The occupational cancer burden: 
Australia and beyond

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Sydney School of Public Health
University of Sydney
The more things change, the more they stay the same

- The past........................Asbestos
- The present.....................Asbestos
- The future.......................Asbestos
What do we know?

- Carcinogenic agents (exposures) ........mostly
- Cancer types associated with carcinogens
- How to avoid exposure
What causes cancer?

- International Agency for Research on Cancer (IARC)

- **Group 1:** Definitely causes cancer in humans
- **Group 2A:** Probably causes cancer in humans
- **Group 2B:** Possibly causes cancer in humans
- **Group 3:** Not enough evidence to decide
- **Group 4:** Does not cause cancer in humans
What don’t we know?

- Who is exposed?
- What are they exposed to?
- How many cases occur that are related to occupational exposures?
Estimating the burden
Why is it so hard??

- Most occupational cancers can be caused by non-occupational causes
- Usually no way to determine the cause in an individual case
- Long latency obscures the connection to exposure

Usually use attributable fraction approach
Occupational cancer estimates made easy

Determine the proportion of cases resulting from exposure to the risk factor

Find the total number of cases

Multiply the proportion by the number of cases

= cases due to the risk factor!
Attributable fraction

Based on:

- exposure prevalence
- relative risk

\[ AF = \frac{\sum Pi \times RRi}{\sum Pi \times RRi} - 1 \]
Producing the estimates

- List of occupational carcinogens
- Estimate of the relative risk for each carcinogen
- Proportion of people exposed
- Number of cancers
The international burden
### Estimates of occupational cancer - selected countries

**United States**
- **1981:** 4% (Doll and Peto)
- **1987:** 6% to 10% (Leigh et al)
- **2003:** 2% to 5% (Steenland et al)

**Finland**
- **2001:** 14% (male) (Nurminen and Karjalainen)
- **2001:** 2% (female) (Nurminen and Karjalainen)

**New Zealand**
- **2005:** 5% to 9% (male) (t’Mannetje et al)
- **2005:** 0.5% to 2% (female) (t’Mannetje et al)
### Global estimates of occupational cancer

<table>
<thead>
<tr>
<th>Year</th>
<th>Estimated Cases</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>456,000</td>
<td>(Takala)</td>
</tr>
<tr>
<td>2004</td>
<td>610,000</td>
<td>(Hamalainen et al)</td>
</tr>
<tr>
<td>2005</td>
<td>152,000</td>
<td>(Driscoll et al)</td>
</tr>
</tbody>
</table>
Mesothelioma estimates

- 43,000 Driscoll et al, 2005
- 14,200 – 25,000 Park et al, 2011
The burden internationally (deaths)

From Nelson et al, 2005
The UK Cancer Burden study

• Number of cancers due to occupation in Great Britain
• Broken down by:
  – Cancer type
  – Carcinogens
  – Industry sectors

• Lesley Rushton, Sally Hutchings
Meticulous, complicated methods
Meticulous, complicated methods (Aust)

Occupational exposure

Cancer
Meticulous, complicated methods (UK)
## Most common types of cancer caused by work

<table>
<thead>
<tr>
<th>Cancer type</th>
<th>No. of work-related cancers, UK 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung</td>
<td>5,447</td>
</tr>
<tr>
<td>Non-melanoma skin</td>
<td>2,928</td>
</tr>
<tr>
<td>Breast</td>
<td>1,969</td>
</tr>
<tr>
<td>Mesothelioma</td>
<td>1,937</td>
</tr>
<tr>
<td>Bladder</td>
<td>550</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13,679</strong></td>
</tr>
</tbody>
</table>

From Rushton et al, 2010
### Most common carcinogens at work

<table>
<thead>
<tr>
<th>Carcinogen</th>
<th>No. of work-related cancers, UK 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestos</td>
<td>4,216</td>
</tr>
<tr>
<td>Shiftwork</td>
<td>1,957</td>
</tr>
<tr>
<td>Mineral oils</td>
<td>1,730</td>
</tr>
<tr>
<td>Solar radiation</td>
<td>1,541</td>
</tr>
<tr>
<td>Silica</td>
<td>907</td>
</tr>
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<td><strong>Total</strong></td>
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From Rushton et al, 2010
### Industries with the highest number of work-related cancers

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<tr>
<th>Industry</th>
<th>No. of work-related cancers, UK 2004</th>
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<tr>
<td>Construction</td>
<td>4,816</td>
</tr>
<tr>
<td>Shiftwork</td>
<td>1,957</td>
</tr>
<tr>
<td>Metal workers</td>
<td>1,250</td>
</tr>
<tr>
<td>Personal and household services</td>
<td>804</td>
</tr>
<tr>
<td>Roofers, road construction</td>
<td>541</td>
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From Rushton et al, 2010
Future predictions of cancers
Why should estimates change over time?

- Different exposure types
- Different exposure intensities
- Different exposure circumstances
- Different cancer profiles
### Testing reduction of exposure standard and changes in compliance
Forecast lung cancers for 2060 for Respirable Crystalline Silica

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2060</th>
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<tbody>
<tr>
<td></td>
<td>Attributable Fraction</td>
<td>Attributable registrations</td>
</tr>
<tr>
<td>Base-line: exposure limit 0.1mg/m³, compliance 33%</td>
<td>3.3</td>
<td>803</td>
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<tr>
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<td>102</td>
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<td>0.07</td>
<td>49</td>
</tr>
<tr>
<td>Exposure limit 0.025mg/m³, compliance 90%</td>
<td>0.03</td>
<td>21</td>
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The burden in Australia
Estimates of occupational cancer - Australia

- 1991 Winder and Lewis
- 1996 Kerr et al
- 1999 Mathers et al

2% to 4% (All based on Doll and Peto)

2001 – 2003 403 accepted compensation claims for cancer
Occupational cancer in Australia

• 5000 cancers each year
  – 11% of incident cancers in males
  – 2% of incident cancers in females

• PLUS about 34 000 Non-melanoma skin cancer (NMSC)
  – 13% of NMSCs in males
  – 4% of NMSCs in females

Fritschi and Driscoll, 2006
### Numbers - males

<table>
<thead>
<tr>
<th>Cancer</th>
<th>Attributable fraction</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronchus and lung</td>
<td>29%</td>
<td>1,530</td>
</tr>
<tr>
<td>Prostate</td>
<td>6%</td>
<td>630</td>
</tr>
<tr>
<td>Mesothelioma</td>
<td>90%</td>
<td>352</td>
</tr>
<tr>
<td>Bladder</td>
<td>14%</td>
<td>304</td>
</tr>
<tr>
<td>Colon</td>
<td>6%</td>
<td>265</td>
</tr>
<tr>
<td>Leukaemia</td>
<td>18%</td>
<td>264</td>
</tr>
<tr>
<td>Non-Hodgkin’s lymphoma</td>
<td>13%</td>
<td>252</td>
</tr>
<tr>
<td>Melanoma</td>
<td>4%</td>
<td>192</td>
</tr>
<tr>
<td>Stomach</td>
<td>10%</td>
<td>131</td>
</tr>
<tr>
<td>Pancreas</td>
<td>13%</td>
<td>122</td>
</tr>
</tbody>
</table>
### Numbers – females

<table>
<thead>
<tr>
<th>Cancer</th>
<th>Attributable fraction</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast</td>
<td>2%</td>
<td>192</td>
</tr>
<tr>
<td>Bronchus and lung</td>
<td>5%</td>
<td>147</td>
</tr>
<tr>
<td>Non-Hodgkin’s lymphoma</td>
<td>3%</td>
<td>49</td>
</tr>
<tr>
<td>Cervix</td>
<td>6%</td>
<td>44</td>
</tr>
<tr>
<td>Stomach</td>
<td>5%</td>
<td>38</td>
</tr>
<tr>
<td>Pancreas</td>
<td>3%</td>
<td>31</td>
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Workers exposed to carcinogens

- 1.5 Million (23%)
- 60% to 90%
  - Forestry and logging
  - Furniture and fixture manufacturing
  - Other mining
  - Petroleum and coal products manufacture
  - Other non-metallic mineral products manufacture
  - Pottery, china and earthware manufacture
  - Fishing
  - Wood and wood products manufacture
  - Air transport

Occupational cancer

Cancer Council forum – May 2012
Where are we heading?
What’s changing?

• Changing industry distribution
• Changing occupation distribution
• Changing demographics – more women, more older persons
• Better control of many ‘traditional’ exposures
• Activity replaced by inactivity
• Public better educated...?
Changing workplace - industry

Proportion of all employed people in the production and service industries – 1966-2011 – from the ABS
Changing workplace - occupation

Proportion of all employed people in blue and white collar occupations – 1966-2011 – from the ABS
Changing workplace – gender

From Trends in Labour Supply, Connolly et al.
Changing workplace – part time

Source: ABS
Exposure changes over time

• Literature review on changes in inhalation exposure in occupational circumstances.

• In the majority of instances, there were significant reductions in exposure, with percentage yearly declines up to 32%.

• Factors commonly cited as being responsible
  – introduction of new standards
  – response to regulatory requirements
  – changes in production methods.
  – ................................................................. Creely et al, 2007
Investigation of a reported cluster of cancer cases at the National Gallery of Australia

Final report

Tim Driscoll
Gary Foster
Felicity Driscoll

September 2008
CFA buries cancer time bomb

Ruth Lamperd | Herald Sun | December 06, 2011 12:00AM

UPDATE: MORE people claiming to be victims of the CFA Fiskville chemical exposure revelation have come forward today.

Former CFA families have contacted the Herald Sun with stories of relatives that died in their 50s.
### Where have cancer cluster concerns arise?

- National Gallery: several types
- University NSW: breast
- Jilalan Rail Yard: several types
- Sydney Airport: breast
- School: several types
- University: vague
- Government office: breast
- Private business: breast
- Industrial site: myeloma
What to do about clusters

Concerns about cancer clusters are unlikely to disappear

Therefore, it is important to:
- Educate the public and people likely to have to respond;
- Respond quickly and appropriately.
Where should we be heading?
Driscoll-Fritschi-Slevin-Vallance guide to cancer control
Driscoll-Fritschi-Slevin-Vallance guide to cancer control

- A strategic approach
- Encourage industry to decrease exposures
- Regulate appropriately
- Use data to guide decisions and actions
- Make sensible decisions when faced with uncertainty
Driscoll-Fritschi-Slevin-Vallance guide to cancer control

- A strategic approach
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- Change with the times
- Asbestos
- Educate
- Inform
- Prioritise
Driscoll-Fritschi-Slevin-Vallance guide to cancer control

• A strategic approach..........................................................Peta Miller
• Encourage industry to decrease exposures......................Lucy Servidio
• Regulate appropriately.....................................................Michael Borowick
• Use data to guide decisions and actions
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• Change with the times.........................................................David Dunstan
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- Prioritise
Using data to guide to decisions and actions and to prioritise

- Who is exposed?
- What are they exposed to?
- What level are they exposed to?
- Where do they work?
- How common is the cancer produced by the exposure?
- What can we do?
- What should the priorities be?
Where should we be heading?

- Decreasing exposure at source
- Improved characterisation of exposure
- Better availability of exposure measures
- Designing out problems
- Better practical support of small businesses and self-employed
- Better education of the public
- Better enforcement where necessary
Change what you can change
Change what you can change

- Stop smoking
- Exercise regularly
- Eat plenty of vegetables and fruit
- Maintain appropriate weight
- Restrict sun exposure
- Restrict alcohol use after Slevin
Conclusions - 1

• The number of occupational cancer cases will always be uncertain

• A significant proportion of the Australian workforce is meaningfully exposed to carcinogens

• The burden of occupational cancer is probably decreasing

• Occupational cancer is still a big enough problem in Australia (and elsewhere) to be taken seriously
Conclusions - 2

• Get some/more/better data on exposure

• Control this exposure!

• Predict future burden under different scenarios and act on this information

• Prioritise sensibly

• Change what you can change