Wood Dust Exposure and Asthma in British Columbia Sawmill Workers

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Background

- Asthma is the most common occupational respiratory disease in developed countries\(^1\)
  - Cause of considerable morbidity to workers, and is a risk factor for COPD - a life-threatening disease
- Red cedar asthma has been well studied and described - soft wood dusts have been implicated as a risk factor (however contribution to occupational asthma unknown)

Wood dust and asthma

• Studies have shown that working in sawmills is related to bronchitis, asthma, & airflow obstruction
  - However, few studies have been able to assess dose-response relationships
  - It is unclear if prolonged exposure to wood dust, or short-term high exposure contributes to occupational asthma
Study objective

• To assess the effect of cumulative softwood dust exposure on asthma

• To assess the effect of shorter-term softwood dust exposure on asthma
Study population

- UBC Sawmill Study:
  - 26,000 workers, employed for at least one year, in one of 14 British Columbia sawmills between 1950-1985 (updated to 1998)
  - Work histories and personal identifiers collected from the sawmills for each member of the cohort

- Current study:
  - Must have worked ≥1 day on or after April 1, 1991 (Start of follow-up)
  - 4854 cohort members included in this analysis and linked to administrative healthcare database
Administrative data

The B.C. Linked Health Database

Population
- Births File: 1985 onward
- Deaths File: 1985 onward
- MSP Registration File: 1985 onward

Health Status

Social Investment / Safety Net
- Workers’ Compensation Board: 1986 - 2000
- EduData: Insert years here!

Health Care System
- Special Populations: BC Cancer Agency: 1986 forward
- Services: BC Ambulance Service: 1999 only
- Continuing Care: 1985 - 2000
- Hospital Separations: FY 1985/86 - FY 2000/01
- Medical Services Plan: FY 1985/86 - FY 2000/01
- Mental Health: 1990 - 1996
- PharmaCare: 1986 - 2001
- Care Providers: MSP Practitioner File: 1986 forward

Social / Physical Context
- Settlement Pattern Data: 1996 and 2001 and later
- Census of Health Professionals: 1985 onward
- Travel Time and Network Data: 2001 onward (currently under development)
- BC Stats Datasets and Profiles: 1991 onward (earlier years on request)
- Canada Census: 1986 onward
Methods

• Asthma cases
  - ≥2 physician visits for asthma (ICD-9 codes 493 (asthma) or 495.8 (red cedar asthma) in a sliding 365-day window
  OR
  - Ever hospitalized with either code 493 or 495.8
Wood dust exposure assessment

Sawmill exposure data:
- Walkthrough surveys, collection of personal & environmental samples (~1400)
- Interviews
- Production records, blueprints, & other data collected (industry or government)

Determinants of exposure:
- Observations during sampling
- Company reports
- Interviews
- Published reports

Model development

Wood dust exposure assessment

- Model then validated using measurements at a non-study mill (n=213)

- From total dust estimates, wood dust exposures were also estimated for each job at each mill, over time
  - Expert opinion and resin acid measurements
Analysis

- **Cumulative exposure:**
  - Average wood dust level that a worker is exposed to in each job
  - Multiply by the length of time a worker is in that job
  - Add exposure of all the jobs a worker had

- **Shorter term exposure:**
  - Second data file includes only jobs with wood dust exposure $\geq 1$ mg/m$^3$
  - Exposure is then examined by TIME exposed at or above this level
  - Exposure during previous jobs not considered

- **Poisson regression was used to examine the internal comparison of wood dust exposure with meeting the asthma case definition**
# Results

- 210 subjects met the case definition for asthma (4.3%)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Asthma cases (n=210)</th>
<th>Non-cases (n=4644)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (% female)</td>
<td>3.3</td>
<td>2.3</td>
<td>0.323</td>
</tr>
<tr>
<td>Race (% non-Caucasian)</td>
<td>61</td>
<td>86</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Age (yrs., on April 1, 1991)</td>
<td>42</td>
<td>40</td>
<td>0.004</td>
</tr>
<tr>
<td>Cumulative wood dust exposure (mg/m³)</td>
<td>4221</td>
<td>4550</td>
<td>0.462</td>
</tr>
<tr>
<td>Years since first exposure (mean)</td>
<td>17</td>
<td>19</td>
<td>0.005</td>
</tr>
</tbody>
</table>
Cumulative exposure to wood dust and risk of asthma

*Adjusted for age, sex, and race

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th># of cases</th>
<th>Rate ratio (95% confidence interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative wood dust exposure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- None</td>
<td>53</td>
<td>1</td>
</tr>
<tr>
<td>- Low</td>
<td>53</td>
<td>0.9 (0.6 - 1.3)</td>
</tr>
<tr>
<td>- Medium</td>
<td>52</td>
<td>0.8 (0.5 - 1.2)</td>
</tr>
<tr>
<td>- High</td>
<td>52</td>
<td>0.8 (0.6 - 1.3)</td>
</tr>
</tbody>
</table>
## Shorter-term wood dust exposure and risk of asthma

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th># cases</th>
<th>Rate ratio (95% confidence interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood dust exposure &gt; 1 mg/m$^3$ (time)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 0 days</td>
<td>165</td>
<td>1</td>
</tr>
<tr>
<td>- &gt;0 - 60 days</td>
<td>6</td>
<td>2.5 (1.1 - 5.6)</td>
</tr>
<tr>
<td>- &gt;60 days - 1 year</td>
<td>12</td>
<td>1.3 (0.7 - 2.3)</td>
</tr>
<tr>
<td>- &gt;1 year - 2 years</td>
<td>12</td>
<td>1.6 (0.9 - 3.0)</td>
</tr>
<tr>
<td>- &gt; 2 years</td>
<td>15</td>
<td>1.0 (0.6 - 1.6)</td>
</tr>
</tbody>
</table>

*Adjusted for age, sex, and race*
Conclusions

• Cumulative exposure model did not show any significant relationships
  - Cumulative exposure unimportant for asthma? Or limitations of study design?
  - Most exposed workers at lower risk than least exposed - healthy worker effect

• Short term exposure to high concentration of wood dust was a risk factor for becoming an asthma case
  - Susceptible workers transferring away from highly exposed jobs?
Acknowledgements

- Sawmill workers
- Companies
- Funded by:
  - Canadian Institutes of Health Research (CIHR)
  - WorkSafe BC
  - National Institute for Occupational Safety and Health (NIOSH)
  - British Columbia Lung Association

Study Website:
www.cher.ubc.ca/UBCSawmillStudy/default.htm