The Burden of Occupational Lung Cancer

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Towards a cancer-free workplace
Measuring the Impact (burden) of Occupational Cancer

- Number or proportion of cancer deaths
- Number or proportion of new cancers
- Years of life lost
- The direct (e.g. healthcare) and indirect (e.g. productivity) costs of preventable cancers
- Current burden vs forward projection?
How do we Estimate the Number of New Cancers?

- Almost no cancers are easily identifiable as occupational (possible exceptions: mesothelioma, nasal adenocarcinoma, angiosarcoma of the liver)
- Workers’ compensation statistics only represent a small fraction, so are not useful

**Two primary methods are available**

- Estimate the number of people exposed in the past and model the current number of cancers
- Identify the proportion from representative case-control studies with very good exposure assessment
## Estimated Burden of Occupational Lung Cancer from Various Studies

<table>
<thead>
<tr>
<th>Author &amp; Location</th>
<th>Men</th>
<th>Women</th>
<th>Carcinogens Considered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driscoll et al (2005)</td>
<td>10%</td>
<td>5%</td>
<td>Arsenic, asbestos, beryllium, cadmium, chromium, diesel exhaust, nickel, silica</td>
</tr>
<tr>
<td>Global</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Steenland et al (2003)</td>
<td>8-19%</td>
<td>2%</td>
<td>Same as global plus radon and ETS</td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Nurminen et al (2001)</td>
<td>29%</td>
<td>5%</td>
<td>Similar to US, but including “exposure circumstances”</td>
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<tr>
<td>Finland</td>
<td></td>
<td></td>
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<tr>
<td>Rushton et al (2010)</td>
<td>21%</td>
<td>5%</td>
<td>Similar to Finland, but including radiation, nickel, PAHs, more circumstances &amp; probable carcinogens</td>
</tr>
<tr>
<td>United Kingdom</td>
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</tbody>
</table>
Asbestos and Lung Cancer

• Asbestos has been the biggest cause of occupational lung cancer

• UK Study (Brown et al, 2012)
  – 8.9% of lung cancers in men
  – 1.7% of lung cancers in women

• Finnish Study (Nurminen et al, 2001)
  – 14% of lung cancers in men
  – 0.6% of lung cancers in women
### IARC Study of Asbestos and Lung Cancer

- Examined the number of excess lung cancers for each case of mesothelioma in the major studies of asbestos workers

<table>
<thead>
<tr>
<th>Asbestos Type</th>
<th>Lung Cancer Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crocidolite</td>
<td>0.7</td>
</tr>
<tr>
<td>Chrysotile + crocidolite</td>
<td>1.7</td>
</tr>
<tr>
<td>Chrysotile</td>
<td>8.2</td>
</tr>
<tr>
<td>Amosite</td>
<td>4.1</td>
</tr>
<tr>
<td>Mixed</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Estimating the Burden of Lung Cancer

• Ratio of lung cancers to mesotheliomas from cohort studies: 2.8-4.5
• In 2007 there were 512 mesotheliomas
• If we assume that 85% of mesotheliomas and apply ratios, 5.3%-8.6% are due to asbestos (8.0%-12.3% in men, 2.2%-3.5% in women)
• Average attributable proportions of lung cancer from case-control studies: 8.9-11.7%

Male Mesothelioma Incidence Rates (age-standardized) by Public Health Unit, Ontario, 1986–2009

Male Mesothelioma Rates (1986–2009)

- 0.75 - 1.34
- 1.34 - 1.47
- 1.47 - 1.71
- 1.71 - 2.19
- 2.19 - 8.41

Lower than Ontario Average (p<0.05)
Higher than Ontario Average (p<0.05)
Diesel Exhaust and Lung Cancer

• Although diesel was only recently classified as a group 1 Carcinogen by IARC, it has long been included in burden studies

• UK Study (Brown et al, 2012)
  – 2.9% of lung cancers in men
  – 0.4% of lung cancers in women

• Finnish Study (Nurminen et al, 2001)
  – 2.5% of lung cancers in men
  – 0.1% of lung cancers in women
Crystalline Silica and Lung Cancer

• Crystalline silica is also one of the biggest cause of occupational lung cancer

• UK Study (Brown et al, 2012)
  – 3.9% of lung cancers in men
  – 0.3% of lung cancers in women

• Finnish Study (Nurminen et al, 2001)
  – 2.7% of lung cancers in men
  – 0.2% of lung cancers in women
Nickel, Chromium and Lung Cancer

• Nickel & chromium (Cr6) are also important lung carcinogens but generate far fewer cancers

• UK Study (Brown et al, 2012)
  – Chromium: 0.22% in men, 0.11% in women
  – Nickel: 0.03% in men, 0.01% in women

• Finnish Study (Nurminen et al, 2001)
  – Chromium: 1.6% in men, 0.1% in women
  – Nickel: 1.5% in men, 0.01% in women
Radon and Lung Cancer

• Radon has long been known as a lung carcinogen, but its impact has not been fully recognized.

• It is now recognized as the second leading cause of lung cancer.

• In Canada, 16% of lung cancers are thought to be caused by radon (Chen et al, 2012).

• In Ontario, 13.6% of lung cancers are thought to be caused by radon, with large geographic variations (Peterson et al, 2013).
Radon and Lung Cancer

- Although radon has been included in some previous occupational, the focus was on very high risk groups

- UK Study (Brown et al, 2012)
  - 0.6% of lung cancers in men
  - 0.6% of lung cancers in women

- Finnish Study (Nurminen et al, 2001)
  - 4.5% of lung cancers in men
  - 1.2% of lung cancers in women
Geographic variation impacts risk as work too.
Assessing the Human & Economic Burden of Occupational Cancer in Canada*

44 Internationally Recognized Workplace Carcinogens

27 Different Types of Cancer

* Funded by a CCSRI Team Grant in collaboration with CCS-ON
Primary Objective of Assessing Burden of Occupational Cancer

• Raise awareness of the magnitude the problem among:
  – Government agencies
  – Employers and unions
  – Physicians and others in healthcare
  – Cancer research and prevention community

• Provide data necessary to prioritize prevention activities
Towards a cancer free workplace

http://occupationalcancer.ca