Effect of outdoor air pollution in Iceland's capital region on asthma drug dispensing

Centre of Public Health Sciences
University of Iceland

Hanne Krage Carlsen, stud. MPH
Supervisors: Þórarinn Gíslason Ph.D., M.D,
Birgir Hrafnkelsson Ph.D.,
Helga Zoëga M.A.
Air pollution

• From traffic and other sources around Reykjavík.
• Known to irritate lungs and worsen symptoms of chronic lung disease.
• Many health limit violations every year for some pollutants: PM$_{10}$ (svifryk) exceeds the 24-hour health limit some 25 times per year.
• Lack of studies in Iceland measuring the effect of high air pollution concentrations on respiratory health.
Aim

• The overall aim of this study is to determine whether day-to-day increases in the levels of air pollution in the Capital Area of Iceland, are associated with an increase the sales of asthma medication.
Methods

Exposure

- Air pollution: $\text{PM}_{10}$, $\text{NO}_2$, $\text{O}_3$, $\text{H}_2\text{S}$
- Source: Municipality of Reykjavík environmental department.

Outcome

- Daily number of people taking out drugs to relieve pulmonary obstruction
- Source: Medicines registry at the Directorate of Health

Regression Covariates

Day-of-week, seasonal trends, time trend, air humidity, temperature, influenza season and pollen
## Descriptive statistics

<table>
<thead>
<tr>
<th>Pollutants</th>
<th>Daily 24-hr mean (range)</th>
<th>Standard deviation</th>
<th>24-hour health limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM10 (µg/m³)</td>
<td>22.95 (3.23 – 261.60)</td>
<td>21.78</td>
<td>50</td>
</tr>
<tr>
<td>NO2 (µg/m³)</td>
<td>23.00 (2.76 – 111.60)</td>
<td>13.83</td>
<td>75</td>
</tr>
<tr>
<td>O3 (µg/m³)</td>
<td>41.11 (1.20 – 91.49)</td>
<td>13.37</td>
<td>120*</td>
</tr>
<tr>
<td>H2S (µg/m³)</td>
<td>3.626 (0.02 – 58.93)</td>
<td>6.1</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pollutants</th>
<th>Max daily 1-hr mean (range)</th>
<th>Standard deviation</th>
<th>1-hour health limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM10 (µg/m³)</td>
<td>79.05(0.00-1779.00)</td>
<td>130.33</td>
<td>-</td>
</tr>
<tr>
<td>NO2 (µg/m³)</td>
<td>51.47(0.00-209.60)</td>
<td>28.11</td>
<td>110-200</td>
</tr>
<tr>
<td>O3 (µg/m³)</td>
<td>58.30 (0.00-136.25)</td>
<td>13.48</td>
<td>-</td>
</tr>
<tr>
<td>H2S (µg/m³)</td>
<td>14.61(0.00-176.55)</td>
<td>26.04</td>
<td>-</td>
</tr>
</tbody>
</table>

*8 hour health limit

<table>
<thead>
<tr>
<th>Health outcome</th>
<th>Mean (range)</th>
<th>std.dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dispensed individuals per day</td>
<td>72.41 (2 – 151)</td>
<td>37.9</td>
</tr>
</tbody>
</table>
Increased number of individuals taking out medication
Risk associated with increase of 10 mcg/m³ PM10
Risk estimate for increment of 10 μg/m3 PM10

lag0-14, each data point represents a 3-day average
Increased number of individuals taking out medication
Risk associated with increase of 10 mcg/m3 H2S
Risk estimate for increment of 10 \( \mu g/m^3 \) H2S

Iag0-14, each data point represents a 3-day average
Conclusion

• Increases in levels of air pollution are associated with increased dispensing of drugs to relieve pulmonary obstruction during the following days in multi-pollutant poisson regression models.
• Size of the effect and the longevity of the association differs between pollutants.
• In studies abroad, similar, positive associations are seen at lag2-10 (Laurent et al 2009, Pitard et al 2004).
• This is the first study in Iceland on health effects of air pollution using the population-based pharmaceutical database.
• Further analysis of the data is ongoing.
Takk

• Oddsjóður & Astma- og ónæmisfélag Íslands
Continuous input model

Risk estimate for increment of 10 µg/m³ PM10

Risk estimate for increment of 10 µg/m³ NO2

Risk estimate for increment of 10 µg/m³ O3

Risk estimate for increment of 10 µg/m³ H2S
Methods II

• Data
  – Daily dispensings from the pharmaceutical registry of The Directorate of Health
    • Daily dispensings of adult in the denser populated capital area by individual, number of prescriptions and volume.
  – Pollution data from the environmental and traffic department of the city of Reykjavík
    • 30-minute data on concentrations of pollutants and climate.

• Poisson regression
  – Poisson regression used to models counts (non-negative discrete variable)
  – Lags – delays in effect
    • Dispensing of drugs on the same day as the pollution event (lag0), one day after (lag1), two days after (lag2) and so on.