Occupational exposure and new-onset asthma - a population based study in northern Europe

Linnéa Lillienberg
Occupational and Environmental Medicine
Sahlgrenska University Hospital, Gothenburg, Sweden

Aims of the study
- Develop a Nordic Job exposure matrix (N-JEM)
- Estimate hazard risks for occupations associated with high asthma risk.

Study population
- All subjects randomly selected born 1945-73.
- Follow-up questionnaire 1999-2001 answered by 74%.

Definitions
New-onset asthma needed a positive answer to the questions:
1. Do you have or have you ever had asthma after the age of 16?
2. Have you ever had asthma diagnosed by a physician?

Atopy: Do you have hay fever or any other nasal allergy?

Occupational exposure
- All occupations or jobs >6 months were classified according to ISCO-88
- Nordic job exposure matrix (N-JEM).
- Occupations associated with high asthma risk

Person-years were calculated for every year with a reported job together with exposure group associated with the job code.
Nordic job exposure matrix (N-JEM)

1. HMW agents
   - Animal derived antigens
   - Plant associated antigens
   - Arthropods, mites, bio-aerosols
   - Enzymes
   - Latex
   - Pharmaceutical products

2. LMW agents
   - Reactive chemicals
   - Acrylates
   - Epoxy compounds
   - Diisocyanates

3. Irritating agents
   - Cleaning agents
   - Wood paper dust
   - Inorganic dust & fumes
   - Metal working fluids
   - Textile dust
   - Vehicle/motor exhaust
   - Environmental tobacco smoke

4. Accidental peak exposure
5. Uncertain or low exposed
6. Reference

Background data of the study population

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of subjects (%)</td>
<td>6 251 (47)</td>
<td>7 033 (53)</td>
</tr>
<tr>
<td>Age year 2000, mean (SD)</td>
<td>42 (7)</td>
<td>42 (7)</td>
</tr>
<tr>
<td>Never smokers (%)</td>
<td>2 840 (45)</td>
<td>3 196 (46)</td>
</tr>
<tr>
<td>Ever smokers (%)</td>
<td>3 264 (53)</td>
<td>3 669 (52)</td>
</tr>
<tr>
<td>Unknown smoking habits (%)</td>
<td>146 (2)</td>
<td>168 (2)</td>
</tr>
<tr>
<td>Exposed</td>
<td>59.5 %</td>
<td>46.3 %</td>
</tr>
<tr>
<td>Not exposed</td>
<td>35.9 %</td>
<td>48.0 %</td>
</tr>
<tr>
<td>Uncertain exposure</td>
<td>4.7 %</td>
<td>5.7 %</td>
</tr>
<tr>
<td>New-onset asthma (%)</td>
<td>153 (2.5)</td>
<td>311 (4.4)</td>
</tr>
</tbody>
</table>

Hazard ratios (HR and 95% CI) of new-onset asthma in men according to the N-JEM

<table>
<thead>
<tr>
<th>Job exposure group</th>
<th>All exposed1 HR (95% CI)</th>
<th>Atopics2 HR (95% CI)</th>
<th>Non-atopics2 HR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any exposure</td>
<td>1.4 (0.96-1.9)</td>
<td>1.3 (0.8-2.2)</td>
<td>1.4 (0.9-2.3)</td>
</tr>
<tr>
<td>HMW agents</td>
<td>1.6 (0.9-2.7)</td>
<td>1.4 (0.6-3.1)</td>
<td>1.7 (0.8-3.6)</td>
</tr>
<tr>
<td>Plant allergens</td>
<td>3.6 (1.4-8.9)</td>
<td>Not applicable</td>
<td>3.9 (1.2-12.7)</td>
</tr>
<tr>
<td>Latex</td>
<td>1.7 (0.7-4.2)</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>LMW agents</td>
<td>1.3 (0.8-2.3)</td>
<td>0.7 (0.3-2.1)</td>
<td>1.9 (0.96-3.7)</td>
</tr>
<tr>
<td>Acrylates</td>
<td>1.7 (0.8-3.6)</td>
<td>Not applicable</td>
<td>3.1 (1.3-7.0)</td>
</tr>
<tr>
<td>Epoxy compounds</td>
<td>2.4 (1.2-4.5)</td>
<td>1.4 (0.4-4.4)</td>
<td>3.3 (1.5-7.3)</td>
</tr>
<tr>
<td>Diisocyanates</td>
<td>2.1 (1.1-3.7)</td>
<td>1.5 (0.6-3.9)</td>
<td>2.6 (1.2-5.2)</td>
</tr>
<tr>
<td>Irritating agents</td>
<td>1.4 (0.99-2.1)1</td>
<td>1.4 (0.8-2.3)</td>
<td>1.5 (0.9-2.5)</td>
</tr>
<tr>
<td>Cleaning agents</td>
<td>2.6 (1.1-6.1)1</td>
<td>Not applicable</td>
<td>4.0 (1.4-11.6)</td>
</tr>
<tr>
<td>Inorganic dust &amp; fumes</td>
<td>1.6 (0.99-2.4)</td>
<td>1.4 (0.7-2.7)</td>
<td>1.7 (0.9-3.2)</td>
</tr>
<tr>
<td>Environmental tobacco smoke</td>
<td>2.0 (0.9-5.0)</td>
<td>1.9 (0.6-6.1)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Peak exposure to irritants</td>
<td>2.6 (1.8-5.0)</td>
<td>2.1 (0.8-5.3)</td>
<td>2.8 (1.2-6.7)</td>
</tr>
</tbody>
</table>

1Adjusted for age and atopy. 2Adjusted for atopy. Not signif. if also adjusted for smoking. Groups with < 3 asthma cases not presented.

Hazard ratios (HR and 95% CI) of new-onset asthma in women according to the N-JEM

<table>
<thead>
<tr>
<th>Job exposure group</th>
<th>All exposed1 HR (95% CI)</th>
<th>Atopics2 HR (95% CI)</th>
<th>Non-atopics2 HR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any exposure</td>
<td>1.2 (0.97-1.6)</td>
<td>1.3 (0.9-1.7)</td>
<td>1.2 (0.8-1.8)</td>
</tr>
<tr>
<td>HMW agents</td>
<td>1.2 (0.9-1.6)</td>
<td>1.3 (0.9-1.9)</td>
<td>1.0 (0.6-1.6)</td>
</tr>
<tr>
<td>Latex Protein</td>
<td>1.2 (0.9-1.7)</td>
<td>1.4 (0.97-2.0)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Pharmaceutical products</td>
<td>1.4 (0.8-2.4)</td>
<td>1.9 (1.0-3.6)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>LMW agents</td>
<td>1.1 (0.6-2.1)</td>
<td>0.7 (0.3-1.9)</td>
<td>1.7 (0.8-4.0)</td>
</tr>
<tr>
<td>Reactive chemicals</td>
<td>1.6 (0.9-3.0)</td>
<td>1.0 (0.4-2.7)</td>
<td>2.7 (1.2-6.2)3</td>
</tr>
<tr>
<td>Irritating agents</td>
<td>1.4 (0.97-2.0)</td>
<td>1.2 (0.8-1.9)</td>
<td>1.6 (0.97-2.8)</td>
</tr>
<tr>
<td>Cleaning agents</td>
<td>2.2 (1.4-3.3)</td>
<td>1.7 (0.9-3.1)</td>
<td>2.9 (1.6-5.3)</td>
</tr>
<tr>
<td>Textile dust</td>
<td>1.1 (0.4-3.5)</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Environmental tobacco smoke</td>
<td>1.6 (0.8-3.1)</td>
<td>1.6 (0.6-3.6)</td>
<td>1.9 (0.7-5.2)</td>
</tr>
<tr>
<td>Uncertain or low exposed</td>
<td>1.0 (0.6-1.7)</td>
<td>1.0 (0.5-2.0)</td>
<td>1.0 (0.4-2.3)</td>
</tr>
</tbody>
</table>

Adjusted for age and atopy. Not significant if also adjusted for smoking. Groups with < 3 asthma cases not presented.

Hazard ratios (HR and 95% CI) of new-onset asthma in men in high risk occupational groups

<table>
<thead>
<tr>
<th>Occupational group</th>
<th>All exposed1 HR (95% CI)</th>
<th>Atopics2 HR (95% CI)</th>
<th>Non-atopics2 HR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaners, building caretaker</td>
<td>2.5 (1.1-5.8)3</td>
<td>Not applicable</td>
<td>3.7 (1.3-10.8)</td>
</tr>
<tr>
<td>Child or other personal care work</td>
<td>2.5 (1.0-6.2)2</td>
<td>2.7 (0.8-8.9)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Building workers (not carpenters)</td>
<td>1.5 (0.8-2.9)1</td>
<td>2.0 (0.9-4.4)</td>
<td>1.1 (0.4-3.1)</td>
</tr>
<tr>
<td>Plumbers</td>
<td>3.9 (1.6-9.7)3</td>
<td>Not applicable</td>
<td>5.6 (2.0-15.7)</td>
</tr>
<tr>
<td>Food and tobacco processing</td>
<td>2.6 (0.96-7.2)</td>
<td>4.1 (1.3-14.1)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Spray painters</td>
<td>7.2 (2.3-22.9)</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

1Adjusted for age and atopy. 2Adjusted for atopy. Not significant if also adjusted for smoking. Groups with < 3 asthma cases not presented.

Hazard ratios (HR and 95% CI) of new-onset asthma in women in high risk occupational groups

<table>
<thead>
<tr>
<th>Occupational group</th>
<th>All exposed1 HR (95% CI)</th>
<th>Atopics2 HR (95% CI)</th>
<th>Non-atopics2 HR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaning, building caretaker</td>
<td>2.2 (1.4-3.3)</td>
<td>1.6 (0.9-3.0)</td>
<td>3.1 (1.7-5.7)</td>
</tr>
<tr>
<td>Nurses</td>
<td>1.4 (0.9-2.1)</td>
<td>1.6 (0.97-2.8)</td>
<td>1.0 (0.4-2.2)</td>
</tr>
<tr>
<td>Child or other personal care work</td>
<td>1.3 (0.9-2.0)5</td>
<td>1.3 (0.9-2.0)</td>
<td>1.3 (0.5-6.2)</td>
</tr>
<tr>
<td>Hairdressers, beauticians</td>
<td>2.0 (0.98-4.1)4</td>
<td>1.1 (0.33-3.4)</td>
<td>4.2 (1.7-10.4)</td>
</tr>
<tr>
<td>Drivers</td>
<td>3.7 (1.2-11.7)</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Environmental tobacco smoke</td>
<td>1.6 (0.7-3.9)3</td>
<td>1.5 (0.5-4.7)</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

1Adjusted for age and atopy. 2Adjusted for atopy. Not significant if also adjusted for smoking. Groups with < 3 asthma cases not presented.
Population attributable risk (PAR %) for asthma in all exposed and in specific exposure groups

Conclusions

Increased risk of new-onset asthma was seen in:

- Men exposed to epoxy, diisocyanates and acrylates
- Men exposed to accidental high peaks of irritants
- Men and women exposed to cleaning agents
- Male plumbers and spray painters as well as female hairdressers and drivers.

Conclusions cont.

- Non-atopics seem to be at higher asthma risk when exposed to LMW and irritating agents.
- Population attributable risk was 14% for men and 7% for women.
- Highest PAR% for men exposed to inorganic dust and fumes, diisocyanates, epoxy and peak exposure to irritants (8-11).

Co-authors in this RHINE study

Eva Andersson¹, Christer Janson², Anna Dahlman-Höglund¹, Bertil Forsberg³, Mathias Holm¹, Thorarinn Gíslason⁴, Rain Jögi⁵, Ernst Omenaas⁶, Vivi Schlünssen⁷, Torben Sigsgaard⁷, Cecilie Svanes⁶ and Kjell Torén¹

¹Occup and Environmental Medicine, Sahlgrenska University Hospital, Gothenburg, Sweden.
²Dept of Medical Sciences, Respiratory Medicine and Allergology, Uppsala University, Sweden.
³Public Health and Clinical Medicine, Umeå University, Sweden.
⁴University of Iceland, Medical Faculty, Reykjavik, Iceland.
⁵Foundation Tartu University Clinics, Lung Clinic Tartu, Estonia.
⁶Bergen Respiratory Research Group, Inst of Medicine, University of Bergen, Norway.
⁷Dept. of Public Health Section for Environmental and Occupational Medicine, Aarhus, Denmark.