Occupational Lung Disease in South Africa

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The National Institute for Occupational Health (NIOH)

- Started in 1946 (Pneumoconiosis Research Unit)
- Centre of excellence for multidisciplinary occupational health research, training and service
- Staff of 150
- Active involvement locally & internationally (WHO Collaborating Centre: ILO; links with NIOSH, FIOH, EPA, HSL, OPCW & IAEA)

Background of the NIOH

- Part of the National Health Laboratory Service (NHLS)
  - 349 pathology laboratories
  - 3 national institutes (NICD, NIOH, NCR)
- 7000 employees
- Service, teaching & research
Occupational Injuries

• Abrupt break in ...
  AGENT – HOST – ENVIRONMENT equilibrium
• Cause established

Occupational Diseases

• Not diagnosed / mis-diagnosed
• Lack of knowledge
• Masked by other diseases
• Long lag time
• Need special investigations
• Difficult to find cause

Routes of Exposure

- Inhalation
- Ingestion
- Dermal absorption (skin)
Parts of Lung Affected

Occupational Lung Diseases

- Broad group of disorders that develop as a result of inhalation of specific particles
- Major classification
  - Hypersensitivity pneumonitis (organic)
  - Pneumoconiosis (mineral dusts)

Occupational Lung Disease

- Work organisation and processes change and become increasingly complex
- More potentially toxic substances - nanoparticles
- It is unlikely that the lung will develop many new ways to react to inhaled substances
- We'll see old lung diseases with new causes

Occupational Exposure Limits for Silica (2008)

<table>
<thead>
<tr>
<th>Country / Province</th>
<th>OEL (mg / m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>0.05</td>
</tr>
<tr>
<td>British Columbia</td>
<td>0.025</td>
</tr>
<tr>
<td>Chile</td>
<td>0.04</td>
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<td>Ireland</td>
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<tr>
<td>Portugal</td>
<td>0.05</td>
</tr>
<tr>
<td>USA - ACGIH®</td>
<td>0.025</td>
</tr>
<tr>
<td>USA - NIOSH®</td>
<td>0.05</td>
</tr>
<tr>
<td>India &amp; South Africa</td>
<td>0.1</td>
</tr>
</tbody>
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Health Technology Assessment
• Lifecycle analysis of technology
• Multidisciplinary team
• Standard setting & guidelines

Chest X-Rays
• Important investigation in lung disease
• Occ lung diseases – majority
• CXR routinely obtained for medical surveillance
• CXR complements physical exam; not a substitute

Normal Chest X-Ray

ILO Radiologic Classification
• Rounded opacities: p (<1.5mm), q, and r (>3 mm)
• Irregular opacities: s, t, or u
• Profusion: 12 point scale (0/0 thru 3/3)
• Grading of pleural thickening
Lung Function

Disease Rates per 1000 autopsies


Active pulmonary tuberculosis in African miners at autopsy, all commodities, 1975 - 2009

Pathaut, NIOH: 2010

Silicosis at autopsy in gold miners, 1975 - 2009

South Africa has the Highest Burden of Tuberculosis per Capita in the World and the Situation is Worsening

Source: *Health Systems Trust, **WHO, Global Tuberculosis Control, Surveillance, Planning, Financing
Disease Induction Periods

- **Short:**
  - Asthma
  - Infections
  - Allergic alveolitis
  - Toxic poisonings

- **Long:**
  - Pneumoconioses
  - Neoplasms

The Pneumoconioses

- Asbestosis
- Silicosis
- Coal Worker’s pneumoconiosis
- Berylliosis
Asbestos related disease

Gross Appearance of Plaque

CT Scan Asbestos Plaques
Silicosis

- Simple Silicosis: small nodules, predominately upper lobes; patient often asymptomatic
- Complicated Silicosis (Progressive Massive Fibrosis): coalescence into large nodules or masses with retraction of upper lobes
- Tuberculosis is a common complication
Coal Worker’s Pneumoconiosis (CWP)

- Coal dust is inert and not particularly fibrogenic.
- Can cause industrial bronchitis, emphysema, and progressive massive fibrosis.
- X-ray looks worse than patient.
- Many symptomatic coal miners have silicosis or tobacco induced COPD.

Hard Metal Disease

- Cobalt is the offending agent.
- Used in metal cutting or grinding tools and in jet engine turbine blades.
- Pulmonary fibrosis – probably due to fibrogenic properties of metal.
- Asthma and hypersensitivity pneumonitis due to metals ability to provoke an immune response (?hapten).
Sick Building Syndrome

- Reports began to appear about the time that new, “tighter”, more energy efficient office buildings were built.
- Hundreds of organic compounds have been identified in indoor air.
- Formaldehyde is an ubiquitous indoor organic that is a mucosal irritant.

Multiple Chemical Sensitivity

- Mucosal complaints
- Asthma like symptoms
- Neuro-cognitive complaints

Occupational Lung Cancers

- Asbestos
- Arsenic
- Bischloromethyl ether
- Coke oven fumes
- Insoluble Hexavalent chromium cmpds

Small Cell Carcinoma of the Lung

- **Bischloromethyl ether (BCME)** – used as industrial intermediate for organic synthesis, organic solvents, bactericides, fungicides, and cross-linking agents
- **Radon Daughters** – Radon-222 a decay product of U-238 is a gas and an alpha particle emitter as are its’ decay products: polonium-218, 214, and -210. Present in some metal mines