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

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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.