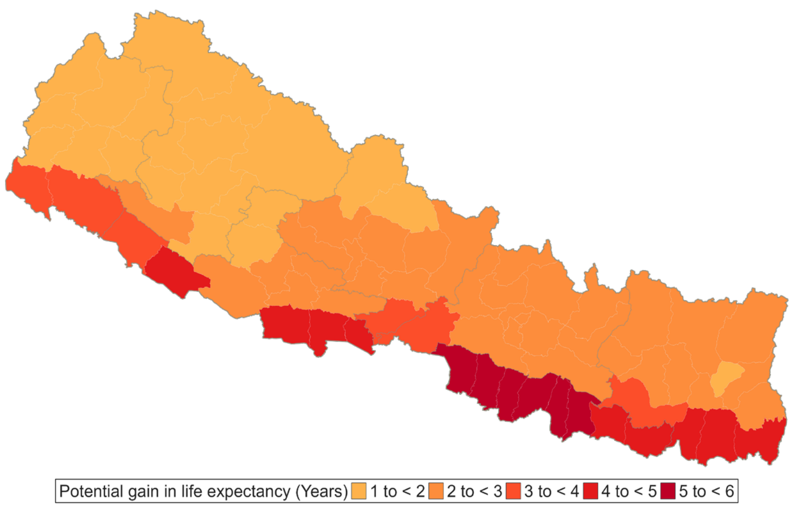
AQLI Air Quality Life Index® | Nepal Fact Sheet

Nepal is the world's third most polluted country based on satellite-derived $PM_{2.5}$ data. Fine particulate air pollution ($PM_{2.5}$) shortens the average Nepalese resident's life expectancy by 3.4 years, relative to what it would be if the World Health Organization (WHO) guideline of 5 µg/m3 was met (Figure 1).[1] Some areas of Nepal fare much worse than average, with air pollution shortening lives by 5.1 years in the ten districts with highest concentration of particulate pollution (Figure 2).[2] These districts lie in southern Nepal and share their borders with the highly-polluted Northern Plains of India.[3]

KEY TAKE-AWAYS

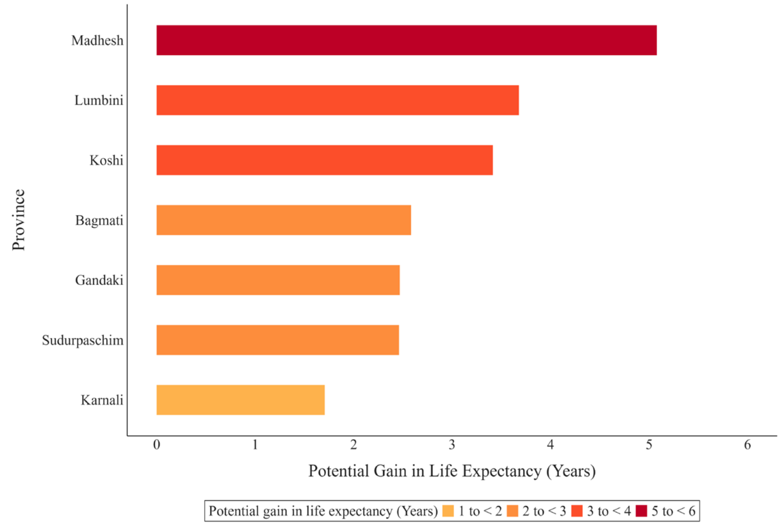
- All of Nepal's 30.7 million people live in areas where the annual average particulate pollution level exceeds the WHO guideline.
- Measured in terms of life expectancy, particulate pollution is the greatest threat to human health in Nepal. While particulate pollution takes 3.4 years off the life of the average Nepalese resident, tobacco use reduces life expectancy by 1.9 years, and dietary risks and high blood pressure reduce life expectancy by 1.5 years (Figure 3).
- In 2022, particulate pollution in Nepal was 18 percent lower relative to 2021. If this decline is sustained, an average Nepal resident could live 10 months longer than what they would have if they were exposed to the 2021 particulate pollution levels.
- However, longer-term pollution trends suggest that Nepal's average annual particulate pollution increased by 49 percent from 1998 to 2022, lowering life expectancy by 1.3 years (Figure 4).
- If Nepal were to reduce particulate pollution to meet the WHO guideline, residents in the mid and eastern Terai region—where nearly 40 percent of Nepal's population resides—would gain 4.8 years of life expectancy.[4] In the capital city of Kathmandu—Nepal's most populous city—residents would gain 2.6 years of life expectancy.

Figure 1.
Potential gain in life expectancy from permanently reducing $PM_{2.5}$ from 2022 concentration to the WHO guideline



1 This data is based on the AQLI 2022 dataset. All annual average $PM_{2.5}$ values (measured in micrograms per cubic meter: µg/m^3) are population weighted.
2 We include the districts of Bara, Dhanusha, Kapilbastu, Mahottari, Nawalparasi West, Parsa, Rautahat, Rupandehi, Sarlahi, and Siraha to calculate this average.
3 We define the Northern plains of India as the following seven states and union territories: Bihar, Chandigarh, Delhi, Haryana, Punjab, Uttar Pradesh, and West Bengal.
4 We define the mid and eastern Terai region as the following districts : Kapilbastu, Rupandehi, Nawalparasi West, Nawalparasi East, Parsa, Bara, Rautahat, Sarlahi, Mahottari, Dhanusha, Siraha, Saptari, Sunsari, Morang, JhapaMahottari, Dhanusha, Siraha, Saptari, Sunsari, Morang, Jhapa.

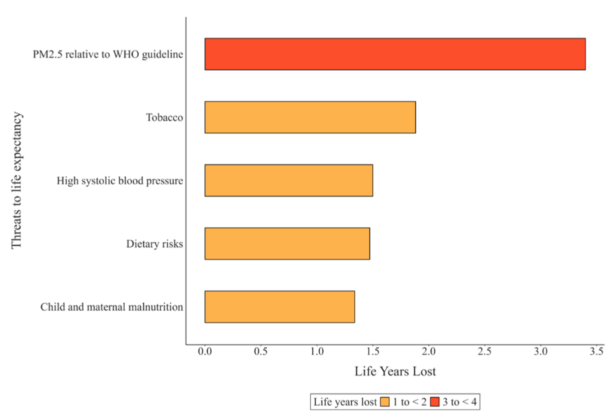
Figure 2.
Potential gain in life expectancy from reducing $PM_{2.5}$ from 2022 levels to the WHO guideline in all provinces of Nepal



POLICY IMPACTS

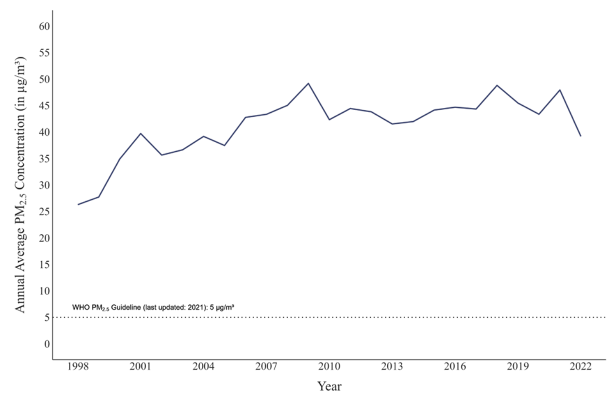
Despite a high health burden due to particulate pollution, the country does not have a national standard for annual average $PM_{2.5}$. However, the country has a 24-hr standard of 40 µg/m³. While there is more to be done, in 2017, Nepal instituted an Air Quality Management Action Plan for Kathmandu Valley.[5] The plan calls for strengthening the valley's air quality monitoring system with a special focus on PM_{10} and $PM_{2.5}$. It uses an integrated urban air quality management framework and incorporates air quality objectives with sectoral policies such as investment in renewable energy, waste management and land use planning. The plan also identifies transport, brick manufacturing, and construction as the most polluting industries, and suggests measures to strengthen air quality monitoring, develop emissions inventory, and conduct impact assessments along with specific policies for a sustainable transport system, emissions reduction, and eco-friendly construction.[6]

Figure 3 · Top 5 threats to life expectancy in Nepal



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 (2022) data.

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



5 Kathmandu Valley is defined as the following districts: Kathmandu, Lalitpur, Bhaktapur

6 Nepal Ministry of Populations and Environment, Department of Environment. 2017. "Air Quality Management Action Plan for Kathmandu Valley" https://doenv.gov.np/progressfiles/Final-Report-on-AQM-Action-Plan-2017-42479-32168-1663670175.pdf

Potential life expectancy impacts of particulate pollution reductions in the 25 most populous regions of Nepal

District	Population (Millions)	Annual Average 2022 $PM_{2.5}$ Concentration (μg/m³)	Life Expectancy Gains from reducing PM2.5 from 2022 concentration to WHO $PM_{2.5}$ guideline of 5 μg/m	Life Expectancy Gains from reducing $PM_{2.5}$ from 2022 concentration by 30 percent
Kathmandu	2	31.3	2.6	0.9
Morang	1.1	47.5	4.2	1.4
Rupandehi	1	54.6	4.9	1.6
Jhapa	0.9	47	4.1	1.4
Kailali	0.9	40.5	3.5	1.2
Sarlahi	0.9	56.2	5	1.7
Dhanusha	0.9	57.1	5.1	1.7
Sunsari	0.9	48.5	4.3	1.4
Bara	0.8	58	5.2	1.7
Rautahat	0.8	59.4	5.3	1.7
Siraha	0.7	54.6	4.9	1.6
Saptari	0.7	52.1	4.6	1.5
Mahottari	0.7	58.7	5.3	1.7

District	Population (Millions)	Annual Average 2022 $PM_{2.5}$ Concentration (μg/m³)	Life Expectancy Gains from reducing $PM_{2.5}$ from 2022 concentration to WHO $PM_{2.5}$ guideline of 5 μg/m	Life Expectancy Gains from reducing $PM_{2.5}$ from 2022 concentration by 30 percent
Parsa	0.7	58.2	5.2	1.7
Chitawan	0.7	40.6	3.5	1.2
Kapilbastu	0.7	53.9	4.8	1.6
Dang	0.6	33.8	2.8	1
Banke	0.6	46.8	4.1	1.4
Kaski	0.6	28.7	2.3	0.8
Kanchanpur	0.5	40.2	3.4	1.2
Lalitpur	0.5	28.4	2.3	0.8
Bardiya	0.5	44.8	3.9	1.3
Makawanpur	0.5	31.7	2.6	0.9
Kabhrepalanchok	0.4	28.2	2.3	0.8
Surkhet	0.4	26.9	2.1	0.8

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 recent 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, global particulate measurements, yielding unprecedented insight into the true cost of particulate 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. The more recent of the two studies found that sustained exposure to an additional 10 μg/m3 of PM10 reduces life expectancy by 0.64 years. In terms of PM2.5, this translates to the relationship that an additional 10 μg/m3 of PM2.5 reduces life expectancy by 0.98 years. All AQLI annual average PM2.5 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 sea-salt and mineral dust removed satellite-derived PM2.5 data. Thus, our data can be interpreted as concentrations stemming primarily from human activity. 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