



CASE STUDY

Decreasing Air Pollution for Equity in India

Healthy City

Climate Issue: Air Pollution

- In India, air pollution is a leading cause of premature death among women and children, with several hundred thousand cases annually
- The uneven spread of air pollution highlights the unequal environmental impacts of economic development
- Lower socioeconomic regions tend to have worse air pollution
- However, there are gaps in understanding what activities contribute the most to air pollution, and who causes them
- Understanding the specific causes and mortality impacts of air pollution, including PM2.5 concentrations, can help policymakers save lives.

What is PM2.5?

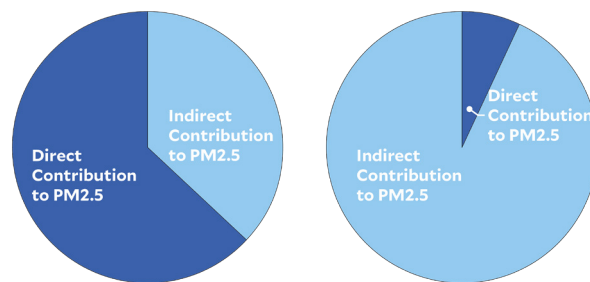
Fine particulate matter, or PM2.5, comprises tiny particles in the air—about 2.5 micrometers in diameter or less. They are produced by the burning of fossil fuels and biomass in natural, industrial, and household activities. These emissions affect residents directly but also contribute to ambient air pollution. Through inhalation, particles can enter the bloodstream, causing health problems like lung and heart diseases.

What Causes Air Pollution in India?

Households are responsible for approximately half of ambient PM2.5 pollution in India. This is due to:

- (1) **Direct sources** that cause the emission of pollutants, such as biomass-burning cook stoves. Often, these emissions remain indoors, but they can also contribute to ambient air pollution
 - (2) **Indirect sources** that lead to pollution through associated processes or resource use. These include vehicles, electricity, and the manufacture of products that households consume
- The science shows that indirect sources contribute almost twice as much to ambient air pollution as direct sources
 - Urban residents do not contribute equally to different sources of air pollution; nor are they equally affected.

Air Pollution Disproportionately Affects Lower-Income Residents



Lower-Income Households Higher-Income Households

- Lower-income households contribute to ambient PM2.5 pollution mostly through direct sources
- As incomes rise, indirect contributions to pollution increase. This is due to high consumption of goods, food production, and waste
- The death rate from ambient PM2.5 pollution is lower among higher-income households
- Lower-income households suffer the most while contributing the least to this pollution.
- Solutions should target the greatest risks to lower-income households. This can maximize the number of lives saved.

NEXT STEPS FOR INDIA

- Incentivize or provide clean cooking fuels and stoves that do not burn biomass. This would significantly reduce indoor air pollution, saving up to 690,000 lives annually
- Set controls for all other ambient PM2.5 sources industry-wide, saving an additional 80,000 lives annually.

WHAT CAN YOUR CITY DO?

EVALUATE specific causes of air pollution to understand who is most responsible versus most impacted

TARGET solutions such as clean cook stoves that prioritize disproportionately-impacted populations

IMPLEMENT tougher emission standards and cleaner production methods for vehicles, factories, and farms.

To find out more information on this case study, contact **Narasimha Rao** at nrao@yale.edu. Case study based off Rao, N.D., Kiesewetter, G., Min, J. et al. Household contributions to and impacts from air pollution in India. *Nat Sustain* 4, 859–867 (2021). <https://doi.org/10.1038/s41893-021-00744-0>