AQLI Air Quality Life Index® | Europe Fact Sheet

Thanks to sustained enforcement of strong policies, European residents are exposed to 30.2 percent less fine particulate pollution ($PM_{2.5}$) than they were in 1998, gaining 5.6 months of life expectancy because of it.[1] Despite this success, the latest scientific evidence on the impact of particulate pollution at even the low levels that exist in much of Europe reveals that 96.8 percent of the population are living in areas with pollution levels exceeding the WHO guideline.[2]

KEY TAKE-AWAYS

- In 2022, particulate pollution in all European countries —with the exception of Iceland, Finland, Sweden and Norway—exceeded the WHO guideline of 5 µg/m³. If Europe's particulate pollution were to meet the WHO guideline, the average resident would gain 7.2 months of life expectancy, adding a total of 515.9 million life years to Europe's life expectancy.
- In April 2024, the European Union (EU) Parliament adopted a stricter 2030 limit for $PM_{2.5}$, lowering the annual PM2.5 limit from the current 25 µg/m³ to 10 µg/m³. As a result of this change, 12 out of the 27 EU countries (Bulgaria, Croatia, Cyprus, Czechia, Greece, Hungary, Italy, Latvia, Poland, Romania, Slovakia and Slovenia) - home to almost 40 percent of EU's population— no longer meet the region's pollution limit. If these countries were to meet the 2030 stricter limit, an average EU resident would live 4 months longer, adding more than over 56.4 million life years to the EU's total life expectancy.
- Pollution in non-EU countries is higher than EU countries. An average resident in a non-EU country stands to lose 3 more months of life expectancy because of the air they breathe compared to a resident of an EU country, relative to if the WHO guideline was met.
- Geographically, Eastern Europe is on average more polluted than Western Europe. An average Eastern European stands to lose 9.4 months of life expectancy relative to the WHO guideline compared to 4.6 months of life lost in Western Europe (Figure 1).

Figure 1 · Potential Gain in Years of Life Expectancy through Permanently Reducing $PM_{2.5}$ from 2022 Concentrations to the WHO

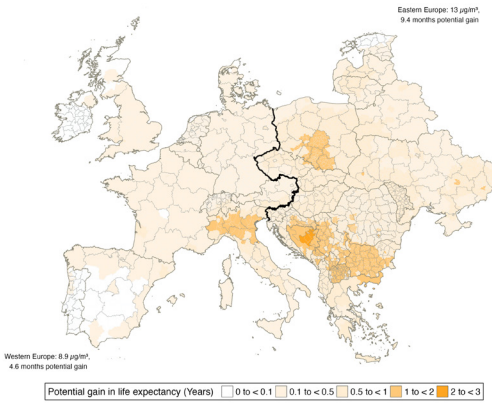
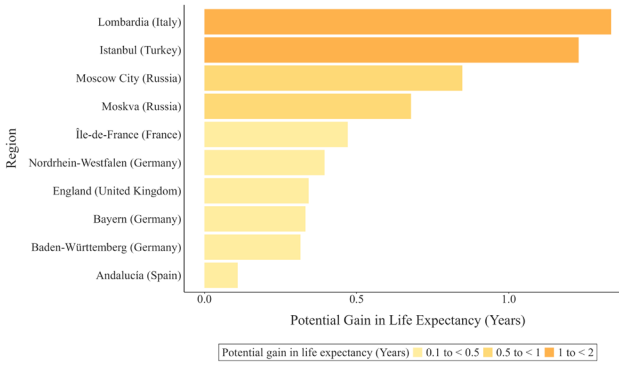


Figure 2 ·Potential gain in life expectancy from reducing $PM_{2.5}$ from 2022 levels to the WHO guideline in the 10 most populous regions of Europe



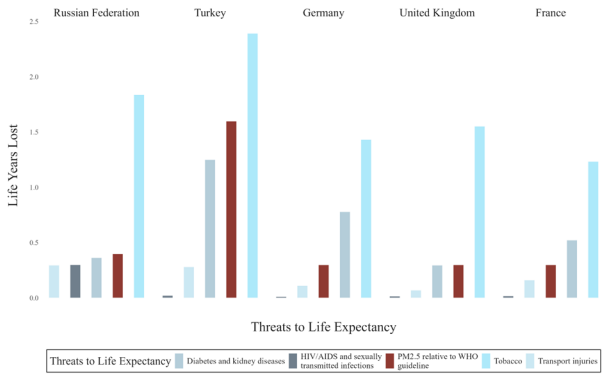
1 Europe is defined as the 53 countries listed in the following file: https://drive.google.com/file/d/1CpDGkKu96HcKr5xCZ3QozIdnozJMetrH/view?usp=drive_link

2 This data is based on the AQLI 2022 dataset. All annual average $PM_{2.5}$ values (measured in micrograms per cubic meter: µg/m³) are population weighted.

3 Western Europe and Eastern Europe are defined here: https://www.google.com/url?q=https://docs.google.com/spreadsheets/d/1U9-juiKmd4a0dr9Y-ZAO7_lj6RPFn04Fu7wIleyaNj0I/edit&sa=D&source=editors&ust=1724271433266427&usg=AOvVaw2pPrSqXWU5t9lJc8c2jAis

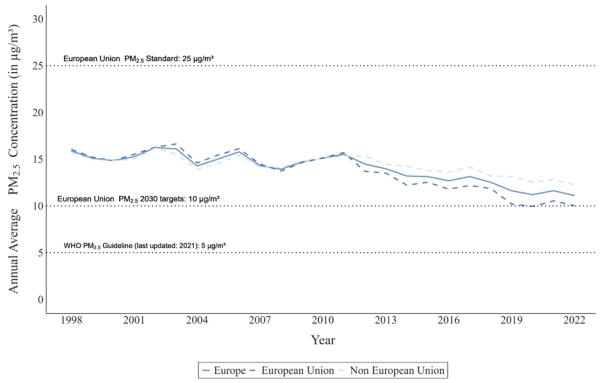
- While Akköy in Turkey is the most polluted region in all of Europe—-with an average resident likely to live 2.9 years longer if the WHO guideline were met— Bosnia and Herzegovina is the most polluted country in Europe. Particularly, the cities of Tuzla and Zenica-Doboj, and their surrounding areas, see high levels of particulate pollution. If pollution were to improve to meet the WHO guideline, residents in Tuzla (the most polluted region in the country) would add 2.5 years onto their lives.
- In the 10 most populous regions in Europe, the potential gain in life expectancy from meeting the WHO guideline is highest in Lombardia, Italy at 1.3 years followed by Istanbul, Turkey at 1.2 years (Figure 2).
- In the 5 most populous countries of Europe, particulate pollution is a greater threat to life expectancy than compared to HIV/AIDS or transport injuries. For instance, in Turkey - the most polluted of the five most populous countries - while particulate pollution is taking off 9.6 months from the life expectancy of an average Italian resident, HIV/AIDS and transport injuries are taking off 0.3 and 2 months, respectively (Figure 3).

Figure 3 · Comparison of selected major global threats to life expectancy in the 5 most populous countries in Europe



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 (2021) data.

Figure 4 · Annual average $PM_{2.5}$ concentration in Europe, 1998-2022



POLICY IMPACTS

Much progress has been made in Europe in reducing particulate pollution. Over the last 25 years, particulate pollution has declined by 30.2 percent on average across the continent as a whole. This improvement came with the introduction of strong pollution policies starting with the creation of the European Environment Agency in the mid-1990's. In subsequent years, the European Union set emissions targets, created a pollution standard, and introduced a comprehensive clean air program to reduce the effect of air pollution on human health.

Much work still remains to further improve air quality across Europe. Thirteen out of 53 countries (13.8 percent of Europe's population) still don't have a national $PM_{2.5}$ standard. And while 99.9 percent of the European Union's population lives in areas that are in compliance with the current annual $PM_{2.5}$ limit of 25 µg/m³, 38 percent of EU's population now live in areas that don't meet the stricter 2030 limit of 10 µg/m³. Europe is taking several active steps towards air pollution mitigation, which if continued has the potential to significantly add years to the lives of its residents. Some of these actions include increasingly stricter emission standards for vehicles (Euro-6), promotion of electric vehicles, low emission zones, actively phasing out coal power, and improving public transportation.

4 This map excludes Islas Canarias (Spain), and Azores and Madeira (Portugal) due to space limitations, but all underlying calculations include these regions. Refer footnote 3 for our definition of Eastern and Western Europe.

Potential life expectancy impacts of particulate pollution reductions in European-countries and the most polluted region in each country

Country	Annual average PM2.5 concentration (in µg/m³)	Life Expectancy Gains from reducing PM2.5 from 2022 Concentrations to the WHO Guideline of 5 µg/m³ in the given country	Percent of population above WHO guideline	Region with highest PM2.5 concentration in 2022	Annual average PM2.5 concentration in most polluted region	Life Expectancy Gains from reducing PM2.5 from 2022 Concentrations to the WHO Guideline of 5 µg/m³ in the most polluted region
Albania	12.6	0.7	100	Kukësit	15.3	1
Armenia	19.5	1.4	100	NA	23.4	1.8
Austria	11	0.6	100	Graz Stadt	12.2	0.7
Azerbaijan	13.2	0.8	100	Sadarak	20	1.5
Belarus	10.4	0.5	100	Kamyanyets	11.1	0.6
Bosnia and Herzegovina	23.9	1.9	100	Tuzla	30.9	2.5
Bulgaria	18.8	1.4	100	Dimitrovgrad	24.7	1.9
Croatia	14.3	0.9	100	Gunja	26.2	2.1
Cyprus	14.7	1	100	NA	15	1
Czechia	12	0.7	100	Karvin	18.2	1.3
France	10.7	0.6	100	Paris	11.6	0.7
Georgia	13.7	0.9	100	Gardabani	16.1	1.1
Germany	10.1	0.5	100	Berlin	10.1	0.5
Greece	13	0.8	100	East Macedonia and Thrace	15.9	1.1
Hungary	12	0.7	100	Siklósi	14	0.9
Italy	14.5	0.9	100	Milano	22	1.7
Kazakhstan	15.9	1.1	100	Saryagashskiy	27.2	2.2
Kosovo	15.5	1	100	Prizren	17.3	1.2
Latvia	14	0.9	100	Riga	14.5	0.9
Liechtenstein	10.9	0.6	100	NA	11.3	0.6
Lithuania	10.6	0.5	100	Joniskio	12.3	0.7
Macedonia	19	1.4	100	NA	22.4	1.7
Moldova	11.5	0.6	100	NA	13.2	0.8
Montenegro	15.1	1	100	NA	18.4	1.3
Netherlands	10.4	0.5	100	Sluis	10.4	0.5
Northern Cyprus	14.5	0.9	100	NA	14.8	1
Poland	14.5	0.9	100	Oświęcim	22.1	1.7
Romania	13.7	0.9	100	Rovinari	18.9	1.4
Russia	12	0.7	100	Khankayskiy rayon	19.1	1.4
San Marino	13.5	0.8	100	NA	14.6	0.9
Serbia	16.9	1.2	100	Mali Zvornik	25.7	2
Slovakia	12.1	0.7	100	Námestovo	15.4	1
Slovenia	12.4	0.7	100	Domžale	13.9	0.9
Spain	13.3	0.8	100	Barcelona	13.3	0.8
Switzerland	11	0.6	100	Mendrisio	13.3	0.8
Turkey	21.1	1.6	100	Akkoy	34.5	2.9
Ukraine	11.5	0.6	100	Dnipropetrovs'ka	16.7	1.1
United Kingdom	11.5	0.6	100	Caerphilly	13.1	0.8
Vatican City	11.1	0.6	100	NA	11.1	0.6
Russia	10	0.5	98.1	Yevrey	14.8	1
San marino	10.7	0.6	100	Faetano	10.7	0.6
Serbia	19.4	1.4	100	Mačvanski	24	1.9
Slovakia	12.9	0.8	100	Žilinský	14.7	1
Slovenia	12.8	0.8	100	Osrednjeslovenska	14	0.9
Spain	6.7	0.2	89	Cataluña	9.8	0.5
Sweden	4.6	0	36.5	Skåne	6	0.1
Switzerland	7.8	0.3	100	Ticino	11.2	0.6
Turkey	21.6	1.6	100	Aydin	29.8	2.4
Ukraine	13.7	0.9	100	Donets'k	17.6	1.2
United Kingdom	7.2	0.2	92.4	Wales	8.2	0.3
Vatican city	10.9	0.6	100	NA	10.9	0.6

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 particulates air pollution from other factors that affect health. The more recent of the two studies 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. To learn more about the methodology used by the AQLI, visit: aqli.epic.uchicago.edu/about/methodology