IPF and Asbestos Reserves – Salvation or Damnation?

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Miriam Lo, Marcuson Consulting Ltd
Agenda

1. Introduction
2. What is IPF?
3. IPF and Asbestos
4. Ongoing research
5. Potential implications on the Insurance market
6. Questions and Discussions

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1. Introduction
UK Asbestos: Projected market loss split by disease

Projection from AWP 2009 (*)

Total Projected post-2008 insurance loss: £11.3bn

£ Millions

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(*) Mesothelioma Scenario 23, non-mesothelioma Scenario 2B
UK Asbestos: Widely-known drivers of loss/ uncertainty to Actuaries

• Mesothelioma losses (c. 90% at 2009)
  – No. of future mesothelioma deaths for males
  – Claims to death ratios
  – Average cost per claim
    • Inflation
    • Legal decisions (eg Decentralisation, LASPO, Ogden)
    • Medical cost

• Other diseases (c. 10% at 2009)
  – Increased costs of Pleural Thickening?
Strong correlation observed between IPF deaths and Asbestos imports* Barber (2015)

Mesothelioma:
# Male annual deaths 1968-2011

IPF:
# Male annual deaths 1962-2012

* Lagged by 48 years compared to deaths
IPF has higher incidence of Female Deaths (c. 2:1) compared to Mesothelioma (c. 6:1)

Mesothelioma:
# Female annual deaths 1968-2011

IPF:
# Female annual deaths 1962-2012

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Should we panic?
2. What is IPF?
What is Idiopathic Pulmonary Fibrosis ("IPF")?

- A form of interstitial lung disease
- Permanent lung scarring of no known cause
- Progressive breathlessness and dry cough
- Typical radiology “UIP pattern” on HRCT
- ~4,000 deaths each year
  - c.f. ~2,500 deaths for mesothelioma
- ~3 years median survival
- Poor prognosis
HRCT Scan

1. Normal lung

2. IPF
What is Interstitial Lung Disease ("ILD")?

- Interstitium: lace-like network of tissue providing support to the lung’s air sacs (alveoli).
- ILD: causes interstitium to be scarred/thickened, making it more difficult for oxygen to pass into bloodstream.
How are ILDs classified?

Interstitial Lung Disease ("ILD")

**Known cause**
- Inorganic exposure
  - Asbestos (Asbestosis)
  - Other (eg Silica, Hard metals, Coal dust)
- Organic exposure (eg Birds, Hay, Mold, Mycobacteria)
- Other known causes (eg drugs, smoking, CTDs)

**Unknown cause**
- Idiopathic interstitial pneumonia
- Granulomatous (Sarcoidosis)
- Other forms (LAM, PLCH)

**Idiopathic Pulmonary Fibrosis ("IPF")**
- Non-IPF

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**Idiopathic Pulmonary Fibrosis ("IPF")**
- Non-IPF
How is IPF diagnosed?

• IPF is a diagnosis of exclusion

• Identical radiological features in:
  – Connective tissue disease e.g. rheumatoid arthritis
  – Drug side effects e.g. methotrexate
  – Chronic Hypersensitivity Pneumonitis e.g. birdfancier’s lung
  – Pneumoconiosis e.g. asbestos

• Some of the conditions above are easier to diagnose eg blood tests, but not for asbestosis, which relies on patient’s recollection of asbestos exposures

• No clear guideline on how to estimate a patient’s past asbestos exposures
IPF mortality in E+W Navaratnam et al (2011)

“we do not understand what causes IPF-CS, why the incidence is on the rise…”

Figure 1 Estimated number of deaths from idiopathic pulmonary fibrosis clinical syndrome, age standardised to the 2008 population of England and Wales. ICD, International Classification of Diseases.

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Why would IPF mortality be rising so rapidly if there is no cause?
3. IPF and Asbestos
Number of IPF deaths vs UK Asbestos Imports* Barber (2015)

# Male annual deaths 1962-2012
Pearson Coefficient = 0.98

# Female annual deaths 1962-2012
Pearson Coefficient = 0.97

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IPF and Asbestos: Is there a causation link?

- The unexplained rising mortality in IPF appears similar to the explained rising mortality of mesothelioma Barber (2012)

- Case-control studies linked IPF with wood and metal working, but no link to asbestos exposure Ley (2013)

- BUT occupations linked to IPF risk, have high mortality from an asbestos-related cancer (mesothelioma) Barber (2012)

Could asbestosis be misclassified as IPF?
# Comparing IPF and Asbestosis

<table>
<thead>
<tr>
<th></th>
<th>IPF</th>
<th>Asbestosis</th>
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<tbody>
<tr>
<td><strong>Condition</strong></td>
<td>Diffuse UIP fibrosis</td>
<td>Diffuse UIP fibrosis</td>
</tr>
<tr>
<td><strong>Cause</strong></td>
<td>No known cause</td>
<td>Asbestos</td>
</tr>
<tr>
<td><strong>Commoner in smokers?</strong></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>First case occurred in UK</strong></td>
<td>1907</td>
<td>1900</td>
</tr>
<tr>
<td><strong># of cases per year in UK</strong></td>
<td>&gt;5,000 (2010)</td>
<td>985 (2014, IIDB)</td>
</tr>
<tr>
<td><strong>Male:Female ratio</strong></td>
<td>~2:1</td>
<td>~10:1</td>
</tr>
<tr>
<td><strong>Geographic high-risk areas</strong></td>
<td>Variable, more concentrated in NW, NI, Scotland</td>
<td>Variable, with hotspots (e.g., shipyards)</td>
</tr>
<tr>
<td><strong>Typical age of diagnosis</strong></td>
<td>60-70</td>
<td>60-70</td>
</tr>
<tr>
<td><strong>Severity of condition</strong></td>
<td>High: average survival period 3 years after diagnosis</td>
<td>Low-Medium: variable disabling and variable progressive condition</td>
</tr>
</tbody>
</table>
Why is correct diagnosis important to patients?

Compensation

• Asbestosis patients may be eligible, established causation link to asbestos
  – General damages: £12,600 - £88,500 Judicial College (2015)

• IPF patients currently not eligible, no known causes

Treatment

• No treatment currently prescribed for Asbestosis patients

• NHS recently licensed treatment for IPF patients
  – Treatment costs c. £25,000 per year
  – 48% reduction in mortality after 1 year
How easy is it to differentiate IPF from Asbestosis?

A. History of asbestos exposure
B. CT scan appearance
C. Counting fibre burden in lung tissue
D. Rate of progression
A. History of asbestos exposure: is there a threshold for asbestosis to develop?

Asbestos Exposure Medical/Legal Threshold in UK
25 fibre/ml-years

Sufficient exposure

Idiopathic pulmonary fibrosis

Asbestos-related pulmonary fibrosis
A. Is the threshold to develop Asbestosis supported by evidence? \textsuperscript{ATS 2004}

- Asbestosis is commonly associated with prolonged exposure, usually over 10 to 20 years.

- However, short, intense exposures to asbestos, lasting form several months to 1 year or more, can be sufficient to cause asbestosis.

- In one study of former workers from an amosite asbestos insulation factory, that had high levels of asbestos dust, employment for as little as 1 month resulted in a prevalence of 20\% of parenchymal opacities 20 years after exposure ceased.
A. Is the threshold to develop Asbestosis supported by evidence? Deng et al 2012

Evidence to support a threshold is based on an epidemiological doubling of risk, and not a biological exposure level that is required for disease to occur.
A. Occupational asbestos exposures are often overlooked in UK  Peto 2009

• Certain occupations are particularly exposed to asbestos

• Mesothelioma risks within each occupational exposure category were still substantially increased even in men who recalled no substantial asbestos exposure

• Many were exposed indirectly or could not identify the asbestos materials they handled

• The increased risk for “medium-risk” industrial work reflects widespread and often unrecognised contact with asbestos in metal working, electrical trades and assembly line work

• 65% of male and 23% of female controls having worked in occupations that were classified as medium or higher risk
A. Accurately estimating lifetime asbestos exposure is complex and difficult **Burgdorf (1999)**

### Table 2. Risk matrix for historical asbestos exposure in Dutch companies and occupations

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<tbody>
<tr>
<td></td>
<td>Exp Pr</td>
<td>Exp Pr</td>
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<tr>
<td><strong>Primary asbestos industry</strong></td>
<td></td>
<td></td>
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<tr>
<td>Asbestos insulation</td>
<td>E3 P3</td>
<td>E3 P3</td>
<td>E3 P3</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Asbestos textile</td>
<td>E3 P3</td>
<td>E3 P3</td>
<td>E3 P3</td>
<td>E2 P1</td>
<td>E1 P1</td>
</tr>
<tr>
<td>Asbestos cement</td>
<td>E3 P3</td>
<td>E3 P3</td>
<td>E3 P3</td>
<td>E2 P2</td>
<td>E1 P1</td>
</tr>
<tr>
<td>Asbestos friction materials</td>
<td>E3 P3</td>
<td>E3 P3</td>
<td>E3 P3</td>
<td>E2 P2</td>
<td>na</td>
</tr>
<tr>
<td>Asbestos flooring</td>
<td>na</td>
<td>na</td>
<td>E3 P3</td>
<td>E1 P1</td>
<td>na</td>
</tr>
<tr>
<td>Asbestos paper and felt</td>
<td>E3 P3</td>
<td>E3 P3</td>
<td>E3 P3</td>
<td>E1 P1</td>
<td>E1 P1</td>
</tr>
<tr>
<td><strong>Secondary asbestos industry</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Insulation work</td>
<td>E3 P2</td>
<td>E3 P2</td>
<td>E3 P2</td>
<td>E2 P1</td>
<td>E1 P1</td>
</tr>
<tr>
<td>Shipbuilding</td>
<td>E3 P2</td>
<td>E3 P2</td>
<td>E3 P2</td>
<td>E2 P1</td>
<td>E1 P1</td>
</tr>
<tr>
<td>Construction</td>
<td>E2 P1</td>
<td>E3 P1</td>
<td>E3 P1</td>
<td>E2 P1</td>
<td>E1 P1</td>
</tr>
<tr>
<td>Car service station</td>
<td>E2 P1</td>
<td>E2 P1</td>
<td>E2 P1</td>
<td>E1 P1</td>
<td>E0 P0</td>
</tr>
<tr>
<td><strong>Specific occupations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loader/sacker</td>
<td>E2 P0</td>
<td>E2 P0</td>
<td>E2 P0</td>
<td>E1 P0</td>
<td>E0 P0</td>
</tr>
<tr>
<td>Stripper/demolisher of furnaces &amp; ovens</td>
<td>E3 P2</td>
<td>E3 P2</td>
<td>E3 P2</td>
<td>E2 P1</td>
<td>E1 P1</td>
</tr>
<tr>
<td>Engine room worker &amp; stationary engineer</td>
<td>E2 P1</td>
<td>E2 P1</td>
<td>E2 P1</td>
<td>E1 P0</td>
<td>E0 P0</td>
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<tr>
<td>Maintenance worker in power plant</td>
<td>E2 P1</td>
<td>E2 P1</td>
<td>E2 P1</td>
<td>E1 P0</td>
<td>E0 P0</td>
</tr>
<tr>
<td>Furnace worker</td>
<td>E2 P2</td>
<td>E2 P2</td>
<td>E2 P2</td>
<td>E1 P0</td>
<td>E0 P0</td>
</tr>
<tr>
<td>Electrical fitter</td>
<td>E2 P1</td>
<td>E2 P1</td>
<td>E2 P1</td>
<td>E1 P0</td>
<td>E0 P0</td>
</tr>
<tr>
<td>Electrician</td>
<td>E1 P1</td>
<td>E1 P1</td>
<td>E1 P1</td>
<td>E0 P0</td>
<td>E0 P0</td>
</tr>
<tr>
<td>Fitter/benchmen, sheet metal worker</td>
<td>E2 P1</td>
<td>E2 P1</td>
<td>E2 P1</td>
<td>E1 P0</td>
<td>E0 P0</td>
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<tr>
<td>Founder, caster</td>
<td>E2 P1</td>
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Exp (exposure category): above 5 fibres/cm³ (E3), between 2 to 5 fibres/cm³ (E2), between 0.5 to 2 fibres/cm³ (E1), below 0.5 fibres/cm³ (E0).  
Pr (probability of exposure category): each worker exposed (P3), each blue collar worker exposed (P2), specific blue collar workers exposed (P1), only few blue collar workers exposed (P0).  
na = not applicable (not present).  

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**Fig. 1. Stepwise decision tree for historical evaluation of asbestos exposure in ascertainment of asbestos.**

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Fig. 1: Sample decision tree for historical evaluation of asbestos exposure in manufacture of asbestos.
## How accurate are UK diagnosis procedures to differentiate IPF from Asbestosis?

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<td>D. Rate of progression</td>
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B. CT Scan Appearance Copley 2003

- The thin-section CT pattern of asbestosis closely resembles that of biopsy-proven UIP (the pattern seen in IPF)
- After adjustment for age, sex, and extent of fibrosis, none of the CT features differed significantly between the patients with asbestosis and those with biopsy-proved UIP
# How accurate are UK diagnosis procedures to differentiate IPF from Asbestosis?

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C. Fibre Counts IIAC 2005

• Biopsy material rarely available in life
• IIAC review (for IIDB) recommend diagnosis based on occupational history not fibre counts
  – Long latency disease
  – T1/2 is years for chrysotile and decades for amphiboles
  – No standardised lab methodology
  – Light microscopy unreliable and misses uncoated fibres
  – More difficult to identify chrysotile even with EM
  – No established UK “normal range”
  – i.e. very difficult (or impossible) to interpret results
How accurate are UK diagnosis procedures to differentiate IPF from Asbestosis?

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D. Rate of Progression Taniguchi (2011)

- Widely accepted that
  - rapidly progressive disease is expected in IPF
  - slowly progressive or stable disease is typical of asbestosis

- BUT, no head to head studies

- Good evidence that annual rate of progression in IPF is variable

Change in lung function:  
a) improved ≥5%  
b) stable  
c) fell by ≥5%
### How accurate are UK diagnosis procedures to differentiate IPF from Asbestosis?

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<td>No</td>
</tr>
<tr>
<td>D. Rate of progression</td>
<td>No good evidence to support this</td>
<td>Sometimes</td>
</tr>
</tbody>
</table>

... **probably not very accurate.**
Differentiating IPF from Asbestosis: Current Approach

IPF
- no history of exposure
- no high risk jobs
- no pleural disease
- no fibres on LM or EM

Asbestosis
- clear history of exposure
- high risk jobs
- pleural plaques/DPT
- +/- high fibre count LM

Rapid progression
Anti-fibrotic drug

Slow progression
Benefits + compensation
Cases that could be mis-diagnosed under current approach

**IPF**
- no history of exposure
- no high risk jobs
- no pleural disease
- no fibres on LM or EM

**Asbestosis**
- clear history of exposure
- high risk jobs
- pleural plaques/DPT
- +/- high fibre count LM

**Rapid progression**
- History of brief high dose exposure

**Slow progression**
- No history of exposure + high fibre count EM

**Benefits + compensation**
- No history of exposure + lifetime high risk jobs

**Anti-fibrotic drug**
- No history of exposure + pleural plaques

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4. Ongoing and Potential Future Research
Future work

• Potential: A validated approach to estimate lifetime exposure based on job titles in each decade linked to IIDB (Dutch model)

• Ongoing: Better IPF case-control studies using an estimate of life-time asbestos exposures (see next slide)

• Ongoing: Access to anti-fibrotic drugs for UIP based on rate of decline rather than arbitrary name chosen
  – Trial study currently recruiting patients with progressive asbestosis for treatment

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Is occupational asbestos exposure a risk factor for “IPF”?  

• Wellcome Trust Funded 3-year case-control study  
• “Idiopathic Pulmonary Fibrosis Job Exposure Study”  
• National recruitment, multi-centre  
• Collaboration with Imperial College London  
• Lifetime occupational histories of patients with IPF versus controls, genetic polymorphisms
5. Potential Implications on the Insurance Market
Questions raised

• Early days for research, lots of uncertainty

• Unanswered questions include:
  – Is there a causal link between asbestos and IPF?
  – If there is a causal link, is it due to occupational exposures or general environmental exposures?
  – Are there other contributing/confounding factors for IPF cases (eg smoking, general industrialisation)?
  – Are most IPF cases in the UK mis-diagnosed asbestosis?
  – Is current IPF treatment effective on asbestosis?
Potential Scenarios

• Illustrative, not intended to be exhaustive or precise
• Projections based on AWP 2009 (Scenario 23 for mesothelioma, Scenario 2B for non-meso)
• **Base:** no casual link between IPF and asbestos
• **Scenario 1:** IPF treatments proven to be effective for asbestosis in 2020
  – 5 years’ treatment for 50% of asbestosis cases from 2020, in addition to existing costs
• **Scenario 2:** causal link between IPF and asbestos established in 2022
  – Average cost per claim as per mesothelioma
  – Number of IPF deaths = 1.4 x total number of mesothelioma deaths
  – Claims to death ratio 1/3rd of mesothelioma for 2009-2021, as per mesothelioma thereafter
Scenario 1: IPF treatment prescribed for Asbestosis

Post-2016 market loss:
£8.9bn

Post-2016 market loss:
£9.3bn

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Scenario 2: IPF linked to asbestos in 5 years’ time

Base

Scenario 2 - IPF linked to asbestos

Post-2016 market loss: £8.9bn

Post-2016 market loss: £20.3bn

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# References

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