## Air pollution's health and economic costs in South Asia

Air pollution brings significant health and societal costs in South Asia. In 2019 alone, air pollution was linked to more than 2 million deaths across the region and accounted for a loss of as much as 2.4 years of life. Economic impacts, including workforce disruptors such as poor health and loss of productivity, cost South Asian countries billions of dollars annually.
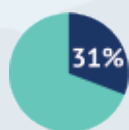
**31%** Home to 9 out of 10 of the world's largest cities, South Asia is at the front line for air pollution impacts and interventions. 31% of fine particulate matter ($PM_{2.5}$) in the region comes from residential sources, including the use of solid fuels for heating and cooking. Additionally, a growing fleet of personal vehicles and continued reliance on coal for energy production poses the challenge of increasing levels of nitrogen dioxide ($NO_2$) and $PM_{2.5}$.

## Nitrogen dioxide: A pollutant of concern in South Asia

Nitrogen dioxide, a gaseous pollutant, is emitted from burning fossil fuels in vehicles, power plants, and industrial facilities; it is often used as a marker for traffic-related air pollution. Increased $NO_2$ levels can also have implications for production of ozone — another gaseous pollutant that can be harmful for health as well as formation of particulate matter. Exposure to $NO_2$ can irritate airways, aggravate existing respiratory diseases, raise the risk of asthma development in children, and increase the frequency and severity of asthma symptoms in children and adults. $NO_2$ exposure has also been linked to
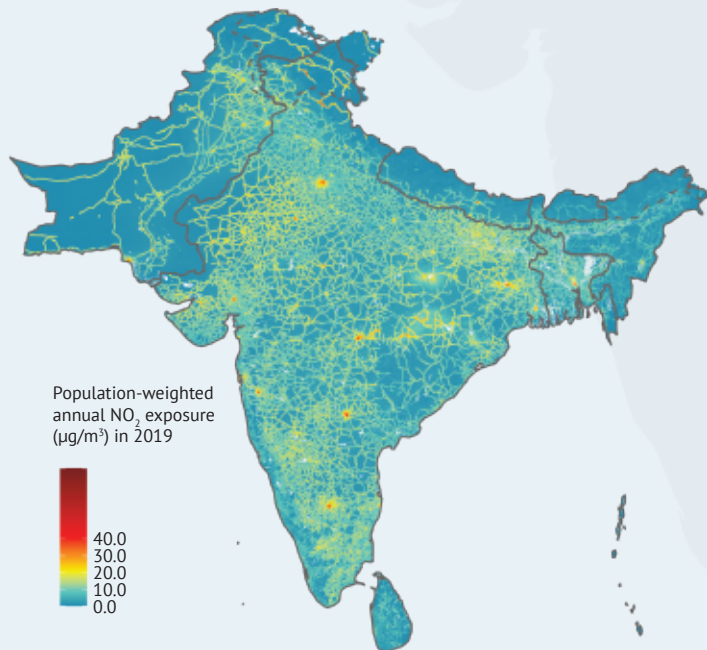
- impaired lung development
- intensifying allergies
- increased susceptibility to respiratory infections



Population-weighted annual $NO_2$ exposure (µg/m³) in 2019

40.0
30.0
20.0
10.0
0.0

South Asia is among the few regions in the world where $NO_2$ levels are increasing in some areas. Between 2000 and 2019, $NO_2$ exposure in South Asia increased by 22%, while global averages decreased by 5%. This increase is likely driven by a reliance on fossil fuels for energy production, expanded industrial activity, and increases in the numbers of passenger vehicles over the last decade. For example, in India in 2019:

- More than 60% of households owned a motorcycle, up from 19% in 1990.

- 16% owned a car, up from only 3% in 1990.

In 2019, only 195 cities in South Asia out of the total 1,500 met the WHO Guideline for $NO_2$ exposure (10 µg/m³).

The top 20 cities with the highest $NO_2$ levels in the region include Kathmandu (Nepal), Hyderabad (India), Bengaluru (India), and Karachi (Pakistan), cities that do not rank high for $PM_{2.5}$ levels.

# Population-weighted pollutant exposure in capital cities and megacities in Bangladesh, India, Nepal, Pakistan, and Sri Lanka in 2019

## PM$_{2.5}$ (µg/m$^3$)

| City | Value |
|---|---|
| Delhi, India | **110** |
| Kolkata, India | **84.0** |
| Biratnagar, Nepal | **76.6** |
| Khulna, Bangladesh | **74.0** |
| Rajshahi, Bangladesh | **73.9** |
| Dhaka, Bangladesh | **71.4** |
| Karachi, Pakistan | **63.6** |
| Multan, Pakistan | **59.0** |
| Patan, India | **57.5** |
| Kathmandu, Nepal | **51.5** |
| Sylhet, Bangladesh | **50.7** |
| Pokhara, Nepal | **50.6** |
| Lahore, Pakistan | **50.2** |
| Hyderabad, India | **47.8** |
| Chattogram, Bangladesh | **46.0** |
| Rawalpindi - Islamabad, Pakistan | **45.6** |
| Mumbai, India | **45.1** |
| Faisalabad, Pakistan | **42.4** |
| Chennai, India | **41.7** |
| Bengaluru, India | **39.3** |
| Colombo, Sri Lanka | **17.7** |

## NO$_2$ (µg/m$^3$)

| City | Value |
|---|---|
| Bengaluru, India | **34.0** |
| Hyderabad, India | **33.2** |
| Kathmandu, Nepal | **30.2** |
| Karachi, Pakistan | **26.6** |
| Mumbai, India | **25.9** |
| Delhi, India | **25.6** |
| Dhaka, Bangladesh | **23.6** |
| Faisalabad, Pakistan | **22.0** |
| Chattogram, Bangladesh | **21.3** |
| Patan, India | **20.6** |
| Rawalpindi - Islamabad, Pakistan | **20.4** |
| Multan, Pakistan | **20.3** |
| Kolkata, India | **20.2** |
| Chennai, India | **20.1** |
| Lahore, Pakistan | **19.3** |
| Biratnagar, Nepal | **18.2** |
| Sylhet, Bangladesh | **13.5** |
| Colombo, Sri Lanka | **13.2** |
| Rajshahi, Bangladesh | **13.1** |
| Pokhara, Nepal | **12.2** |
| Khulna, Bangladesh | **11.0** |

*Note that the dotted line represents the WHO Annual Air Quality Guideline for PM$_{2.5}$ (5 µg/m$^3$) and NO$_2$ (10 µg/m$^3$), respectively.*

# PM$_{2.5}$ pollution remains high and harmful

PM$_{2.5}$ exposures in South Asian cities are among the highest in the world. Average exposure across urban areas in 2019 was 68.4 μg/m³ — more than 50% above the global average of 42.6 μg/m³. Fewer than 1% of cities in the region meet the WHO Guideline for PM$_{2.5}$. Of the cities with the lowest exposure to PM$_{2.5}$, the majority exist in Sri Lanka, along India's coastline, or in the northern mountains in Pakistan (see figure below).
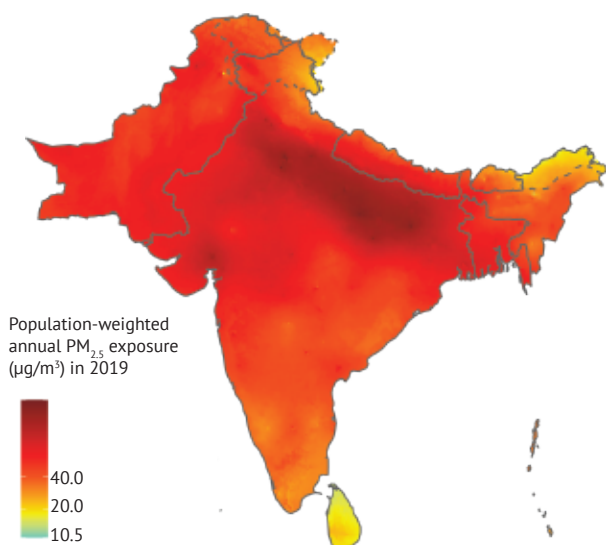
| Country | Years of Life Lost Due to PM$_{2.5}$ Pollution |
|---|---|
| Bangladesh | 1.1 |
| India | 1.5 |
| Nepal | 1.2 |
| Pakistan | 1.3 |
| Sri Lanka | 0.6 |



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## Average urban disease burden linked to ambient PM$_{2.5}$ is highest among cities in Nepal and lowest among cities in Pakistan



Population-weighted annual PM$_{2.5}$ exposure (μg/m³) in 2019

40.0
20.0
10.5

Air pollution is the leading environmental risk factor for poor health in South Asia. At the population level, the disease burden of air pollution can strain health care systems and have broader impact on communities and economies.

Exposure to PM$_{2.5}$ resulted in a total of 425,000 deaths across 1,500 cities in South Asia included in this analysis.

On average, PM$_{2.5}$ exposure was linked to 85 deaths for every 100,000 people across the region.

34% of the deaths in the 20 most populated cities, including the capital cities, are linked to exposure to PM$_{2.5}$.

# Targeted interventions are underway to address key sources

Emissions reductions are imperative for improvements in air quality and public health. The high population density across the region, elevated levels of pollution, and unique makeup of pollution sources mean that regional action can bring improvements to air quality. In recent years, a collaborative airshed management approach has been proposed and efforts are beginning to promote regional action.

**Tackling emissions from vehicles:** In 2020, India's national government chose to leapfrog from Bharat Stage IV to the more stringent Bharat Stage VI vehicle tailpipe emission standards. With the new standards, India introduced stricter limits for on-road and nonroad vehicles and encouraged ultra-low sulfur fuel.

**Cleaning up the brick kilns:** Following the earthquake in 2015 in Kathmandu, Nepal, brick kilns were rebuilt using the cleaner zig-zag technology. This new type of kiln led to reductions in fuel use and fewer emissions. Following the successful implementation in Kathmandu, the technology has since been expanded across South Asia. For more, check out this video.

**Developing a coordinated national strategy:** In Pakistan, legislators and clean air advocates have worked with the Ministry of the Environment to develop a National Clean Air Plan. The first of its kind in Pakistan, the National Clean Air Plan has prompted greater awareness about air pollution and gives power to provinces to implement necessary improvements.

**Joint action on air pollution and climate:** Bangladesh, a founding member of the Climate and Clean Air Coalition, demonstrated its commitment to improving air quality through the National Action Plan for Reducing Short-Lived Climate Pollutants. Although this plan largely addresses black carbon, a full implementation would reduce emissions by 40% by 2030.