Recent evidence on health aspects of air pollution

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Presentation Outline

1. Public health burden of disease from air pollution
2. Importance of air quality as a risk factor for health
3. Main conclusions from WHO evidence review
4. Next steps and implications for TFH work
Ambient air pollution ($PM_{2.5}$):

- **Globally:**
  - 3.1 million deaths

- **In Western, Central and Eastern Europe:**
  - 430,000 premature deaths;
  - over 7 million years of healthy life lost
The PM$_{2.5}$ estimates are generated from the grid cell average of SAT and TM5 and calibrated with a prediction model incorporating surface measurements.
Availability of data & monitoring networks

Exposure to particulate matter with an aerodynamic diameter of 10 μm or less (PM10) in 1100 urban areas*, 2003–2010

* The mean annual concentration of fine suspended particles of less than 10 microns in diameters is a common measure of air pollution. The mean is a population-weighted average for urban population in cities above 100 000 inhabitants of a country.
# Population exposure in the EU

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>EU reference value</th>
<th>Exposure estimate (%)</th>
<th>WHO AQG</th>
<th>Exposure estimate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM$_{2.5}$</td>
<td>Year (20)</td>
<td>20–31</td>
<td>Year (10)</td>
<td>91–96</td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>Day (50)</td>
<td>22–33</td>
<td>Year (20)</td>
<td>85–88</td>
</tr>
<tr>
<td>O$_3$</td>
<td>8-hour (120)</td>
<td>14–18</td>
<td>8-hour (100)</td>
<td>97–98</td>
</tr>
<tr>
<td>NO$_2$</td>
<td>Year (40)</td>
<td>5–13</td>
<td>Year (40)</td>
<td>5–13</td>
</tr>
<tr>
<td>BaP</td>
<td>Year (20)</td>
<td>22–31</td>
<td>Year (0.12)</td>
<td>76–94</td>
</tr>
<tr>
<td>SO$_2$</td>
<td>Day (125)</td>
<td>&lt; 1</td>
<td>Day (20)</td>
<td>46–54</td>
</tr>
<tr>
<td>CO</td>
<td>8-hour (10)</td>
<td>&lt; 2</td>
<td>8-hour (10)</td>
<td>&lt; 2</td>
</tr>
<tr>
<td>Pb</td>
<td>Year (0.5)</td>
<td>&lt; 1</td>
<td>Year (0.5)</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Benzene</td>
<td>Year (5)</td>
<td>&lt; 1</td>
<td>Year (1.7)</td>
<td>12–13</td>
</tr>
</tbody>
</table>

**Colour coding:**
- < 5 %
- 5–50 %
- 50–75 %
- > 75 %

Source: EEA, 2013
About WHO REVIHAAP & HRAPIE projects

- Objective to provide the EC and its stakeholders with scientific evidence-based advice on health aspects of AP
- In support of the review of EU air quality legislation
- Provides answers to 26 key policy-relevant questions
- Address health considerations only
- Jointly financed WHO and EC, coordinated by WHO/Europe, more than 70 experts involved
- Reports available on WHO website
Long-term exposure to PM$_{2.5}$ and mortality at levels below the current WHO recommendations

Canadian cohort study:
- long-term PM2.5
- 2.1 million adults
- 1991-2001
- annual average: 8.7 µg/m$^3$

Crouse et al. EHP 2012
Organs of the human body affected by particulate air pollution

- Respiratory mortality
- Respiratory symptoms
- Rhinitis/Pneumonia
- Airway inflammation
- Decreased lung function
- Decreased lung growth
- Lung cancer

- Stroke
- Diseases of the central nervous system

- Cardiovascular mortality
- Cardiovascular hospital admission
- Changes in heart rate variability
- ST-segment depression

- Changes in blood pressure
- Endothelial function
- Increased blood coagulation
- Systemic inflammation

- Premature birth
- Decreased birth weight
- Decreased foetal growth
- Intrauterine growth retardation
- Decreased sperm quality

Modified after Peters et al. JOEM 2011
IARC: Outdoor air pollution a leading environmental cause of cancer deaths

Lyon/Geneva, 17 October 2013 – The specialized cancer agency of the World Health Organization, the International Agency for Research on Cancer (IARC), announced today that it has classified outdoor air pollution as carcinogenic to humans (Group 1).

After thoroughly reviewing the latest available scientific literature, the world’s leading experts convened by the IARC Monographs Programme concluded that there is sufficient evidence that exposure to outdoor air pollution causes lung cancer (Group 1). They also noted a positive association with an increased risk of bladder cancer.

Particulate matter, a major component of outdoor air pollution, was evaluated separately and was also classified as carcinogenic to humans (Group 1).

The IARC evaluation showed an increasing risk of lung cancer with increasing levels of exposure to particulate matter and air pollution. Although the composition of air pollution and levels of exposure can vary dramatically between locations, the conclusions of the Working Group apply to all regions of the world.

1. Exposure Data

1.1 Constituents of coal emissions from household use of coal

1.1.1 Types and forms of coal

Coal is a highly variable fuel, which ranges from high heating-value anthracite through sub-bituminous coals to low heating-value lignite. Although coal is an aromatic hydrocarbon mixture, the heating value of the fuel varies widely depending on which type of coal it is and the method of mining. The heating value of coal ranges from 11.3 MJ/kg for sub-bituminous coal to 31.8 MJ/kg for anthracite.

1.1.2 Constituents of coal emissions

When using small and simple combustion devices such as household cooking and heating stoves, coals are difficult to burn without substantial emission of pollutants principally due to the difficulty of completely pre-mixing the fuel and air during burning. Consequently, a substantial fraction of the fuel carbon is converted to products of incomplete combustion. For example, volatile organic compounds are released during the early phase of the combustion process. These include alkenes, alkanes, benzene, toluene, xylene, and polycyclic aromatic hydrocarbons (PAHs).
REVIHAAP and HRAPIE Main conclusions

• Considerable amount of new scientific information on health effects of PM, ozone and NO$_2$ has been published in the recent years
  – Health effects observed at levels commonly present in Europe
  – Supports the scientific conclusions of the WHO Air Quality Guidelines, last updated in 2005
    • Evidence has strengthened
    • Indicates that the effects can occur at air pollution concentrations lower than those serving to establish the 2005 Guidelines
    • REVIHAAP group of experts recommends revision of WHO guidelines accordingly
REVIHAAP and HRAPIE Main conclusions

- Provides scientific arguments for the decisive actions to improve air quality and reduce the burden of disease associated with air pollution.
- Developed for EU context, but equally relevant to all Member States in their development and implementation of effective strategies to reduce air pollution and its significant impacts on public health.
  - Summary of REVIHAAP report available in Russian.
Next steps and implications for TFH work 2014-2015

- Develop further the methodologies for the assessment of effects of air pollution on human health (draft workplan item 1.2.3)
  - Development of Global Platform on AQ and Health (consultation planned Jan 2014)
  - WHO developing burden of disease assessments
  - WHO Experts meeting on methods for health impact assessment of air pollution at global, regional and local levels (planned back-to-back with TFH meeting May 2014)
- Collect and analyze evidence on health impacts of PM and ozone (includes BC) (draft workplan item 1.2.4)
  - Revision of WHO Ambient Air Quality Guidelines
  - Publication of WHO Indoor Air Quality Guidelines for Household Fuel Combustion (expected 2014)
THANK YOU FOR YOUR ATTENTION!