Asbestos Review Program Update

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Head of Occupational and Respiratory Health Unit, Institute for Lung Health, WA

CCWA Lung Cancer: an update for 2015
Introduction

• Asbestos and the lung – the legacy of asbestos
• What should be done for asbestos exposed individuals?
• The ARP screening project
• Wider aspects of occupational exposures and lung cancer
Asbestos

- Mined from the ground
- Crystaline-hydrated silicate mineral – fibre

- Serpentine
  - Chrysotile (white)
    - long, curly, pliable

- Amphibole
  - Crocidolite (blue), amosite (brown)
    - short, straight, stiff
**Plan Your New Home for 194? WITH Hardie's FIBROLITE**

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**When the Fire Alarm Went Off, It Took Two Hours to Evacuate New York's World Trade Centre.**

The bigger the building, the more important fire-proofing becomes.

That's why today's buildings have asbestos-cement walls and even floors containing asbestos.

Asbestos contains fire, cannot burn and holds up after metal and glass have melted down, giving vital time for people to escape.

You'll also find asbestos sealing plumbing joints, insulating heating pipes, electric motors and emergency generators.

Asbestos. We couldn't live the way we do without it.

**When life depends on it, you use asbestos.**

Asbestos Corporation Limited,

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Canada.

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Dry Asbestos Insulation Material used to insulate attics - Very unusual

Transite Furnace Flue

Asbestos Siding

Linoleum Backing

Vinyl Asbestos Floor Tiles

Acoustic Ceiling Material

Taping Compound & Asbestos Plaster

Asbestos-Cement Logs & Artificial Ash

Asbestos Taping Inside Registers

Pipe Insulation & Elbow Mud

Asbestos Fabric Vibration - Insulation Joint

Block Insulation

Asbestos Taping on Return Seams

Door Gaskets

Aircell Pads Inside Furnaces

Aircell and Sheet Metal Ductwork Insulation

Insulation Inside Fuse-Boxes and Old Wire Insulation
Asbestos and the lung

- “Benign” effects
  - Pleural plaques
  - Diffuse pleural thickening
  - Rolled atelectasis
  - Benign asbestos related pleural effusion
  - Asbestosis

- Malignant
  - Malignant mesothelioma
  - Lung cancer
Trades

Carpenters, joiners, builder
Plumber
Boilermakers
Fitters, turners, machinists
Telecommunications
Mechanic, fitter, panel beaters
Marine engineers
Shipwrights, Waterside workers
Armed services
### Asbestos Exposure at Wittenoom

<table>
<thead>
<tr>
<th>Role</th>
<th>f/cc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine miner</td>
<td>20</td>
</tr>
<tr>
<td>Machine bagger (new mill)</td>
<td>80</td>
</tr>
<tr>
<td>Hand bagger (new mill)</td>
<td>100</td>
</tr>
<tr>
<td>Hand bagger (old mill)</td>
<td>130</td>
</tr>
<tr>
<td>New mill average</td>
<td>50</td>
</tr>
<tr>
<td>Old mill average</td>
<td>80</td>
</tr>
</tbody>
</table>
Pleural Plaques

- Most common manifestations of asbestos exposure – often incidental
- Bilateral on the parietal pleura of the chest wall, diaphragm or mediastinum
- More common with increasing time since first exposure and with greater cumulative exposure
PP and lung cancer risk?

- Recent paper of ~5000 asbestos workers reported an adjusted increased risk of lung cancer (OR 2.4) with pleural plaque
- Adjusted for smoking and time since first exposure to asbestos

Pairon, AJRCCM, 2014
PP and lung cancer risk?

• Recent paper of ~5000 asbestos workers reported an adjusted increased risk of lung cancer (OR 2.4) with pleural plaque
• Adjusted for smoking and time since first exposure to asbestos
• BUT
  – n=36, used death certificates
  – PPs are dose dependent – not adjusted for
  – Biological mechanism?

Pairon, AJRCCM, 2014
PP and lung cancer risk?

• 2218 asbestos exposed from WA
• 103 histologically confirmed lung cancers
• Adjusted for – tobacco, time since first exposure and cumulative asbestos exposure

• Asbestosis HR 3-6 increased risk
• Ever smoker HR 18.1
• PP & risk of lung cancer HR 1.04

Brims, WCLC, 2015
Relative Risk of lung cancer

• Asbestos exposed, never smoker:  1.08-2.82

• No asbestos, smoker:    1.78-10.13

• Asbestos exposed, smoker   5.57-25.20

Multiplicative risk

Straif, 2009; deKlerk, 1991; Reid 2006; Lee, 2001
Asbestos Review Program (ARP)

• 1990 – surviving members of Wittenoom workers cohort invited to take part in cancer prevention program

• Regular annual surveillance

• 2007 – analysis demonstrated no benefit
• ‘Non-Wittenoom’ cohort also developed 3 months cumulative exposure to asbestos +/- Presence of pleural plaques

• Mixed fibre, low-medium exposure

• Majority of the cohort
ARP

• March 2015 n=4241 (3462 men) participated
  – Smoking, alcohol, dietary questionnaires
  – Blood (biomarkers, DNA)
  – Lung function (FEV\textsubscript{1}, FVC, DLCO)
  – Annual LDCT (~2750 to date)

• 1,333 deaths all causes (2014)
  – 197 lung cancer
  – 189 mesothelioma
Why low dose CT?

- Background (Perth): 2-3 mSv
- CXR – PA & Lat: 0.1 mSv
- ‘Standard’ CT Chest: 5-8 mSv
- PET-CT: >10-15 mSv
- LDCT: <5 mSv
- Ultra LDCT: <1 mSv
  - 0.1 to 0.15 mSv at PMH and Envision
- 7 Hour flight: 0.02 mSv
## Year 1: characteristics of the cohort

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean, SD)</td>
<td>68.8 (9.9)</td>
</tr>
<tr>
<td>Male</td>
<td>83.4%</td>
</tr>
<tr>
<td>Smoking status: Current</td>
<td>6.5%</td>
</tr>
<tr>
<td>Smoking status: Ex</td>
<td>57.2%</td>
</tr>
<tr>
<td>Smoking status: Never</td>
<td>36.4%</td>
</tr>
<tr>
<td>Pack years (mean, SD)</td>
<td>17.1 (25)</td>
</tr>
<tr>
<td>Asbestos exposure: Wittenoom worker</td>
<td>16.0%</td>
</tr>
<tr>
<td>Asbestos exposure: Wittenoom resident</td>
<td>24.3%</td>
</tr>
<tr>
<td>Asbestos exposure: Other occupational</td>
<td>59.7%</td>
</tr>
<tr>
<td>Mean time since 1st exposure (years, SD)</td>
<td>50.8 (9.0)</td>
</tr>
<tr>
<td>Mean exposure duration (months, SD)</td>
<td>149 (175)</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total subjects</td>
<td>906 (100%)</td>
<td>973 (100%)</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; scan</td>
<td>906 (100%)</td>
<td>115 (11.8%)</td>
</tr>
<tr>
<td>Indeterminate nodule</td>
<td>79 (8.85%)</td>
<td>42 (4.3%)</td>
</tr>
<tr>
<td>Recall</td>
<td>77 (8.4%)</td>
<td>37 (3.8%)</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>7 (0.77%)</td>
<td>3 (0.3%)</td>
</tr>
<tr>
<td>Mesothelioma</td>
<td>4 (0.44%)</td>
<td>1 (0.1%)</td>
</tr>
</tbody>
</table>

- All lung cancer cases asymptomatic
- All early stage
- Two Year 2 lung cancers were incident cases
- Two new prevalent lung cancer cases
Low dose CT for asbestos exposed?

- USPSTF “55-80-30-15” (NLST)
- 3.6% of ARP cohort eligible under NLST
- But similar prevalence of lung cancer

Brims, AJRCCM 2015
What can be done for those exposed to asbestos?

• Detailed occupational / exposure history
• Informed risk assessment
• Reassurance (?)

• Asbestos Review Program (SCGH)
  – Open to anyone with 3/12 cumulative exposure to asbestos +/- pleural plaques
  – Annual review – health questionnaire, lung function, LDCT
*dose dependent risk; raised risk with tobacco smoke

Cancer Australia, 2014
<table>
<thead>
<tr>
<th>Country</th>
<th>Exp Date</th>
<th>Other Exp</th>
<th>First</th>
<th>Smoke</th>
<th>Clubs</th>
<th>Grease</th>
<th>VIT</th>
<th>Lung</th>
<th>Stoma</th>
<th>Other</th>
<th>Last</th>
<th>Cement</th>
<th>harbour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aus</td>
<td>1970</td>
<td>1870-1965</td>
<td>3y</td>
<td>2y</td>
<td>2y</td>
<td>3y</td>
<td>1y</td>
<td>3y</td>
<td>1y</td>
<td>3y</td>
<td>1y</td>
<td>3y</td>
<td>1y</td>
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<tr>
<td>Aus</td>
<td>1975</td>
<td>1970-1965</td>
<td>3y</td>
<td>1y</td>
<td>1y</td>
<td>3y</td>
<td>1y</td>
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<td>1970</td>
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<td>2y</td>
<td>2y</td>
<td>3y</td>
<td>1y</td>
<td>3y</td>
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<td>3y</td>
<td>1y</td>
<td>3y</td>
<td>1y</td>
</tr>
</tbody>
</table>

Western Australia Mesothelioma Register 1971-
Figure 2.3: New cases of mesothelioma by year of diagnosis and sex, 1982 to 2014

Source: Table A8.
ARP – new recruitment drive

- Early detection of lung cancer using LDCT is only avenue to improve outcomes

- Anyone with >3/12 cumulative asbestos exposure +/- presence of pleural plaques

  - Referrals to the Asbestos clinic SCGH
  - Fraser Brims
  - fraser.brims@health.wa.gov.au
Asbestos and lung cancer

• Classic occupations exposed:
  – Carpenters, boiler makers, laggers, ship & railway construction, ship breaking, armed services, builders, plumbers...

• Risk of developing LC increases after >10 years exposure, lag time between 20-40yrs  Valik, 2002

• Increases with increasing duration of exposure

• Chrysotile - longer time to develop?  Wang, 2012; Yano, 2010
Asbestos fibre type

- Healthy worker effect
  - Underestimate of risk Naimi, 2013; Naimi, 2014
- Risk of different fibre type(s) is unclear Hodgson, 2000, Lenters, 2011, van der Bij, 2013
- Mixed fibre exposures
Diesel engine exhaust

- 2012 IARC classified DEE as class 1 carcinogen
- Strongest evidence is in highly exposed workers
- Complex composition: gas, particulate, PAH, VOCs
- Proxy measure: respirable elemental carbon (REC)
- Variable risk estimates
  - Miners, rail road, truckers 2-3 fold increased risk
  - Railroad workers – 40% increased risk
  - Truckers, dockyard workers – 15-40% increased risk

Benbrahim-Tallaa, Lancet Oncology 2012
DEE in Australia

- Cross sectional survey >5000 current workers in Australia (2011)
- 13.4% respondents ‘substantial’ DEE exposure
- Highest in WA (17.0%)
- Agricultural, mining, transport, construction, mechanics.
- Males > females

- Extrapolation: 1.2 million Australians currently exposed in the workplace
Male mesothelioma mortality, WHO 2010

The graph shows the male mesothelioma mortality rates for various countries in 2010. The mortality rates are represented in a polar coordinate system with the countries listed along the radial lines and the mortality rates marked along the circumference. The countries with the highest mortality rates are located near the center, while those with lower rates are further out along the radial lines.

Key countries with high mortality rates include:
- U.K.
- Netherlands
- Australia
- Malta
- Croatia
- Italy
- Luxembourg
- Denmark
- Finland
- Norway
- Germany
- Sweden
- Austria
- Slovenia
- Hong Kong
- Czech Republic
- Argentina
- Poland
- Spain
- Japan
- U.S.A.
- Israel
- Ireland

Other countries with lower mortality rates include:
- Lithuania
- Serbia
- Estonia
- Romania
- Slovakia
- Portugal
- Mexico
- Hungary
- Hong Kong
- Latvia
- Czech Republic
- Argentina
- Poland
- Spain
- Japan
- U.S.A.
- Israel
- Ireland

The graph provides a visual representation of how the mortality rates vary across different countries.