FACT SHEET: EUROPE

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THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

HEALTH IMPACTS OF AIR POLLUTION FROM TRANSPORTATION SOURCES IN LONDON

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 LONDON REGION

In 2015, approximately 1,500 premature deaths in metropolitan London 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 4,500, meaning that transportation accounted for just under one-third (32.7%) of all deaths from air pollution that year in London.

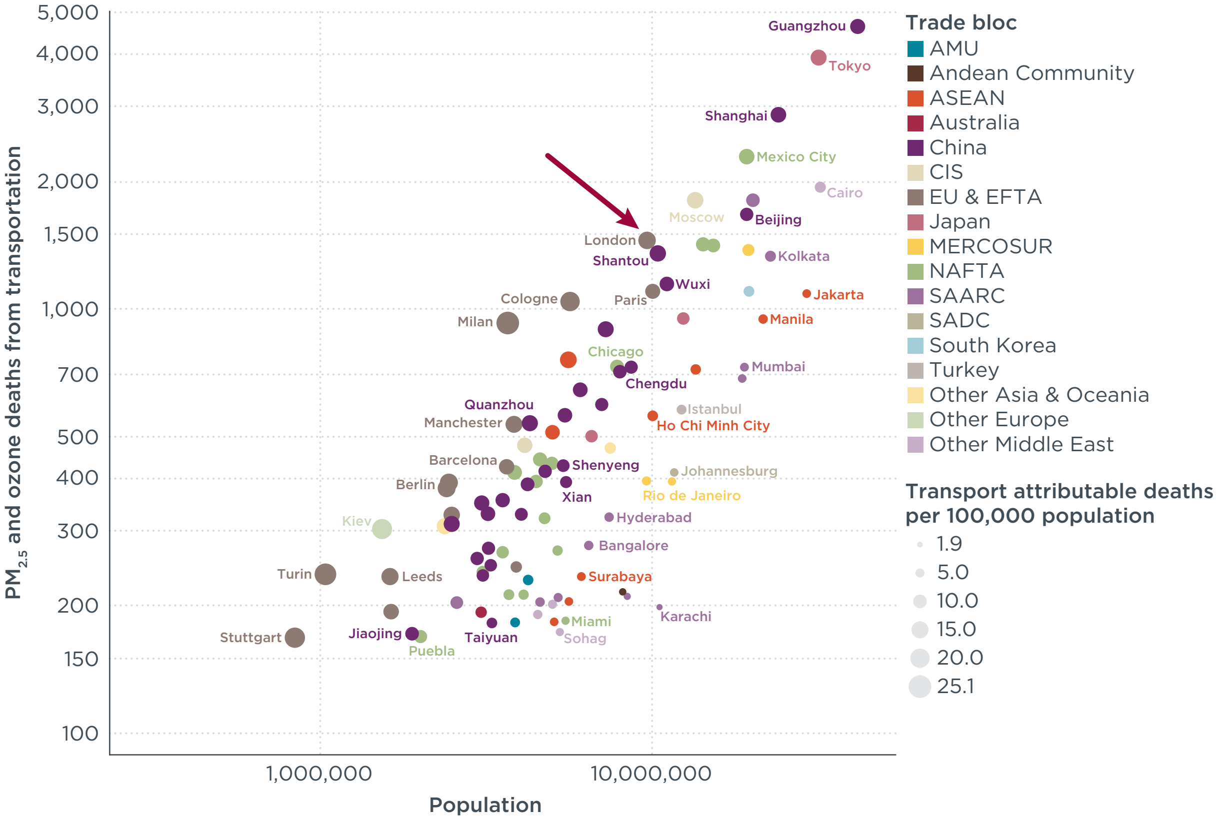
London accounted for 17.4% of transportation-attributable deaths from $PM_{2.5}$ and ozone pollution in the United Kingdom in 2015, for a mortality rate of 15 deaths per 100,000 population (approximately 9.7 million in London and suburbs in 2015).

Among European Union member states, the United Kingdom had the second-highest transportation health burden in 2015, behind Germany. If London itself were an EU member state, it would have ranked tenth in transportation health burden in 2015, ahead of Hungary and Romania.

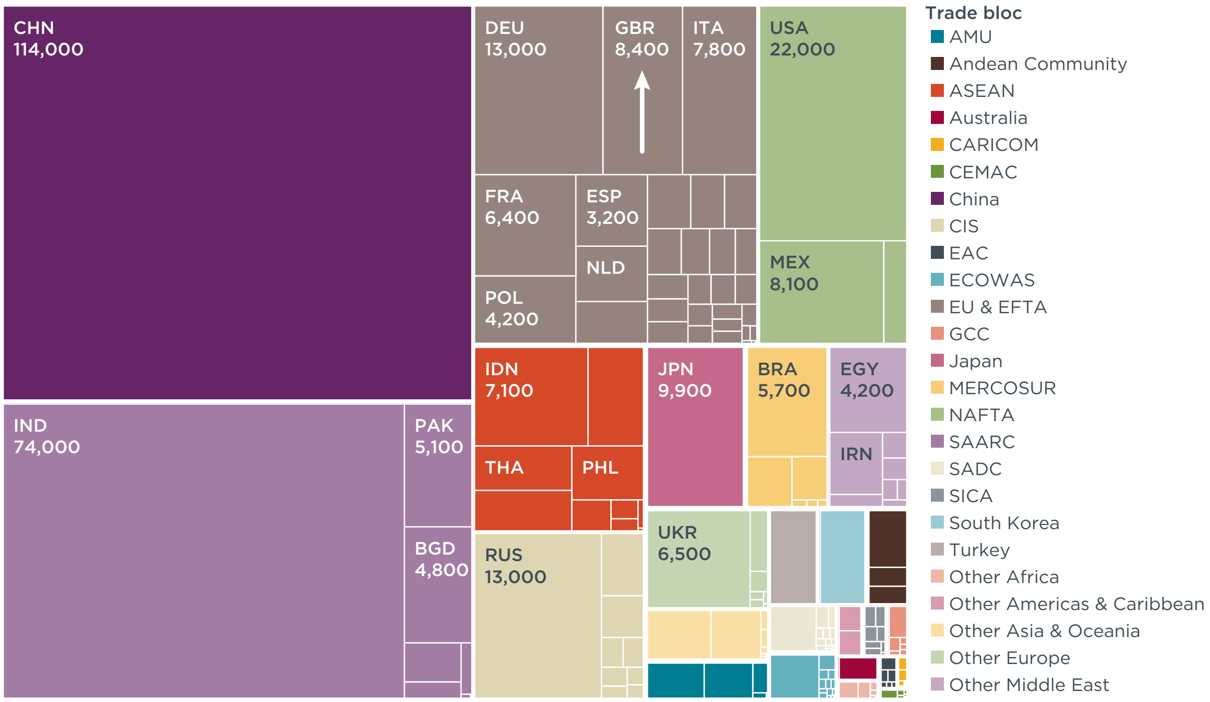
On-road diesel vehicles contributed 46% of the transportation health burden in London, followed by international shipping (37%); non-road mobile sources, including agricultural and construction equipment and rail (11%); and on-road non-diesel vehicles (6%). The high contribution of on-road diesel vehicles 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 100 major urban areas worldwide that the study evaluated, London ranked 28th in population and ninth in the number of deaths attributable to transportation emissions in 2015—that is, the health burden from transportation emissions in London is disproportionately heavy.

London had the eighth-highest fraction of deaths from air pollution attributable to transportation emissions in 2015 among major cities worldwide. The ten worst, in order, were Milan, Rotterdam, Turin, Stuttgart, Mexico City, Leeds, Manchester, London, Paris, and Cologne.



Transportation-attributable deaths from $PM_{2.5}$ and ozone pollution, mortality rates, and population in 100 major urban areas, 2015. Bubble color indicates the trade bloc in which an urban area is located. Bubble size indicates the transportation-attributable mortality rate per 100,000 population.[1]



National total $PM_{2.5}$ and ozone mortality 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 $PM_{2.5}$ and ozone mortality in 2015.

1 Acronyms of the trade blocs identified in the figure: AMU = Arab Maghreb Union (North Africa); ASEAN = Association of Southeast Asian Nations; CARICOM = Caribbean Community; CEMAC = Central African Economic and Monetary Community; CIS = Commonwealth of Independent States; EAC = East African Community; ECOWAS = Economic Community of West African States; EU & EFTA = European Union and European Free Trade Association; GCC = Gulf Cooperation Council; MERCOSUR = Southern Common Market (South America); NAFTA = North American Free Trade Agreement; SAARC = South Asian Association for Regional Cooperation; SADC = Southern African Development Community; SICA = Central American Integration System.

POLICY IMPLICATIONS

London suffers a high public-health burden from transportation emissions, and controlling those emissions is of central importance to any air-quality management plan. In London, reducing emissions from on-road diesel vehicles would have substantial benefits for public health, because those vehicles account for the largest share of the city's transportation-attributable deaths from air pollution. London is already taking a number of actions to address vehicle-related air pollution, including its ultra-low-emission and low-emission zones, investments in walking and cycling infrastructure, and policies promoting clean buses and taxis. London has also partnered with the TRUE initiative, which recently released a report detailing the real-world emissions of vehicles in London.

The high contribution of international shipping to London's air pollution problem suggests that further actions are needed to control shipping emissions. All ships must use low-sulfur fuels (maximum 0.1% sulfur content by mass) or SO_x scrubbers within the North Sea Sulfur Emission Control Area, which covers the English Channel and the North Sea. Starting in 2021, new ships must meet stringent Tier III NO_x standards set by the International Maritime Organization to enter the North Sea Emission Control Area. Several policy options are available to accelerate or augment these expected emission reductions. They include: establishing a black carbon emission standard for ships, restricting port access to or awarding reduced port fees for newer ships or those that use low-emission or zero-emission fuels, and promoting shore power to reduce emissions in ports. Additionally, the United Kingdom could seek to establish an Emission Control Area covering the waters off its western shores.

OVERALL SUMMARY AND METHODS

The study estimates the contribution of transportation sector emissions globally to $PM_{2.5}$ 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 $PM_{2.5}$ 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 $PM_{2.5}$ 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).

APPLICABILITY TO AIR-QUALITY LIMIT VALUES

According to the World Health Organization, ambient $PM_{2.5}$ pollution is harmful to human health even at concentrations below the 2005 guideline limit of 10 micrograms per cubic meter (µg/m3); therefore the aim is to achieve the lowest possible levels of ambient $PM_{2.5}$. Since 2015, the Global Burden of Disease methods assess $PM_{2.5}$ health impacts relative to a theoretical minimum-risk exposure level, defined as a uniform distribution between 2.4 and 5.9 µg/m3 based on the minimum and fifth percentile exposure level of outdoor air pollution cohort studies conducted in North America. Greater London had an estimated population-weighted mean $PM_{2.5}$ exposure of 13.9 µg/m3 in 2015 (95% confidence interval: 12.8 to 15.2)—roughly 2 to 6 times the theoretical minimum-risk exposure level for ambient $PM_{2.5}$.

For this reason, even though London met the EU air-quality standards for annual average $PM_{2.5}$ in 2015 (set at 25 µg/m3), there is still a need from a public health perspective to further reduce $PM_{2.5}$ levels in London. Additionally, although the GBD methods do not evaluate the direct health impacts of exposure to nitrogen dioxide (NO_2), NO_2 is a precursor to both $PM_{2.5}$ (in the form of nitrate aerosols) and ozone. Therefore, policies that target reductions in NO_2—for which London exceeds EU air-quality standards—would reduce the incidence of premature deaths from ambient $PM_{2.5}$ and ozone, the health endpoints that were quantified for 2010 and 2015 in this study.

PUBLICATION DETAILS

Title: *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

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