Occupational Lung Disease in South Africa

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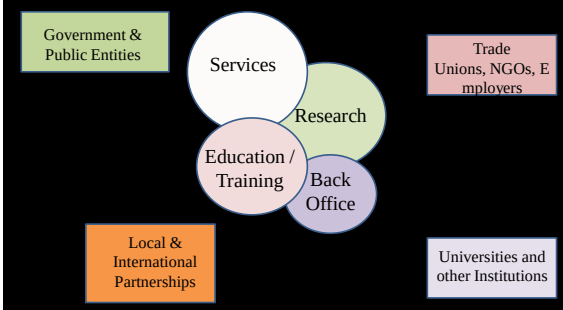
The National Institute for Occupational Health (NIOH)

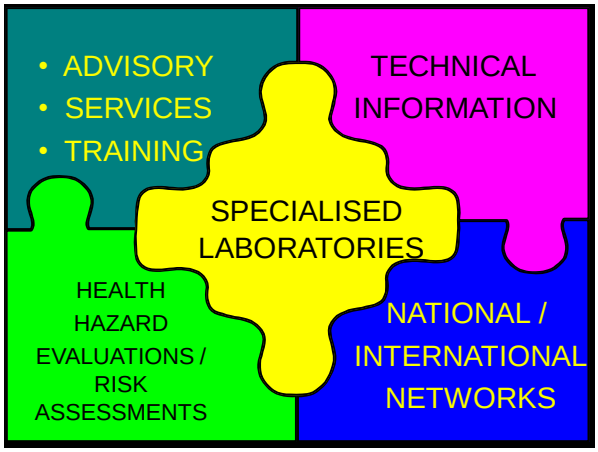
- Started in 1946 (Pneumoconiosis Research Unit)
- centre of excellence for multidisciplinary occupational health research, training and service
- Staff of 150
- Active involvement locally & internationally (WHO Collaborating Centre: ILO; links with NIOSH, FIOH, EPA, HSL, OPCW & IAEA)

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

The NIOH





Occupational Injuries

- Abrupt break in …

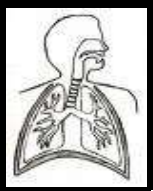
AGENT – HOST – ENVIRONMENT equilibrium

- Cause established

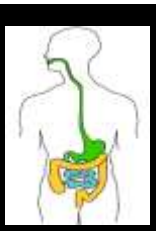
Occupational Diseases

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

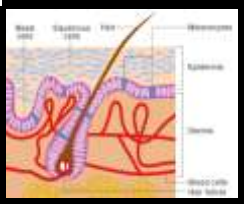
Routes of Exposure



Inhalation

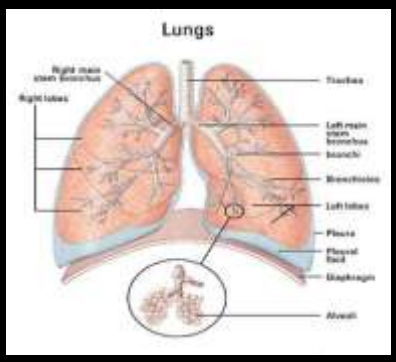


Ingestion



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)

Country / Province#	OEL (mg / m³)
Argentina	0.05
#British Columbia	0.025
Chile	0.04
Ireland	0.05
Italy	0.05
Japan	0.03
Portugal	0.05
USA - ACGIH*	0.025
USA - NIOSH*	0.05
India & South Africa	**0.1**

Source: Maciejeska A. 2008. *Int J of Occ Med & Env Health 21 (1): 1-23*

Health Technology Assessment

- Lifecycle analysis of technology
- Multidisciplinary team
- Standard setting & guidelines

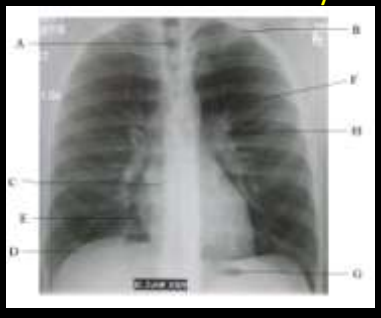
'fitness testing'

'gloves'

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

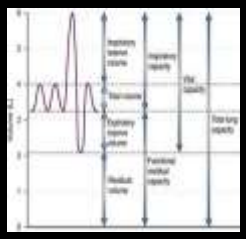


A=Airway; B=Bone, C=Cardiac silhouette, D=Diaphragm, E=Edge of the heart, F=Field of lung, G=Gastric bubble, H=Hilum of lung.

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



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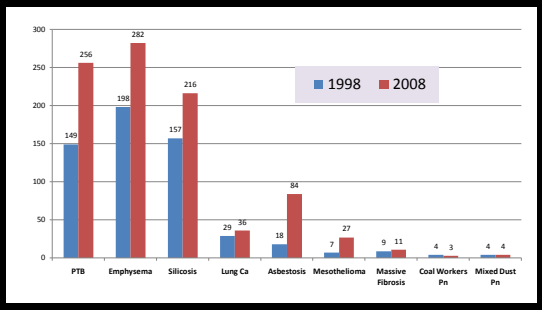
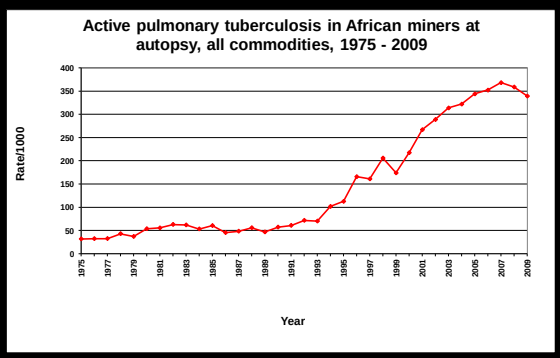
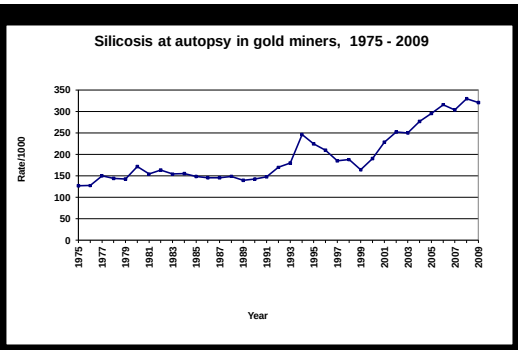
Disease Rates per 1000 autopsies



Pathaut: 1998, 2008

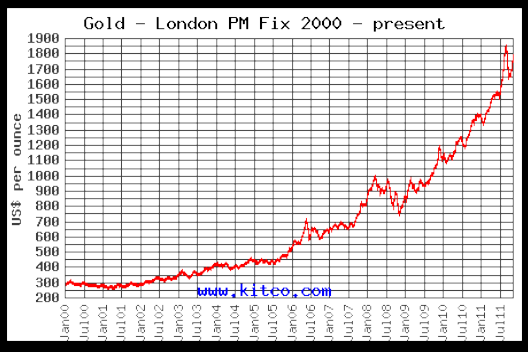


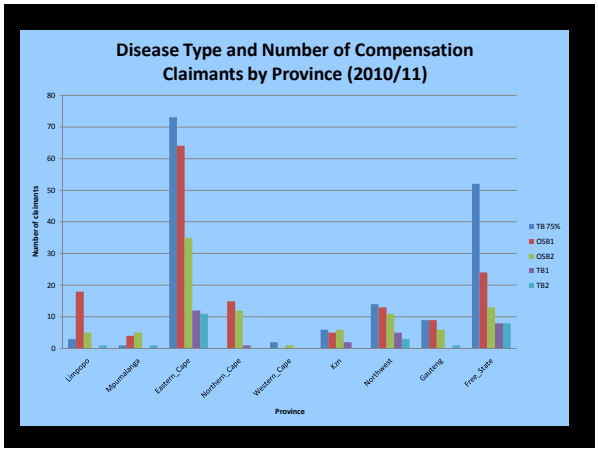
Pathaut, NIOH. 2010

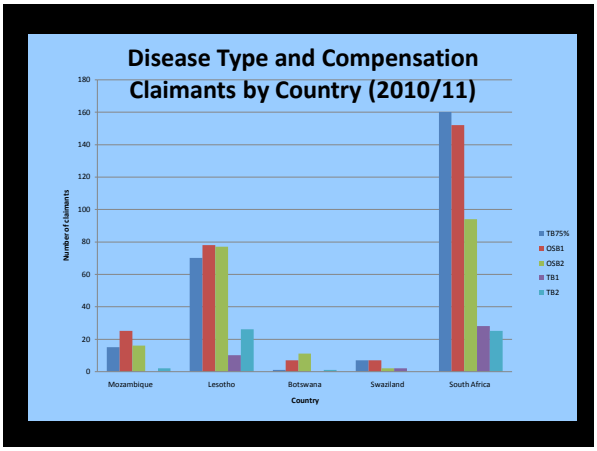


Nelson et al. Three decades of silicosis: disease trends at autopsy in South African gold miners. Environ Health Perspect. 2010

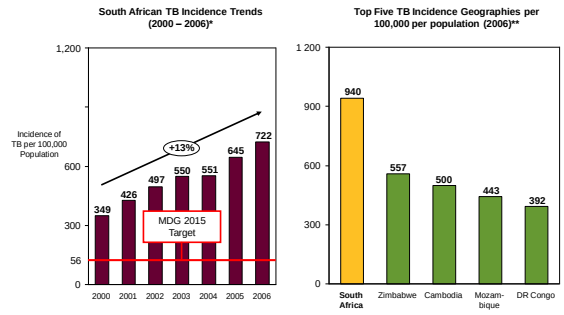
Gold Price (2000 – current)







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

Normal
Lung from a man who neither smoked nor worked in dust.

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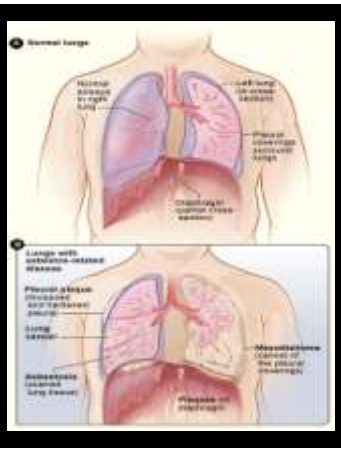
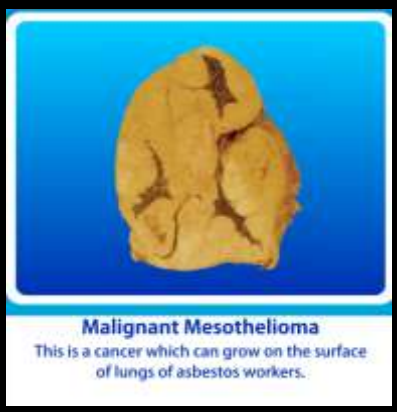
Emphysema
Smoking and working in a dusty place destroyed the air spaces in the lungs of this foundry worker.

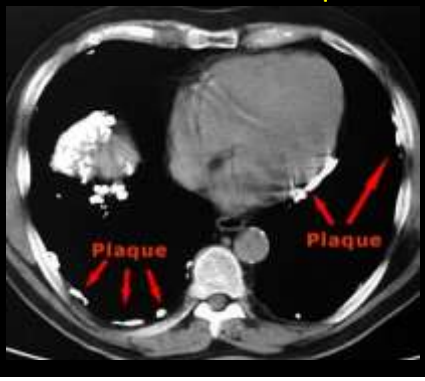
Asbestos related disease





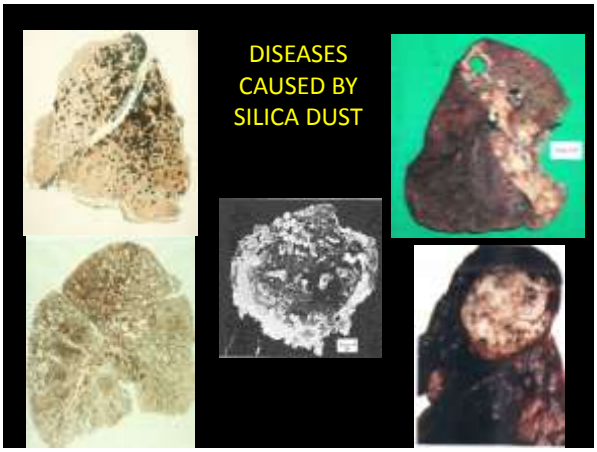
Gross Appearance of Plaque

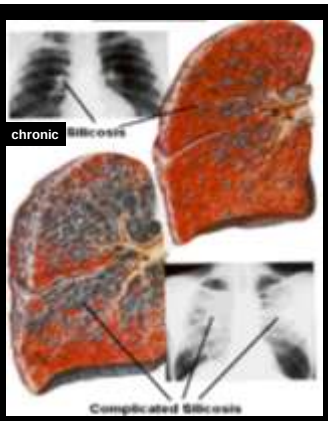
CT Scan Asbestos Plaques



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





Massive fibrosis

Silicosis. Chest radiograph shows multiple larger nodules, 3–5 mm in diameter, with a bias for the upper lobes. Note calcification in some of the pulmonary nodules and the hilar lymph nodes. Courtesy of Paul Stark, MD.

Coal Worker's Pneumoconiosis (CWP)

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

Coal worker's pneumoconiosis. Chest radiograph shows multiple noncalcified micronodules throughout both lungs. Courtesy of Paul Stark, MD.

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
- Soluble nickel
- Mustard gas
- Radon daughters

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