The assessment of the implementation of fuel related legislations and their impact on air quality and public health - The Aphekom Project

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Background and Aims

The work presented here has been conducted as part the EU-funded Aphekom project that aims to improve knowledge and communication for decision making on air pollution and health in Europe.

A multicity analysis involving 20 cities across Europe was initiated assessing the impact of the implementation of the EU legislation (Council Directive 93/12/EEC and its amended version 1999/32/EC) designed to reduce the sulphur content of fuels (mainly diesel oil used by diesel vehicles, shipping and home heating) on air quality, mortality and associated monetary costs.

Methods

Daily SO2 air pollution and mortality data from 20 participating EU cities* was obtained and analysed. A descriptive analysis using time-series plots was conducted to assess changes in pollutant levels overtime. The association between mortality and daily variations in air pollution overtime was assessed using GAM in the R statistical software environment. City specific effect estimates were combined using meta-analysis and used in an HIA to predict attributable cases to level changes in SO2 in each individual centre.

Air Quality analysis

- General downwards trend in SO2 levels overtime
- BUT no obvious step change found after implementation of Council Directives
  - Gradual change overtime (shown in graph)
  - Overall drop of about 66% in ambient SO2 levels comparing pre-Directive period to time period after the year 2000

Health data analysis and monetary value

- Increase of 10 µg/m3 in SO2 found to be associated with an (pooled) increase of daily all-cause (0.53%), respiratory (0.49%) and cardiovascular (0.72%) mortality
  - Intuitively one would expect that a decrease in daily SO2 levels would result in a decrease in daily deaths.

14 centres that implemented all three stages of the fuel legislations

<table>
<thead>
<tr>
<th>Time period</th>
<th>All cause mortality</th>
<th>Respiratory mortality</th>
<th>Cardiovascular Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Premature deaths avoided per year</td>
<td>95 CI -</td>
<td>95 CI +</td>
</tr>
<tr>
<td>≥ 01.10.1994 to &lt;01.10.1996</td>
<td>639</td>
<td>223</td>
<td>1056</td>
</tr>
<tr>
<td>≥ 01.10.1996 to &lt;01.07.2000</td>
<td>1093</td>
<td>382</td>
<td>1808</td>
</tr>
<tr>
<td>≥ 01.07.2000</td>
<td>1616</td>
<td>564</td>
<td>2676</td>
</tr>
</tbody>
</table>

20 centres that implemented 1 common stage of the fuel legislations (Directive 1999/32/EC)

<table>
<thead>
<tr>
<th>Time period</th>
<th>All cause mortality</th>
<th>Respiratory mortality</th>
<th>Cardiovascular Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 01.07.2000*</td>
<td>2212</td>
<td>772</td>
<td>3663</td>
</tr>
</tbody>
</table>


Discussion & Conclusion

- SO2 levels have reduced significantly over time
- Within the context of the many changing factors determining temporal patterns we failed to identify clear step changes in measured SO2 concentrations
- No change in the dose-response function → Important finding with significant relevance for policy makers AND demonstrating that there is no safe threshold level!

Overall the findings underscore the health and monetary benefits from drafting and implementing effective EU policies on air pollution!

Acknowledgments

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