Health impact assessment of traffic-related air pollution in Copenhagen Municipality

Brønnum-Hansen, Henrik; Bender, Anne Mette; Andersen, Zorana Jovanovic; Sørensen, Jan; Bønløkke, Jakob Hjort; Boshuizen, Hendrik; Becker, Thomas; Diderichsen, Finn; Loft, Steffen

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Aim In this study we quantify health impacts of ambient air pollution in five Southern European countries: Greece, Italy, Portugal, Slovenia and Spain in 2015.

Methods:
Health impacts of ambient air pollution in Southern Europe were studied in Greece, Italy, Portugal, Slovenia and Spain. Ambient air pollution concentrations in Southern Europe largely exceed the guideline values set by World Health Organization (WHO) for fine particles (PM2.5) and partly for ozone (O3). Exposure to ambient air pollution has been linked to different health outcomes and risk factors. Ozone (O3) and fine particles (PM2.5) concentrations were collected and analyzed using the Health and Risk Assessment Project in Europe (HRAPIE) working group. The current results are presented for 2014. PM2.5 was related according to recommendations of the WHO’s Health impact assessment of traffic-related air pollution should be considered in policy making to improve public health.

Background:
Fine particle and ozone concentrations are exceeding the WHO’s guideline values in many Southern European countries. Reduction of these concentrations would contribute to improving public health.

Results:
Ozone concentrations were highest in Greece and Spain, while ambient air pollution concentrations were highest in Greece. Ambient air pollution concentrations in Southern Europe together were attributable to 16,800; 14,400; 8,400; 14,200 and 9,200 years of life lost per one million inhabitants in Greece, Italy, Portugal, Slovenia and Spain, respectively. PM2.5 and O3 were largest in Greece and lowest in Portugal. Ambient air pollution is a significant health risk factor in the European Union. Health impacts attributable to PM2.5 and O3 were 5-7% of the total health impacts of mortality and cardiovascular and respiratory outcomes and mortality.

Disease burden methods produce information about risk factors in comparable units enabling comparison between different health outcomes and risk factors. Linking ambient air pollution exposure, for instance to disease burden data by background disease burden, enables quantification of health impacts in comparable measures.

Methods:
Health impacts were estimated using disease burden methods. We utilized country level population weighted average concentrations generated by European Environmental Agency (EEA).

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1Department of Public Health, University of Copenhagen, Copenhagen, Denmark
2Healthcare Outcomes Research Centre, Royal College of Surgeons in Ireland, Dublin, Ireland
3Department of Public Health, Aarhus University, Aarhus, Denmark

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Background:
High-resolution exposure to traffic-related air pollution can be assessed by modelling levels of nitrogen dioxide (NO2) which together with ultrafine particles mainly originate from diesel-powered vehicles in urban areas. The purpose of the study was to estimate the health benefits of reduced exposure to vehicle emissions assessed as NO2 among the citizens of Copenhagen Municipality, Denmark.

Methods:
We utilized residential NO2 concentrations modelled by use of chemistry transport models to calculate contributions from emission sources to air pollution. We used exposure-response functions linking NO2 concentration estimates with the risk of diabetes, cardiovascular diseases, and respiratory diseases derived from a large Danish study. The DYNAMO-HIA model was applied to the population of Copenhagen by using residential NO2 concentrations combined with demographic data and data from nationwide registers on incidence and prevalence of diseases associated with air pollution. Different scenarios were modelled to estimate the impact of NO2 exposure on related diseases and the potential health benefits of lowering the NO2 level in Copenhagen.

Results:
If NO2 exposure was restricted to the rural level life expectancy in 2040 would increase by two years for men and almost a half year for women. The greatest gain in disease-free life expectancy for men would be lifetime without ischemic heart disease (2.2 years), chronic obstructive pulmonary disease (2.1 years), and asthma (2.3 years). Among women the greatest increase would be lifetime without diabetes (1.2 years) and without stroke (1.1 years).

Conclusions:
Reducing the NO2 exposure by controlling traffic-related air pollution reduces the occurrence of some of the most prevalent diseases and increases life expectancy which can be quantified by DYNAMO-HIA with a high resolution exposure modelling. This tool has demonstrated how traffic planners can assess health benefits from reduced levels of traffic-related air pollution.

Key messages:
• Lowering NO2 exposure by reducing traffic-related air pollution would reduce occurrence of cardiovascular, respiratory and metabolic diseases, lung cancer, and increase disease-free life expectancy.
• The full potential of health gain by reducing NO2 exposure level to that of rural areas would increase life expectancy in Copenhagen by two years for men and almost a half year for women.