Health impact assessment of short and long-term exposure to ozone and PM in 25 European cities

M. Pascal[1], C. Declercq[1], M. Corso[1], C. Badaloni[2], G. Cesaroni[2], S. Henschel[3], K. Meister[4], K. Eshai[1], S. Medina[1] on behalf of the Aphekom collaborative network

1/ French Institute for Public Health Surveillance, Saint-Maurice, France – 2/ Rome E Health Authority, Italy – 3/ Dublin Institute of Technology, Ireland – 4/ Umea University, Sweden

Introduction

Stakeholders drafting policies to reduce air pollution must take into account economic and social constraints, political orientations and urban planning, as well as health.

Health impact assessments (HIAs) provide objective estimates of the impacts of improvements in air quality on a given population's health.

The Aphekom project presents an updated estimate of the health impacts of urban air pollution in Europe. It involves 25 European cities (figure 1).

FIGURE 1 THE APHEKOM NETWORK

Data and Methods

A classical HIA process was applied (figure 2) to assess the current burden of air pollution on health, considering:

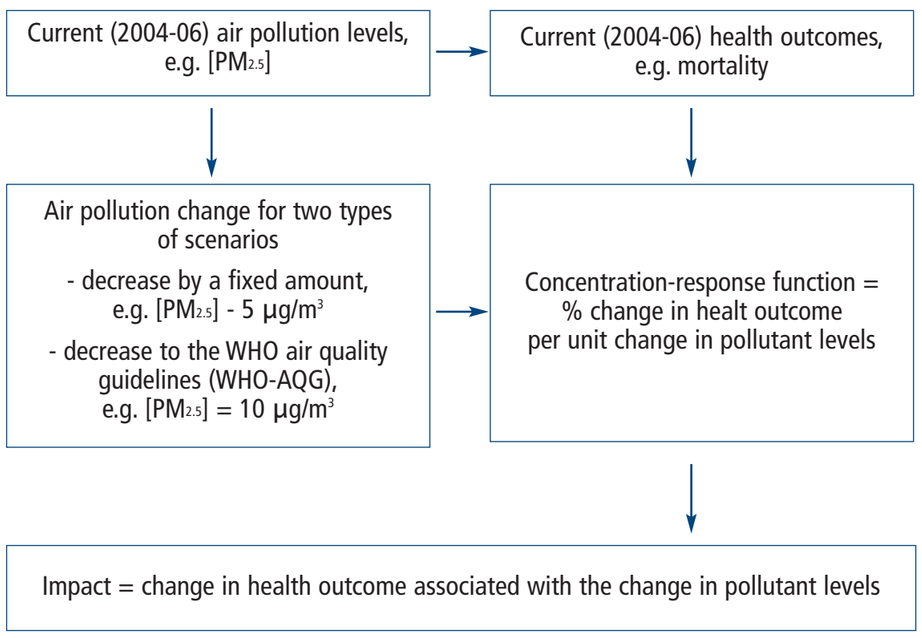
- the short-term impact of PM_{10} and O_3 on total non-external mortality and on cardiac and respiratory hospitalisations;
- the long-term impact of $PM_{2.5}$ on total and cardiovascular mortality.

Routine mortality, hospital admissions and pollutant concentrations data were collected in each city.

Concentration response functions were chosen favouring meta-analyses of multicentre studies in European cities when available [1-4].

Scenarios were a decrease to the WHO-air quality guidelines (WHO-AQG): 20 µg/m³ for PM_{10}, 10 µg/m³ for $PM_{2.5}$ in annual mean, 100 µg/m³ for O_3 8-hour max.

FIGURE 2 SUMMARY OF THE HIA APPROACH



All computations were performed using guidelines and Excel spreadsheets developed by the Aphekom project.

Results

The cities totalled 38,919,190 inhabitants, 21% being older than 65 years old.

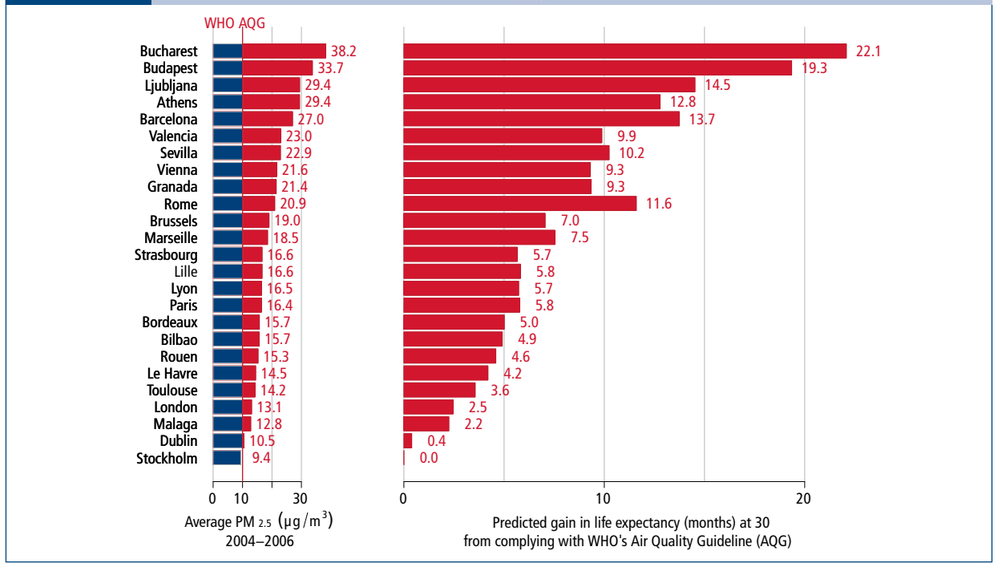
Only Dublin, Malaga and Stockholm complied with the WHO-AQG for the annual level of PM_{10}, and only Stockholm for $PM_{2.5}$.

No city complied with the WHO-AQG for the daily 8h-maximum values of O_3. The proportion of days with values over the WHO-AQG varied from nearly 0 in Dublin to 32.2% in Athens (median: 9.4%).

Compliance with the WHO- AQG would:

- for $PM_{2.5}$, add up 0 to 22 months in life expectancy at age 30, depending on the city (figure 3), equivalent to an annual burden on mortality of nearly 19,000 deaths;
- for PM_{10}, postpone 2,200 deaths, and avoid 2,500 cardiac hospitalisations and 5,300 respiratory hospitalisations each year;
- for ozone, postpone 200 deaths, and avoid 156 respiratory hospitalisations each year.

FIGURE 3 ESTIMATED AVERAGE GAIN (MONTHS) IN LIFE EXPECTANCY AT AGE 30 IN 25 APHEKOM CITIES FOR A DECREASE IN AVERAGE ANNUAL LEVEL OF $PM_{2.5}$ TO 10 µg/m³ (WHO AIR QUALITY GUIDELINE)



Discussion

Our results provide an at least estimate of the burden on health of air pollution in the 25 Aphekom cities.

The largest health burden is attributable to the long-term impact of chronic exposure to $PM_{2.5}$. Aphekom estimated the associated monetary gain to be around €30 billion annually, including savings on health expenditures, absenteeism and intangible costs such as well-being, life expectancy and quality of life.

Aphekom's work is particularly relevant, as:

- various European Union member states have exceeded mandated limit values on particles since 2005;
- EU and national agendas are being prepared for implementing existing regulations on air pollution and for revising current EU legislation in 2013.

Results call for a more stringent regulation, and an improved monitoring of air pollution in Europe, especially for fine and ultrafine particles.

References

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More http://www.aphekom.org and http://si.easp.es/aphekom/

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Contact : Mathilde Pascal (m.pascal@invs.sante.fr) - Institut de veille sanitaire - Département santé environnement - 12, rue du Val d'Osne 94415 Saint-Maurice Cedex - Tél. : +33 (0)1 41 79 68 87 - Fax : +33 (0)1 41 79 68 40

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