

JUNE 2019

communications@theicct.org [WWW.THEICCT.ORG](http://WWW.THEICCT.ORG)

## HEALTH IMPACTS OF AIR POLLUTION FROM TRANSPORTATION SOURCES IN DELHI

A new study provides a detailed picture of the health impacts attributable to emissions from four transportation subsectors: on-road diesel vehicles, on-road non-diesel vehicles, shipping, and non-road mobile sources such as agricultural and construction equipment. The study, by researchers from the International Council on Clean Transportation, George Washington University Milken Institute School of Public Health, and the University of Colorado Boulder, links state-of-the-art vehicle emissions, air pollution, and epidemiological models to estimate health impacts at the global, regional, national, and local levels in 2010 and 2015.

### KEY FINDINGS FOR THE NEW DELHI REGION

In 2015, 1,800 premature deaths in New Delhi were attributable to ambient  $PM_{2.5}$  and ozone from transportation tailpipe emissions. Deaths attributable to ambient  $PM_{2.5}$  and ozone from all sources totaled 17,000, meaning that transportation accounted for just over one-tenth (11%) of all deaths from air pollution that year in New Delhi.

Compared with other major urban areas in India, New Delhi had the highest number of deaths attributable to transportation emissions in 2015 and the highest mortality rate—9 deaths per 100,000 population. New Delhi accounted for 2.5% of transportation-attributable deaths from  $PM_{2.5}$  and ozone pollution in India in 2015.

Compared with other countries, India ranked second after China in the number of deaths attributable to transportation emissions in 2015.

An estimated 74,000<sup>1</sup> premature deaths were attributable to transportation emissions in India 2015. This represents a 28% increase in annual transportation-attributable deaths in India compared with 2010.

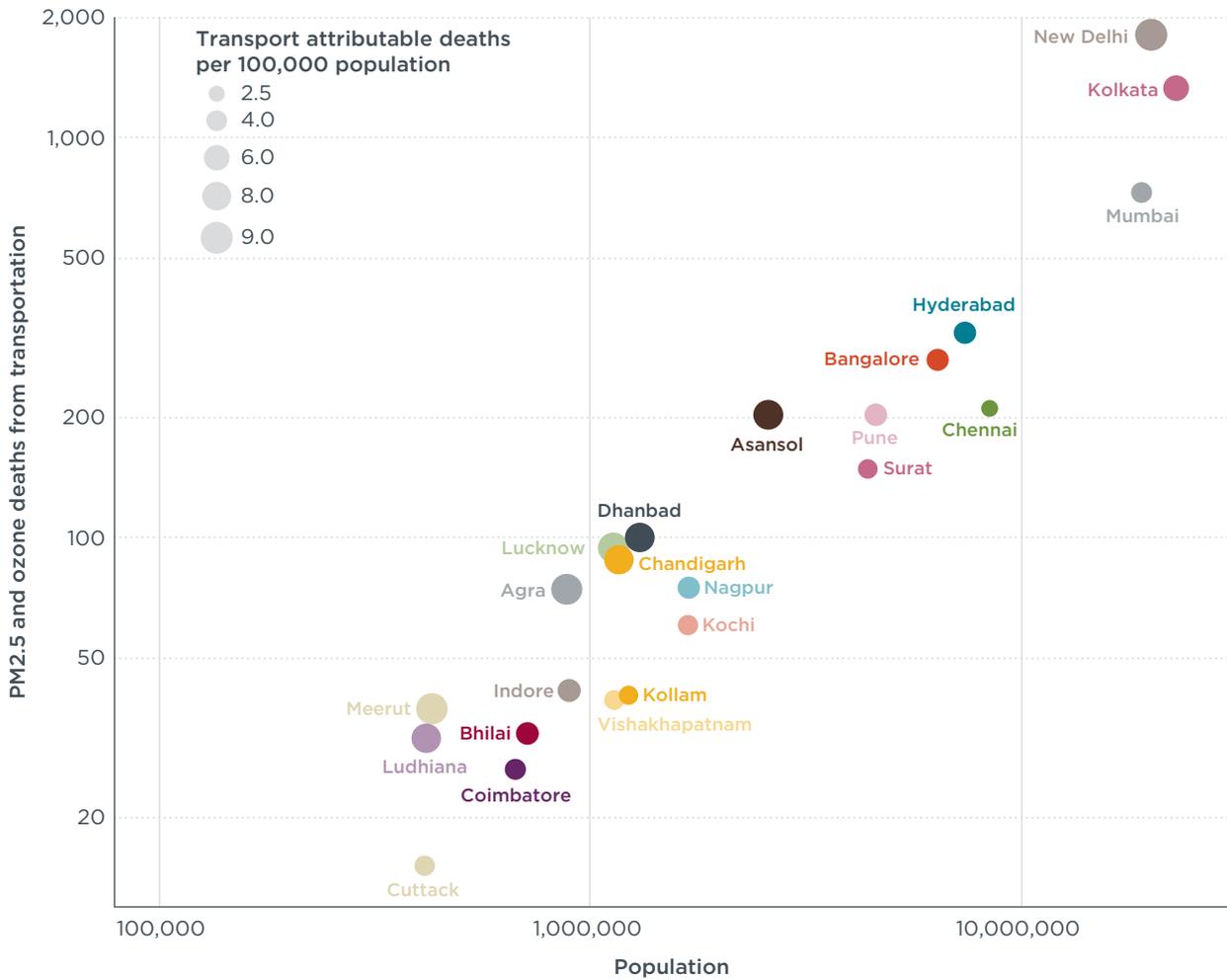
On-road diesel vehicles contributed 60% of the transportation health burden in New Delhi, followed by non-road mobile sources, including agricultural and construction equipment and rail (24%); on-road non-diesel vehicles (13%); and international shipping (1%). The high contribution of on-road diesel vehicles reflects both tailpipe  $PM_{2.5}$  and  $NO_x$  emissions, the latter of which [contribute](#) to secondary  $PM_{2.5}$  (in the form of nitrate aerosols) and ozone.

Among 200 major urban areas worldwide that the study evaluated, New Delhi ranked 8<sup>th</sup> in population and 6<sup>th</sup> in the number of deaths attributable to transportation emissions in 2015. The top ten by number of deaths attributable to transportation emissions in 2015 were Guangzhou, Tokyo, Shanghai, Mexico City, Cairo, Moscow, New Delhi, Beijing, London, and Los Angeles.

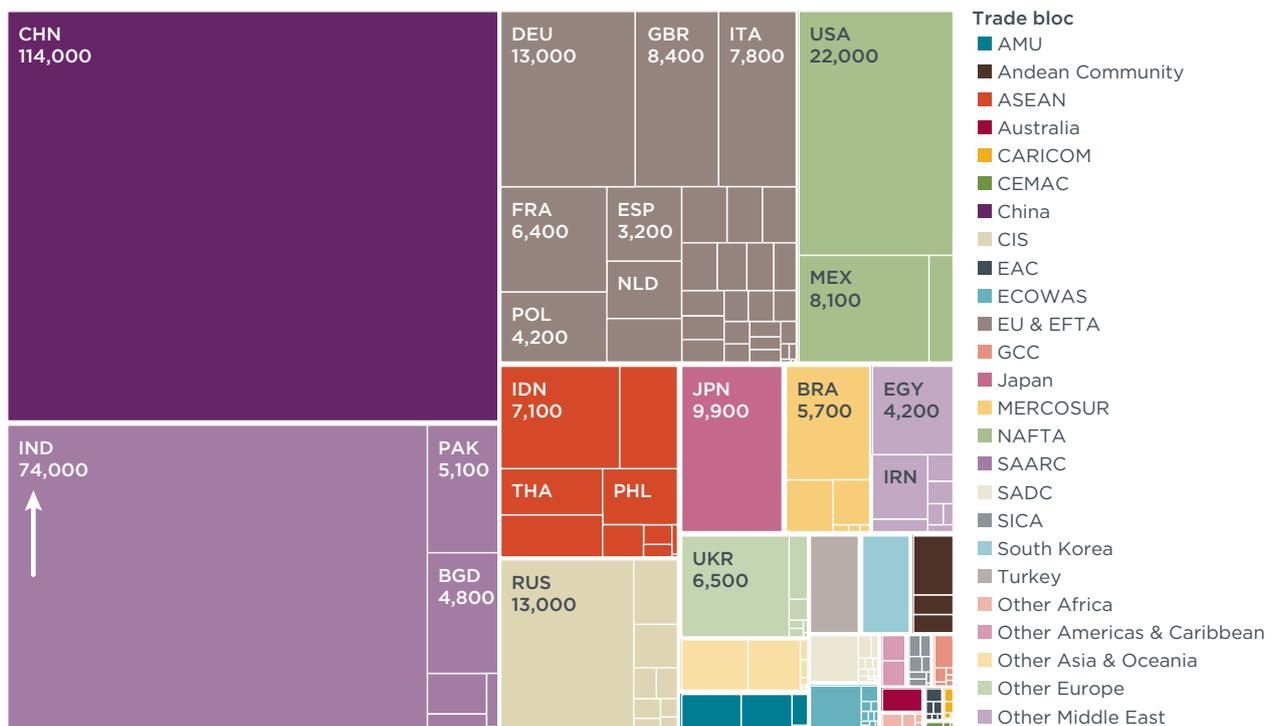
### POLICY IMPLICATIONS

The Delhi government has planned or has already undertaken several actions to curb vehicular pollution as part of the comprehensive action plan for [air pollution control](#). These measures include implementing an environment pollution charge of 1% on registration of diesel vehicles with engines greater than 2L, expanding the compressed natural gas program, requiring the installation of vapor recovery systems at refueling stations, and auditing of the 'pollution

<sup>1</sup> The estimated 95% confidence interval is 51,000 to 95,000 reflecting uncertainty in the concentration-response function.



Transportation-attributable deaths from PM<sub>2.5</sub> and ozone pollution, mortality rates, and population in major urban areas in India, 2015. Bubble size indicates the transportation-attributable mortality rate per 100,000 population.



National total PM<sub>2.5</sub> and ozone mortality that is attributable to transportation emissions in 2015 in major trade blocs globally, using central relative risk estimates. The size of each box corresponds to each region's share of global transportation-attributable PM<sub>2.5</sub> and ozone mortality in 2015.

under control' centers. A [Graded Response Action Plan](#) was implemented in 2017 by the Environmental Pollution Authority, allowing agencies to undertake such actions as restricting truck traffic into Delhi and raising parking fees. In another effort to improve air quality, the Delhi government released the draft "Delhi Electric Vehicle Policy 2018," which aims to increase the market share of battery-electric vehicles to 25% of all new vehicles by 2023.

In New Delhi, targeting emissions from on-road diesel vehicles could generate substantial benefits for public health, because these vehicles account for such a high proportion of the city's transportation-attributable deaths from air pollution. Our findings also highlight the importance of the upcoming BS VI emissions standards which will come into full effect starting April 2020. Strengthening [vehicle scrappage programs](#) in conjunction with the implementation of BS VI could further accelerate the benefits for air quality and public health.

## OVERALL SUMMARY AND METHODS

The study estimates the contribution of transportation sector emissions globally to PM<sub>2.5</sub> and ozone pollution and the health effects of those pollutants in 2010 and 2015. The analysis is restricted to the air pollution-related health impacts of transportation

tailpipe emissions because a clear set of well-understood policies is available to reduce emissions, and global inventories of transportation tailpipe emissions exist.

The analysis used the GEOS-Chem global chemical transport model to simulate the fractions of PM<sub>2.5</sub> and ozone concentrations that are attributable to transportation emissions (transportation-attributable fraction, or TAF). It combines that data with epidemiological health impact assessment methods consistent with the [Global Burden of Disease](#) 2017 study to estimate the associated disease burden.

To evaluate the health burden attributable to specific subsectors (on-road diesel vehicles, on-road non-diesel vehicles, international shipping, and non-road mobile sources), the analysis summed the gridded PM<sub>2.5</sub> and ozone deaths attributable to each transportation subsector according to national boundaries and urban areas. Urban area definitions are taken from the Global Human Settlement grid for 2015 at 1km resolution, and regridded to 0.1° resolution. The study used the "urban centers or high-density clusters" definition, which treats areas with dense contiguous urbanicity as one large city. The number of transportation-attributable mortalities in a subset of one of these areas could be estimated by multiplying the appropriate population estimate by the estimated transportation-attributable mortality rate (i.e., deaths per 100,000 population).

---

### PUBLICATION DETAILS

*A global snapshot of the air pollution-related health impacts of transportation sector emissions in 2010 and 2015*

**Download:** [www.theicct.org/publications/health-impacts-transport-emissions-2010-2015](http://www.theicct.org/publications/health-impacts-transport-emissions-2010-2015)

**Authors:** Susan Anenberg, George Washington University Milken Institute School of Public Health; Joshua Miller, International Council on Clean Transportation; Daven Henze, University of Colorado, Boulder; Ray Minjares, International Council on Clean Transportation

**Contact:** Joshua Miller ([josh@theicct.org](mailto:josh@theicct.org))



The International Council on Clean Transportation is an independent nonprofit organization founded to provide first-rate, unbiased research and technical analysis to environmental regulators.

2019 © INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION