Health Impacts from Major Sources of Air Pollution in Southeast Europe

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Health Effects Institute

Independent Research Institute Providing Trusted Science

Rigorous science
Global experts

Targeted Research and Reanalysis
Over 350 studies on a wide variety of air pollutants and sources:
PM, ozone, air toxics; coal, diesel, natural gas, others
Targeted studies in 30+ countries

Scientific Review
The Health Effects of Exposure to Traffic
Health Effects of Air Pollution in Asia

Global Health
The State of Global Air
Global Burden of Disease- Major Air Pollution Sources
Work in regions including South Asia, Southeast Europe, East Africa

https://www.healtheffects.org/ | https://www.stateofglobalair.org/
Highest quality, integrated assessment of long-term exposure and health impacts

Widely used and cited across the world

Report card on air pollution and health in more than 200 countries

Collaboration between the Health Effects Institute (HEI) and Institute for Health Metrics and Evaluation (IHME)

Global Burden of Disease (GBD) Study

www.stateofglobalair.org
Synthesize **relevant local health evidence in the context of regional and global air pollution**, and to identify key knowledge gaps that limit policy action.

Strategically communicate **data & evidence on air pollution and health** to the broader scientific and health communities, the public, and the government to inform and drive clean air.

Details and downloads: [https://www.stateofglobalair.org/resources/southeast-europe](https://www.stateofglobalair.org/resources/southeast-europe)

Twitter: @HEISoGA
What types of evidence has been published locally?

Interactive literature database — Air Pollution and Health in Southeast Europe

More than 100 studies from the region

Download CSV files with information on studies or view the data online

Dynamic updates

https://www.healtheffects.org/global/spatial-bibliography

Please send any research papers or reports to SEE@healtheffects.org
Health Effects of Air Pollution

**SHORT-TERM**

Ear, nose, and throat irritation- coughing, difficulty in breathing, water in eyes

Aggravation of allergies, asthma, chronic obstructive pulmonary disease, and bronchitis.

In people with heart disease- arrhythmias, heart attacks, and even death

Emergency room visits

**LONG-TERM**

Chronic heart and lung diseases

Diabetes

Stroke

Lung cancer

Impact on newborns

Other

Figure: citieswewant.isglobal.org
More than 95% of the population in the region in areas where the PM$_{2.5}$ exposures exceed the WHO guideline for healthy air (5 µg/m$^3$)

https://www.stateofglobalair.org/resources/southeast-europe
Despite slow progress, the health burden of outdoor PM$_{2.5}$ remains high

Air pollution was the 7th leading risk factor for deaths in Bulgaria in 2019.
Air pollution makes a significant contribution to the non-communicable disease burden.

- 22.7% of COPD deaths
- 18.7% of diabetes deaths
- 14.8% of ischemic heart disease deaths
- 17.0% of lung cancer deaths
- 15.8% of ischemic stroke deaths
- 13.5% of lower-respiratory infection deaths
- 7.7% of neonatal deaths
Exposure to air pollution reduces life expectancy by a year in Bulgaria; globally, the average human life is shortened by approximately 1.8 years.
How can we identify major sources of PM$_{2.5}$ pollution & quantify attributable disease burden?

**Approach:**
Conduct emissions sensitivity simulations with a global atmospheric chemistry transport model to estimate fractional contributions to ambient PM$_{2.5}$ ...integrate with PM$_{2.5}$ exposure estimates and concentration response relationships from the GBD to quantify source-specific disease burdens
Definitions

Emissions | Concentrations

**Fuels**

- **Total coal** - includes emissions from hard coal, brown coal, coal coke combustion
- **Liquid Oil and Natural Gas** - includes light and heavy oil, diesel oil, and natural gas
- **Solid biofuel** - includes solid biofuel combustion
- **Process** - includes non-combustion process source emissions, such as solvent use, industrial processes, and agricultural fertilizer application

**Sources**

- **Residential** - includes residential heating and cooking
- **Energy** - includes electricity and heat production, fuel production and transformation, oil and gas fugitive/flaring, and fossil fuel fires
- **Transportation** - represents emissions from both on-road and non-road transportation
Fossil fuel (coal and liquid fuel and natural gas) combustion contributes between 29% to 36% of PM$_{2.5}$ exposures in Southeast European countries.

Residential use and energy are large contributors to PM$_{2.5}$ exposures and the disease burden across Southeast Europe; transport contributes between 5% to 14% across countries.

Energy production is the leading source of PM$_{2.5}$ in many Southeast European cities and contributes between 15%–50% across the region [Belis et al.2019]*

Contribution of coal to outdoor PM$_{2.5}$

Southeast Europe vs rest of the world

18.5% of PM$_{2.5}$ in Bulgaria

Contribution of residential fuel use to outdoor PM$_{2.5}$

Southeast Europe vs rest of the world

Solid biofuel

15.5% of PM$_{2.5}$ in Bulgaria

Coal

~2% of PM$_{2.5}$ in Bulgaria

Contribution of road transport use to outdoor PM$_{2.5}$

Southeast Europe vs rest of the world

6% of PM$_{2.5}$ in Bulgaria

Trends in pollutant emissions

Bulgaria

Since 1990, sectoral emissions have declined.

Sectors with the largest contributions to emissions in 2017 were residential (37%), on-road transportation (19%), and energy (15%).
Total energy supply (TES) by source, Bulgaria 1990-2019

https://www.iea.org/countries/bulgaria
Major Sources of Air Pollution - Bulgaria

Use of fossil fuels (i.e., coal, oil, and natural gas) linked to 30.4% of the total health impacts related to PM$_{2.5}$ in Bulgaria.

Total coal was the leading fuel contributor to outdoor PM$_{2.5}$ levels.

Residential sources contributed the most (17.6%) to PM$_{2.5}$-attributable deaths in 2019, followed by energy production (17%); road transport contributed to 6.1%.
Residential sector, and in some cases, industry, is the largest emissions source

“Transport is absolutely dominant source of PM$_{10}$ pollution in the central city area and along the roads with heavy traffic during both cold and warm season” [Dimitrova and Velizarova 2021]
Significant health impacts related to air pollution exposure

Growing local evidence links air pollution to a range of health effects, both in the short-term and long-term.

Use of fossil fuels responsible for nearly 1/3rd of total health impacts

Integrating air quality, energy, and climate policies is likely to bring substantial health benefits.

Reliable data on sources, disease burden can aid policymaking

Credible evidence can influence air quality, climate and public health policies.

Key Messages
Thank you!

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Estimating burden of disease from air pollution

Global population exposures

Minimum risk exposure level

Exposure-response relationships

Population-attributable fraction due to air pollution

Burden of Disease Attributable to Air Pollution

Disease-specific burden

Underlying air quality data

Ground monitoring data

Satellite data

Population data

Chemical Transport Models

Population-weighted exposures for every country*

*Based on aggregation from estimates at 11x11 km grid scales
Why do health burden estimates vary?

- Exposure estimates
- Exposure–response functions
- Counterfactual
- Health outcomes of interest
Spatial Patterns in Levels of Outdoor PM$_{2.5}$

Note: orange border represents Bulgaria and grey border is the rest of the countries in Southeast Europe.