Asthma in New Zealand sawmill workers
New Zealand research on respiratory disease in wood workers

**Respiratory Cancer:**

Kawachi, Pearce, Fraser, 1989

<table>
<thead>
<tr>
<th>NZ JEM category</th>
<th>Cases/Controls</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never exposed</td>
<td>142/266</td>
<td>1</td>
</tr>
<tr>
<td>Ever exposed</td>
<td>219/443</td>
<td>0.95 (0.69-1.29)</td>
</tr>
<tr>
<td>High exposure</td>
<td>42/66</td>
<td>1.46 (0.82-2.60)</td>
</tr>
</tbody>
</table>

**Non-malignant respiratory symptoms:**

Norrish *et al*, 1992
Douwes *et al*, 2001
Fransman *et al*, 2003
Douwes *et al*, 2006
Cross-Sectional study: New Zealand Sawmill Workers

- N=772
- Modified ECRHS questionnaire
- Job title and work area
- Potential confounders

# Symptom prevalence and adjusted prevalence odds ratios in NZ sawmill workers

<table>
<thead>
<tr>
<th>Symptom in last 12 months</th>
<th>Symptom Prevalence %</th>
<th>OR</th>
<th>95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheezing</td>
<td>29.6*</td>
<td>1.4*</td>
<td>1.1 – 1.9</td>
</tr>
<tr>
<td>Wheezing without cold</td>
<td>16.0</td>
<td>1.0</td>
<td>0.7 – 1.5</td>
</tr>
<tr>
<td>Woken by SOB</td>
<td>13.5*</td>
<td>1.4</td>
<td>0.9 – 2.1</td>
</tr>
<tr>
<td>Asthma attack</td>
<td>7.0</td>
<td>1.4</td>
<td>0.8 – 2.4</td>
</tr>
<tr>
<td>Asthma medication</td>
<td>9.8*</td>
<td>1.8*</td>
<td>1.1 – 2.9</td>
</tr>
<tr>
<td>Asthma</td>
<td>18.0</td>
<td>1.6*</td>
<td>1.1 – 2.3</td>
</tr>
</tbody>
</table>

Reference, General population

* P<0.05; compared to general population and adjusted for age, gender and ethnicity
Symptom prevalence and job-title-based wood dust exposure in sawmill workers

- Daily cough:
  - non-exp: 10%
  - low exp: 25%
  - high dry: 30%
  - high green: 45%

- Asthma:
  - non-exp: 15%
  - low exp: 20%
  - high dry: 25%
  - high green: 30%

- Runny nose >1/week:
  - non-exp: 10%
  - low exp: 15%
  - high dry: 20%
  - high green: 25%
Follow-up Study

- 58 asthmatic and 163 non-asthmatic workers
- Randomly selected from the X-Sectional study
- Questionnaire survey
- Objective measurement of:
  - personal exposure
  - Lung function
  - Reactions to common allergens

**Personal dust and bacterial endotoxin exposure in NZ sawmill workers by job category**

<table>
<thead>
<tr>
<th>Exposure category</th>
<th>Dust concentration (mg/m³)</th>
<th>Endotoxin concentration (EU/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>AM</td>
</tr>
<tr>
<td>Green mill</td>
<td>47</td>
<td>0.8</td>
</tr>
<tr>
<td>Dry mill</td>
<td>39</td>
<td>1.0</td>
</tr>
<tr>
<td>Yard</td>
<td>17</td>
<td>0.6</td>
</tr>
<tr>
<td>Other</td>
<td>30</td>
<td>0.3</td>
</tr>
<tr>
<td>Total</td>
<td>136</td>
<td>0.7</td>
</tr>
</tbody>
</table>
# Lung function by wood dust exposure category

<table>
<thead>
<tr>
<th></th>
<th>High dry (95%CL)</th>
<th>High green (95%CL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC</td>
<td>-3.6 (-8.3, 1.1)</td>
<td>-6.3 (-11.3, -1.3)*</td>
</tr>
<tr>
<td>FEV1</td>
<td>-3.9 (-8.4, 0.6)</td>
<td>-5.7 (-10.6, -0.9)*</td>
</tr>
<tr>
<td>PEF</td>
<td>-8.0 (-14.2, -1.9)*</td>
<td>-8.1 (-14.8, -1.4)*</td>
</tr>
</tbody>
</table>

*Reduction in % predicted  
Reference: all non/low exposed workers.  
Adjusted for asthma, sex, age, ethnicity, smoking, height.  
* $p<0.05$
# Lung function by wood dust exposure - stratified for asthma status

<table>
<thead>
<tr>
<th></th>
<th>“High dry”</th>
<th>“High green”</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FVC</strong></td>
<td>-3.33</td>
<td>-5.63</td>
<td>-7.57*</td>
</tr>
<tr>
<td><strong>FEV₁</strong></td>
<td>-2.92</td>
<td>-12.45*</td>
<td>-5.64</td>
</tr>
<tr>
<td><strong>PEF</strong></td>
<td>-6.47</td>
<td>-21.00*</td>
<td>-8.54*</td>
</tr>
</tbody>
</table>

*Reduction in % predicted

Reference group: non-asthmatics that are non/low exposed

Adjusted for sex, age, ethnicity, smoking, height

* p<0.05
Exposure and Atopy

Adjusted for asthma, sex, age, ethnicity, and smoking

* $p<0.05$
What have we observed in New Zealand?

• Increased prevalence of asthma in NZ sawmill workers.
• Exposure to a range of airborne contaminants in wood processing, although levels not „high’.
• Elevated exposure to both “green” and “dry” dust is associated with a significant decline in lung function, of both an obstructive (FEV$_1$, PEF) and a restrictive (FVC) nature.
• Effects on lung function were observed in both asthmatic and non-asthmatic workers.
• Exposure to high levels of “green” dust was associated with allergy.
What we still don’t know

Do these exposures ‘cause’ respiratory disease, or merely exacerbate pre-existing respiratory conditions?

Incidence of asthma and allergies in wood workers?

Progression of the disease, are the effects reversible?

Which exposure(s) are responsible?
- Dust
- resin acids
- Terpenes
- Fungi or bacteria

What mechanism is involved?
- Allergic
- Non-allergic inflammation
Longitudinal study of respiratory disease in sawmill workers

- Measure the incidence of new cases of allergies and asthma, and examine their associations with sawmill exposures.
- Examine longitudinal changes in lung function, and examine their associations with sawmill exposures.
- Investigate the mechanisms underlying these effects, and the levels at which effects occur.
- Investigate whether the effects are reversible once exposure has ceased.
Methods

• Longitudinal study
• 300 workers followed for 4 years
• Measure associations between wood dust, endotoxins and resin acids exposure and outcome measures over 12, 24 and 36 months.
Main outcome measures

Annual testing over three years to measure:

• **Lung function.**
• Reported symptoms by **questionnaire.**
• **Atopic sensitisation** using skin prick test reactivity to common allergens.
• **Dust exposure**, and specific components in the wood dust.

In final year assess:

• underlying **immunological mechanisms** using sputum induction and exhaled NO.
• **Reversibility** in newly symptomatic workers who leave the industry.