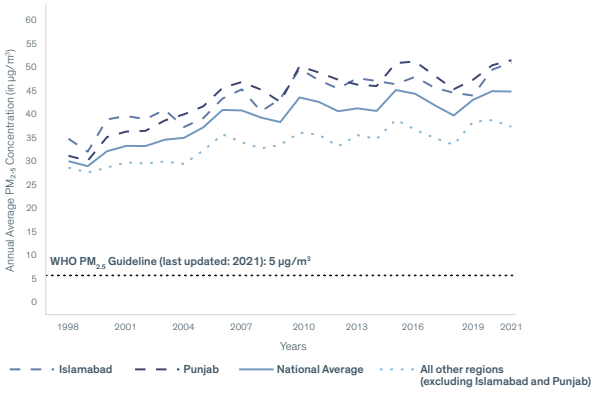
Region	Population (millions)	Annual average 2021 $PM_{2.5}$ concentration ($\mu g/m^3$)	Life expectancy gains from reducing $PM_{2.5}$ from 2021 concentration to WHO $PM_{2.5}$ guideline of 5 $\mu g/m$ (years)	Life expectancy gains from reducing $PM_{2.5}$ from 2021 concentration to national $PM_{2.5}$ guideline of 15 $\mu g/m^3$ (years)	Life expectancy gains from reducing $PM_{2.5}$ from 2021 concentration by 30 percent (years)
Lahore	9.3	81.8	7.5	6.5	2.4
Faisalabad	7.1	44.1	3.8	2.9	1.3
East Karachi	5.9	33.3	2.8	1.8	1
Rawalpindi	5.9	49.1	4.3	3.3	1.4
Multan	5.8	48.1	4.2	3.2	1.4
West Karachi	5.5	32.4	2.7	1.7	1
South Karachi	5.4	31.4	2.6	1.6	0.9
Bahawalpur	5.2	45.3	3.9	3	1.3
Rahim Yar Khan	5	50.3	4.4	3.5	1.5
Muzaffargarh	4.8	48.3	4.2	3.3	1.4
Peshawar	4.8	64.8	5.9	4.9	1.9
Gujranwala	4.5	62.5	5.6	4.7	1.8
Malir Karachi	4.3	33.4	2.8	1.8	1
Central Karachi	4.3	31.9	2.6	1.7	0.9
Sargodha	4.3	43.6	3.8	2.8	1.3
Bahawalnagar	3.9	48.6	4.3	3.3	1.4
Sialkot	3.6	59.6	5.4	4.4	1.8
Jhang	3.5	39.2	3.4	2.4	1.2
Gujrat	3.4	47.6	4.2	3.2	1.4
Bhakkar	3.3	39.3	3.4	2.4	1.2
Kasur	3.3	70.4	6.4	5.4	2.1
Khanewal	3.3	43.6	3.8	2.8	1.3
Vehari	3.2	46.6	4.1	3.1	1.4
Attock	3	47.6	4.2	3.2	1.4
Sheikhupura	3	72.2	6.6	5.6	2.1

Figure 3 · Top 5 threats to life expectancy in Pakistan



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 latest AQLI (2021) data.

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



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 PM_{10} 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 $PM_{2.5}$ 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.

aqli-info@uchicago.edu aqli.epic.uchicago.edu @UChiAir #AQLI

Embargoed until Tuesday, August 29 at 12am ET