New lessons from an old hazard - Black lung in coal miners

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MONASH
Centre for Occupational and Environmental Health

UIC SCHOOL OF PUBLIC HEALTH
UNIVERSITY OF ILLINOIS AT CHICAGO

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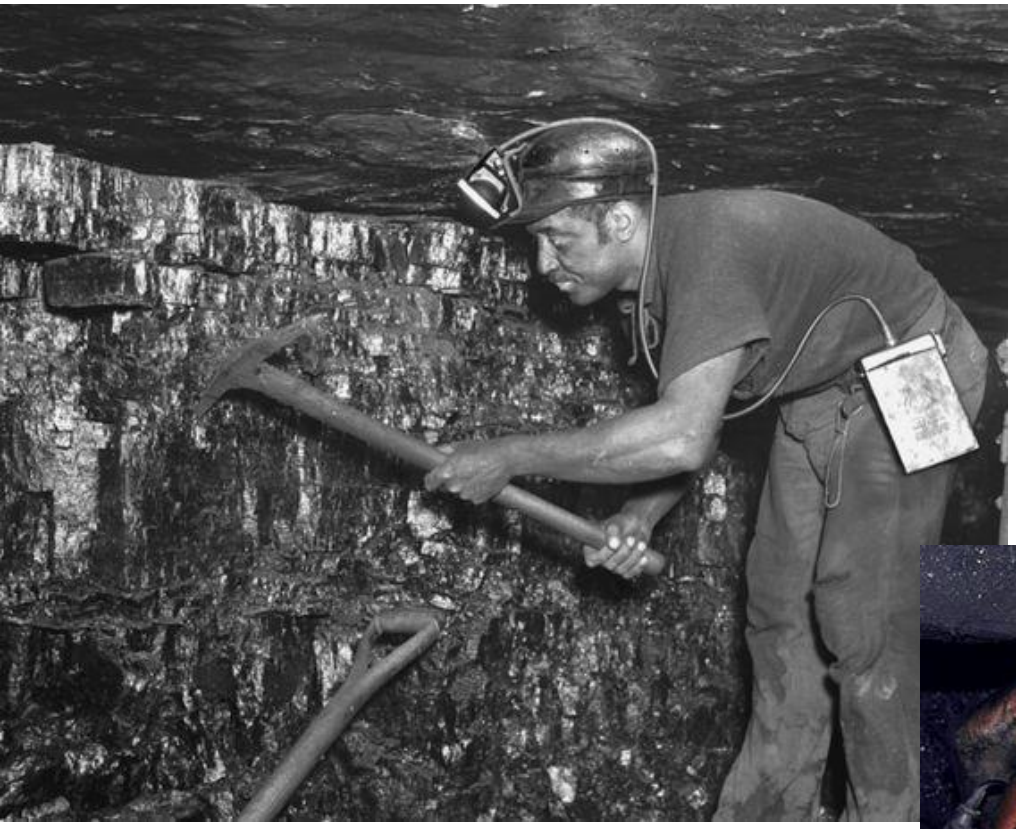
Conference theme:

"A Past forgotten
is a Future repeated"

Coal mining – the old days!



Coal mine dust lung diseases (CMDLD)

- Coal workers' pneumoconiosis (CWP)
- Silicosis
- Mixed dust pneumoconiosis
- Chronic bronchitis
- Emphysema
- Diffuse dust-related fibrosis
- Progressive massive fibrosis (PMF)

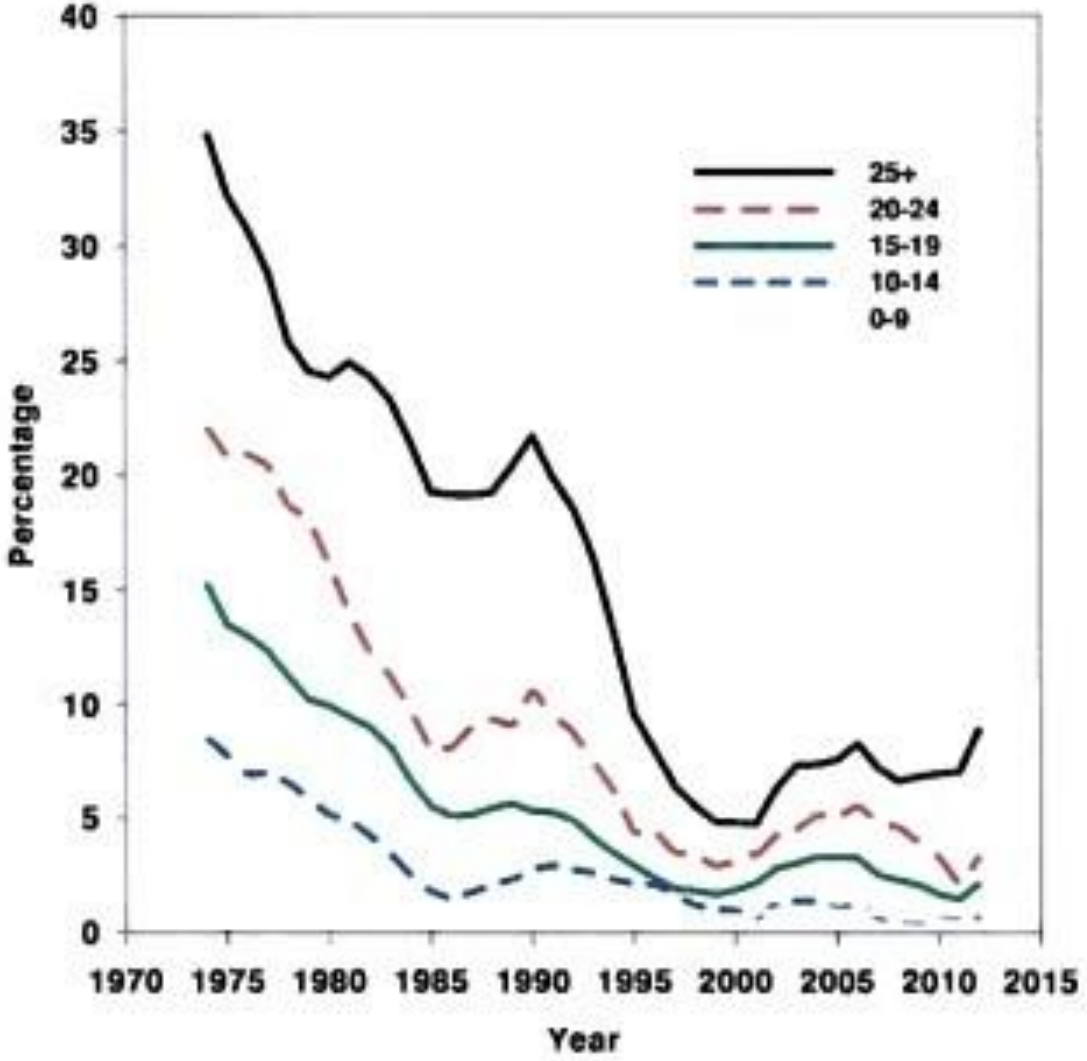


FIGURE 2. Percentage of examined US underground miners with coal workers' pneumoconiosis (ILO category 1/0+), 1970–2012. Data are shown as 5-year moving average, with separate plots for various tenures in coal mining. Data are from NIOSH CWHSP.[19]

CWP in Queensland coal miners

- 1984 report of a chest x-ray screening program (7,907 miners) found 75 cases of CWP
- Since then, coal mine workers' health scheme in operation
- No new cases for at least two decades
- In 2015, several new cases identified outside the scheme
- Raised concerns about effectiveness of scheme

DECEMBER 1 2015

'Black lung' disease returns to Queensland mines

The potentially deadly black lung disease has re-emerged in Australian coalmines for the first time in more than three decades.

Queensland Mines Minister Anthony Lynham confirmed in parliament on Tuesday that three cases of pneumoconiosis – or black lung – had been reported by the state's coal industry.

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Media Statements

Minister for State Development and Minister for Natural Resources and Mines
The Honourable Anthony Lynham

Thursday, January 14, 2016

Action plan revealed on coal miners' health issue

The Palaszczuk Government today released a five-point plan to tackle an important health issue for the state's past and current coal miners.

Natural Resources and Mines Minister and Acting Health Minister Dr Anthony Lynham announced measures to help identify and prevent coal miner's pneumoconiosis, a lung disease caused by long-term inhalation of coal dust in underground coal mining operations.

"Protecting the health and safety of workers is a fundamental issue for any Labor Government, and particularly for me as a doctor," Dr Lynham said.

"We have confirmed five cases of coal miner's pneumoconiosis in Queensland and I have asked for Queensland Health data on any other possible cases.

"There's still research to be done on the medical and workplace records, but I suspect there are more cases to come.

"I am determined to get on top of this issue to protect workers now and into the future and to be open and transparent as we progress."

Dr Lynham outlined action on the five points.

- **A review to improve the existing screening system**, where coal mine workers have chest X-rays when they start work, at least every five years, and when they retire.

"Monash University's Professor Malcolm Sim is heading the review of the Coal Mine Workers' Health Scheme, which I ordered late last year after the early cases were identified." he said.

Objectives of the review

A. Determine whether the respiratory component of the medical assessment performed under the Queensland Coal Mine Workers' Health Scheme is adequately designed and implemented to most effectively detect the early stages of coal mine dust lung diseases in Queensland coal mine workers

B. Recommend necessary changes to correct deficiencies identified under Objective A, recommend measures to follow up cases that may have been missed as a result of these deficiencies and identify what additional capacity is needed in Queensland to improve this scheme.

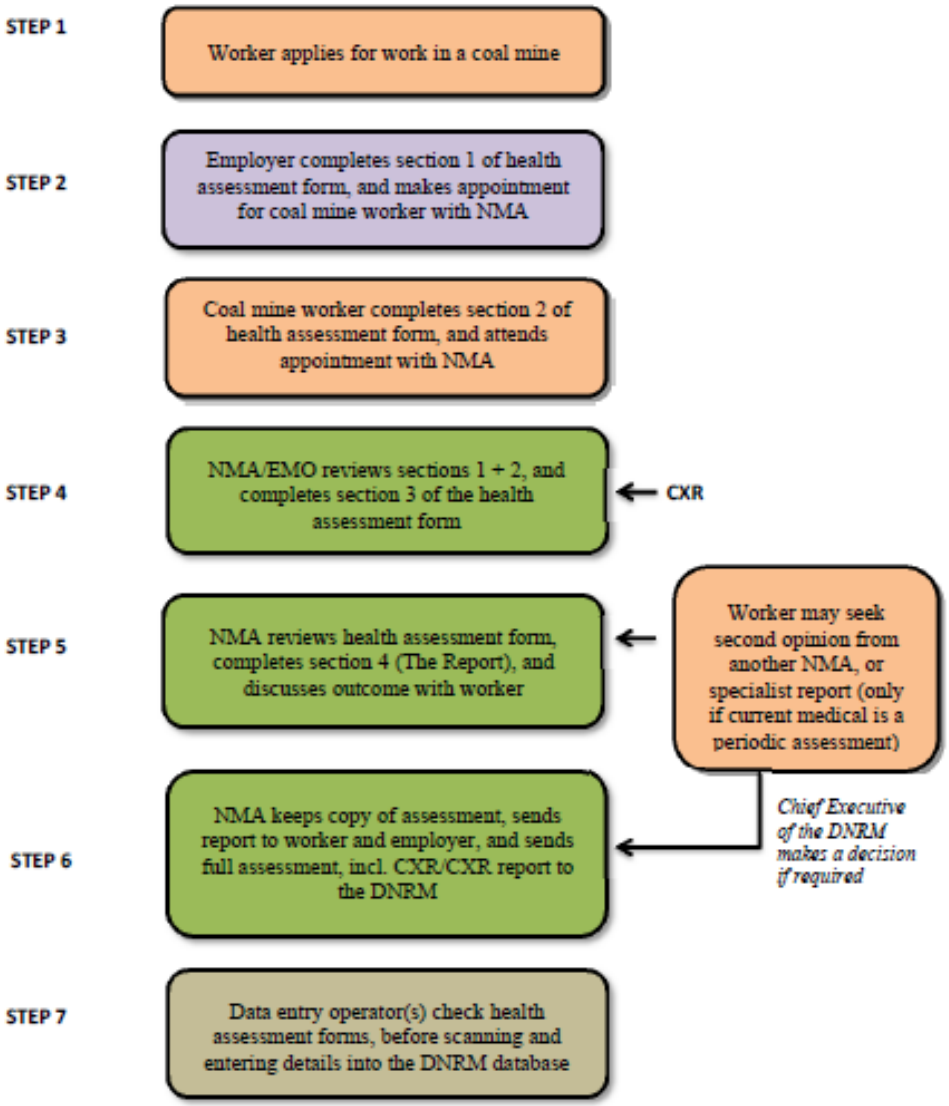


Figure 2: Flow chart of the process of the current Coal Mine Workers' Health Scheme

Purpose of the respiratory component of the current health scheme

- Currently main focus is to assess fitness for work
- Respiratory health is just one of many aspects of health assessed
- Detection of the early stages of CMDLD has been lost as a purpose of the scheme
- Surveillance purpose across industry also lost
- The purpose should set the direction for the scheme
- Recommend this purpose be reinstated on an individual level, but also industry-wide surveillance

Nominated Medical Advisers

- Linchpin of the scheme
- 237 on the list, large increase during the boom
- Most located away from mine sites

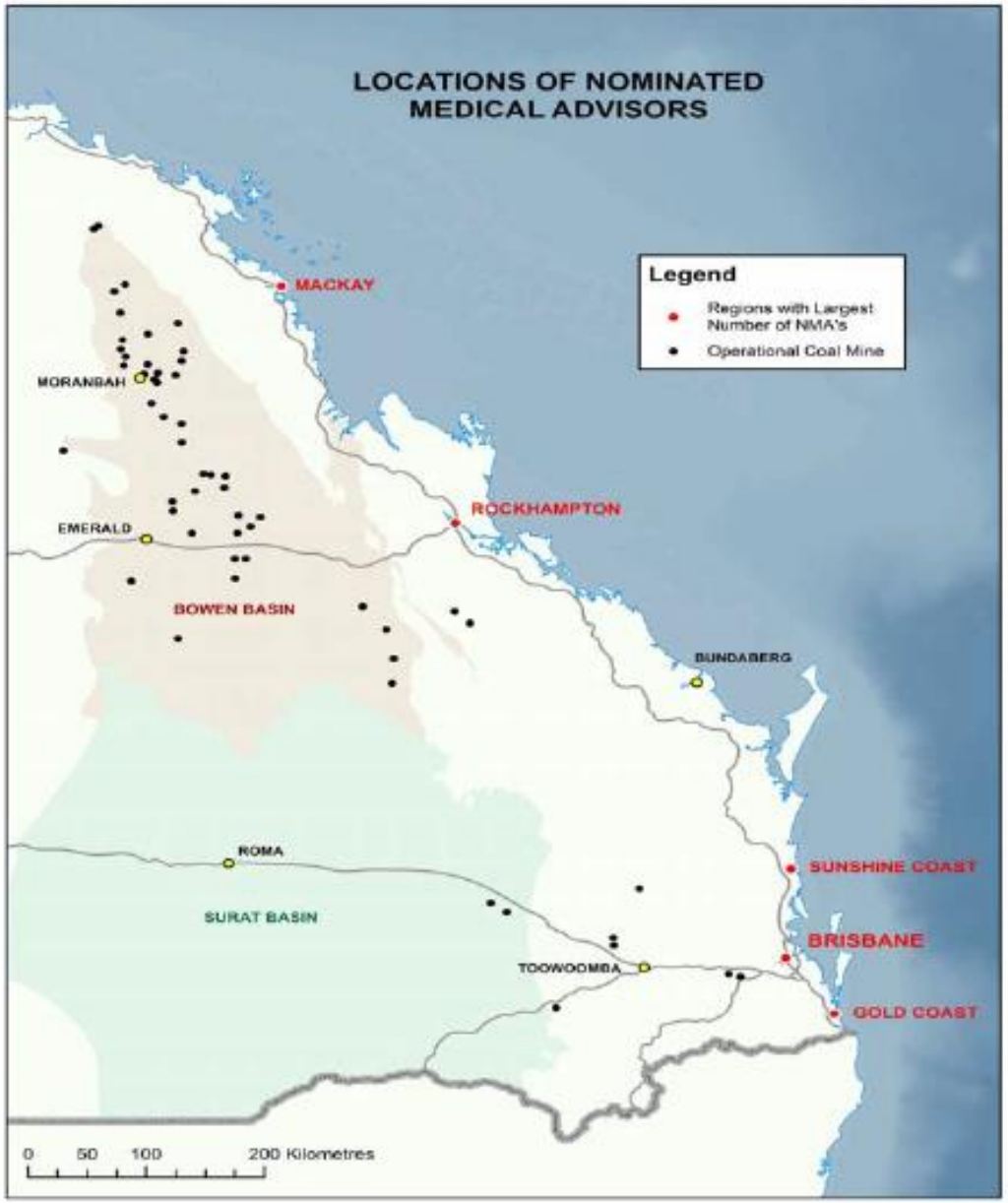


Figure 3: Underground mine and main locations of NMAs in Queensland (Figure

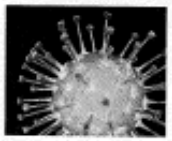
Nominated Medical Advisers

- Linchpin of the scheme
- 237 on the list, large increase during the boom
- Most located away from coal mine sites
- No vetting of qualifications/experience
- Role of ‘examining medical officer’ not well defined
- Training had dropped off with increasing Nºs
- No clear guidelines about how to follow up respiratory abnormalities
- Recommend fewer Drs, approval by DNRM and appropriate training, clinical guidelines

Australian Doctor

In Brief

Staff writers



Six zoster triggers identified

FACTORS associated with reactivation of herpes zoster virus to cause shingles include stress, sleep disturbance, depression, recent weight loss, family history and prior episodes of zoster, according to US research. The case-control study of 389 herpes zoster patients and 511 matched controls also found that herpes zoster was not associated with trauma, smoking, tonsillectomy, diet, or reported exposure to pesticides or herbicides. *Infectious Diseases* 2016; online.

Warning over diabetes supplies glitch

PATIENTS with diabetes may experience delays obtaining supplies through the National Diabetes Services Scheme (NDSS) because of glitches with the 1 July switch to distribution via retail pharmacies, according to Diabetes Australia. Supply problems have occurred because of issues with the NDSS Connect computer system and also from patients stocking up before the 1 July changeover, the group says. Urgent supplies of insulin pump consumables and other diabetes products may be obtained by contacting the NDSS on 1300 136 588.

Bexsero in short supply

WORLDWIDE demand

Black lung: GPs set up to fail?

ANTONY SCHOLEFIELD

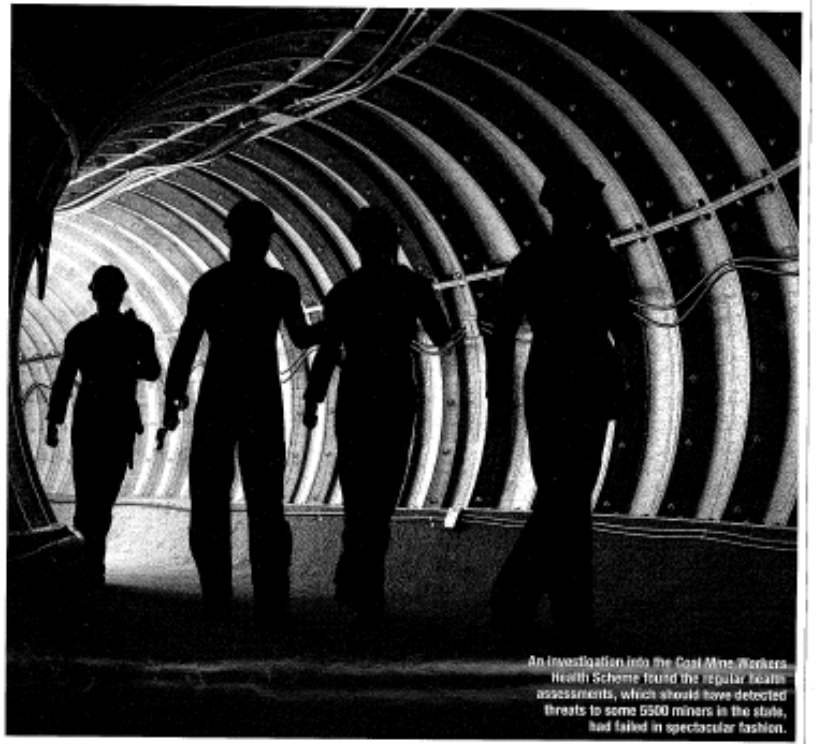
"IT'S amazing that in a fully developed country [where] ... we pay professionals to look for this disease, they [were] saying we were all clear — only to find out that [we're] not."

Steve Mellor is a contractor who spent 11 years working underground in Queensland mines. He's one of 11 former miners in the state diagnosed with so-called black lung, or coal workers' pneumoconiosis.

He was speaking last week after an investigation into the Coal Mine Workers Health Scheme found the regular health assessments, which should have detected threats to some 5500 miners working in the state, had been failing in a spectacular fashion.

In many cases, assessments were of a poor quality with no proper follow-up — even when evidence of lung disease was indicated. So cases of a potentially fatal disease, assumed not to exist in Australia, were missed.

"[There were] major system failures at virtually all levels," the review, commissioned by the Queensland Government, declared, sparking a blaze of bad news headlines.



An investigation into the Coal Mine Workers Health Scheme found the regular health assessments, which should have detected threats to some 5500 miners in the state, had failed in spectacular fashion.

The health scheme

Originally set up in 1983, the health scheme ensures miners are assessed when they are first recruited to the state's mines and every five years thereafter.

According to the review, the assessments — currently carried out by some 247 doctors known as nominated medical advisors — involve examining each miner's medical history, carrying out physical examinations, ordering spirometry tests and ordering posterior-anterior chest X-rays.

Dr Ewen McPhee, a GP from Emerald in Central Queensland, is one of the 97 GPs working as medical advisors.

The system is a mess, he

'We're not in the position to do that longitudinal stuff that's required to identify these chronic diseases like black lung.'

— *Dr Ewen McPhee, Queensland GP*

showed signs of black lung, but only two of them had been picked up by radiologists in Australia. And even with those two suspected cases, there was no follow-up.

Extrapolating from this sample, the union representing the miners claimed there could be more than 350 miners out there with undiagnosed pneumoconiosis.

The review team also assessed the quality of spirometry, mainly undertaken in general practices.

About 40% of the 256 spirometry tests re-examined proved to be of substandard technical quality that did "not allow meaningful interpretation", the review said.

One issue the review

health checks for their workers.

But why was the Department of Natural Resources and Mines so slack, for so long in its surveillance to detect the disease?

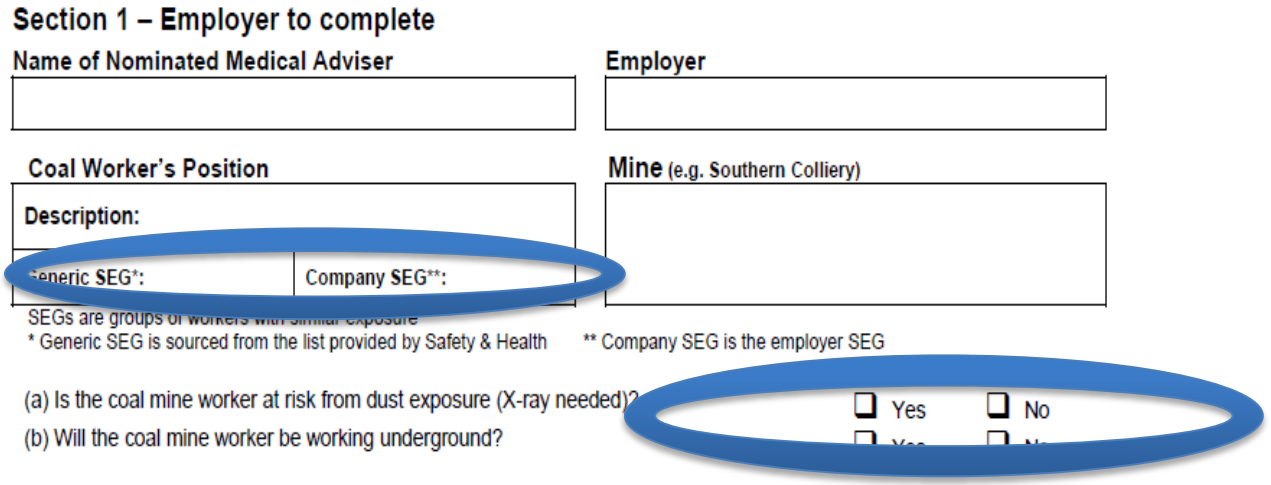
Part of the problem, according to the review, was that the health checks were considered more as a 'fitness to work' assessment by the mines.

The other issue was that while black lung had loomed large in the industry's history but, by the 1990s, it was no longer considered a threat to miners in Queensland. So few were expecting to find it, until cases were identified last year.

The review has called for root-and-branch reform,

Criteria for “at risk from dust exposure”

- Coal mine worker’s hazard exposure, including to dust, required to be provided by employer in Section 1 of the form
- Triggers the need for a CXR



Section 1 – Employer to complete

Name of Nominated Medical Adviser

Employer

Coal Worker’s Position

Description:

Generic SEG*: | **Company SEG**:**

Mine (e.g. Southern Colliery)

SEGs are groups of workers with similar exposure

* Generic SEG is sourced from the list provided by Safety & Health

** Company SEG is the employer SEG

(a) Is the coal mine worker at risk from dust exposure (X-ray needed)? ☐ Yes ☐ No

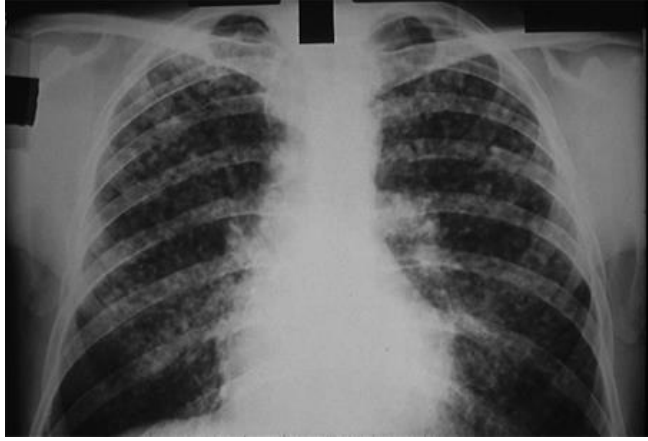
(b) Will the coal mine worker be working underground? ☐ Yes ☐ No

- Poorly completed in the reviewed forms

Problems

1. SEGs useful for dust monitoring/control, but not sufficient for this purpose
2. Simpler criteria needed: underground and some above ground jobs
3. Focuses on current exposure, but long term exposure more important in CXR decision
4. Doesn’t apply well for contractors
5. Greater medical input needed into whether CXR required, taking into account job and dust exposure history

Chest x-ray review



- Only included CXRs from miners with at least 10 years of coal mine dust exposure in order to include higher risk miner.
- 257 digital CXRs reviewed
- Dual independent reading
- Used ILO classification form
- Compared findings with original radiology report

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ILO International Classification of Radiographs of Pneumoconioses

The ILO International Classification of Radiographs of Pneumoconioses is a powerful tool used throughout the world to improve workers' health surveillance, conduct epidemiological research and make comparisons of statistical data. Some countries have established legal requirements for use of the Classification in the assessment of compensation claims, although the Classification was not originally designed for this purpose. The value of the Classification depends critically on the consistency with which users apply the Guidelines published by the ILO and the standard radiographs that

Tools

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CHEST RADIOGRAPH CLASSIFICATION

Reset Form

FEDERAL MINE SAFETY AND HEALTH ACT OF 1977
DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL & PREVENTION

Coal Workers' Health Surveillance Program
National Institute for Occupational Safety and Health
1095 Willowdale Road, MS LB208
Morgantown, WV 26505
FAX: 304-285-6058

OMB No.: 0920-0020
CDC/NIOSH (M) 2.8
REV. 01/2015

DATE OF RADIOGRAPH (mP-dG-\\\\)

[ ][ ]-[ ][ ]-[ ][ ][ ][ ]

EXAMINEE'S Social Security Number

[ ][ ][ ]-[ ][ ]-[ ][ ][ ][ ]

Full SSN is optional, last 4 digits are required.

TYPE OF READING

A ☐ B ☐ F ☐

FACILITY Number - Unit Number

[ ][ ][ ][ ][ ]-[ ][ ][ ]

Note: Please record your interpretation of a single radiograph by placing an "x" in the appropriate boxes on this form. Classify all appearances described in the ILO International Classification of Radiographs of Pneumoconiosis or Illustrated by the ILO Standard Radiographs. Use symbols and record comments as appropriate.

1. IMAGE QUALITY

[1] [2] [3] [U/R]

(If not Grade 1, mark all boxes that apply)

☐ Overexposed (dark) ☐ Improper position ☐ Underinflation

☐ Underexposed (light) ☐ Poor contrast ☐ Mottle

☐ Artifacts ☐ Poor processing ☐ Other (please specify) _____

2A. ANY CLASSIFIABLE PARENCHYMAL ABNORMALITIES? YES ☐ Complete Sections 2B and 2C NO ☐ Proceed to Section 3A

2B. SMALL OPACITIES

a. SHAPE/SIZE PRIMARY	a. SHAPE/SIZE SECONDARY	b. ZONES R	b. ZONES L	c. PROFUSION
p	p	UPPER		0/- 0/0 0/1
q	q	MIDDLE		1/0 1/1 1/2
r	r	LOWER		2/1 2/2 2/3
s	s			3/2 3/3 3/+
t	t			
u	u			

2C. LARGE OPACITIES

SIZE [0] [A] [B] [C] Proceed to Section 3A

3A. ANY CLASSIFIABLE PLEURAL ABNORMALITIES? YES ☐ Complete Sections 3B, 3C NO ☐ Proceed to Section 4A

3B. PLEURAL PLAQUES *(mark site, calcification, extent, and width)*

Chest wall	Site	Calcification	Extent (chest wall; combined for in profile and face on)	Width (in profile only) (3mm minimum width required)
In profile	[O] [R] [L]	[O] [R] [L]		
Face on	[O] [R] [L]	[O] [R] [L]		
Diaphragm	[O] [R] [L]	[O] [R] [L]		
Other site(s)	[O] [R] [L]	[O] [R] [L]		

Extent (chest wall; combined for in profile and face on)
Up to 1/4 of lateral chest wall = 1
1/4 to 1/2 of lateral chest wall = 2
> 1/2 of lateral chest wall = 3

[O] [R] [1] [2] [3] [O] [L] [1] [2] [3]

Width (in profile only)
(3mm minimum width required)
3 to 5 mm = a
5 to 10 mm = b
> 10 mm = c

[O] [R] [a] [b] [c] [O] [L] [a] [b] [c]

3C. COSTOPHRENIC ANGLE OBLITERATION [R] [L] Proceed to Section 3D NO ☐ Proceed to Section 4A

3D. DIFFUSE PLEURAL THICKENING *(mark site, calcification, extent, and width)*

Chest wall	Site	Calcification	Extent (chest wall; combined for in profile and face on)	Width (in profile only) (3mm minimum width required)

Extent (chest wall; combined for in profile and face on)
Up to 1/4 of lateral chest wall = 1
1/4 to 1/2 of lateral chest wall = 2

Width (in profile only)
(3mm minimum width required)
3 to 5 mm = a
5 to 10 mm = b

CXR Review – Image Quality

1. Good (25%)
2. Acceptable, with no technical defect likely to impair classification of the radiograph for pneumoconiosis (55%)
3. Acceptable, with some technical defect but still adequate for classification purposes (19%)
4. Unacceptable for classification purposes (1%)

Quality Issues:

1. Poor positioning
2. Poor contrast
3. Excessive edge enhancement

Findings from review of 257 CXRs

1. No Complicated Pneumoconiosis or PMF
2. No Advanced Category Simple Pneumoconiosis, i.e. 2/1 or greater
3. 18 CXRs had features consistent with Category 1 simple pneumoconiosis
4. For two CXRs, the original radiology report had indicated changes consistent with early CWP
5. Due to quality issues with CXRs, follow up CT scans being arranged
6. Previous follow up exercise by CT found some false positives on CXR

Recommendations

1. Referral for CXR under the scheme needs to identify it is for the scheme
2. Digital films
3. Address quality issues
4. Smaller number of radiologists
5. Upskilling in ILO reporting
6. Independent dual reading
7. Use ILO reporting form
8. Appropriate follow-up where changes detected

Spirometry

Spirometry review

Consisted of two components:

1. Survey of spirometry equipment and training:

- Online survey developed by the review team
- Link distributed by the DNRM to currently listed NMAs
- Completed by 74 NMAs (about 30%)

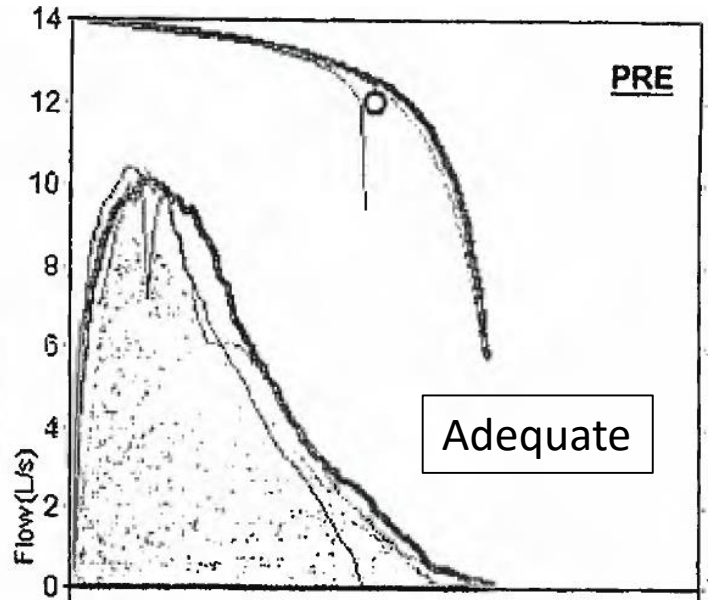
2. Spirometry quality and interpretation:

- Quality and accuracy of a sample of 260 spirograms assessed by two reviewers, Professor Bruce Thompson and Dr Ryan Hoy
- Reviewers' results were compared with NMA reports

Spirometry survey results

- Poor knowledge of the spirometry equipment:
  - 25% (approx.) did not know whether their spirometer had automated quality control
  - Almost 50% did not know the reference values used by their equipment
- Poor quality control:
  - 79% of spirometers reported to have had a calibration check, but most (66%) had not been calibrated in 2016
  - Only 1/3rd of spirometry sites participated in ongoing QA programs
- Only two-thirds of spirometry testers had attended a training course, for 23% completed training > 3 years ago

Spirograms


14
12
10
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Flow(L/s)
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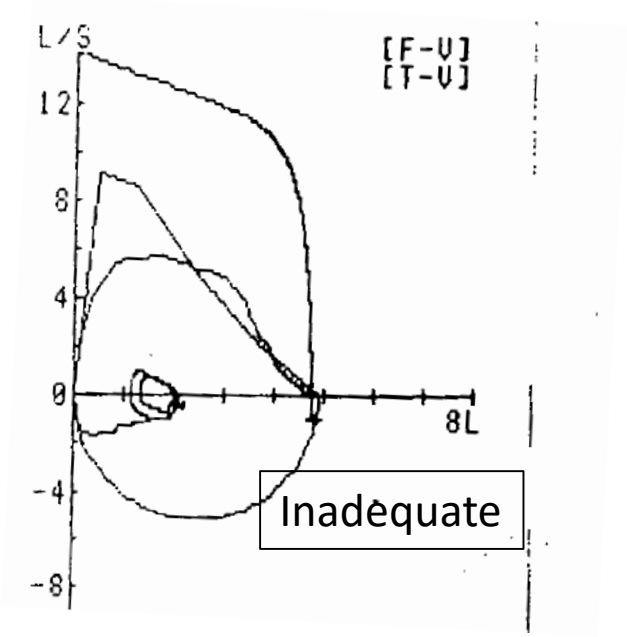
Adequate


L/S
[F-V]
[T-V]
12
8
4
0
-4
-8
8L
Inadequate

Spirometry review – *Cont'd*

Results of spirometry reading & quality:

- 40% (102/256) could not be interpreted as they had not been performed to ATS/ERS standards
- Only 41% (106/256) of spirograms provided had been accurately interpreted and reported by NMAs
- 30 spirograms deemed abnormal by the reviewers:
  – 6 showed mild obstructive disease patterns
  – 24 showed possible restriction (21 mild, 3 moderate)
- Only 1 of the abnormal results had been accurately identified in the NMA reports

Recommendations for spirometry

- Need to get away from ‘office’ spirometry!
- Technicians require suitable training and updates by the Thoracic Society or similar body
- Accredited laboratories or spirometry specific accreditation
- Adhere to ATS criteria
- Use appropriate reference ranges
- Suitable QC procedures
- Appropriate follow up of abnormalities

Queensland medical capacity

- Three main specialties:
  - Radiologists
  - Thoracic physicians
  - Occupational physicians
- Excellent specialist training in Aust
- Harnessing this capability for the purpose of the scheme has been lacking
- Also lack of recent experience with CWP
- Active input of specialist bodies critical
- Clinical guidelines and audit needed

Other aspects of the review

- Respiratory part of the form needs expansion and redesign
- Move to electronic data collection and storage: forms, CXR and spirometry
- Drs can access previous medical records
- Facilitate ongoing surveillance/trends
- Can learn a lot from interstate/overseas schemes
- Other sources of data on CWP not helpful
- Research design to better estimate extent
- Acknowledge assistance of Reference Group

Take-home messages

- Erroneous belief that CWP was history
- Complacency and loss of purpose of the scheme
- ‘If you don’t look, you won’t find’
- System problem, not individuals
- Resp component needs complete overhaul
- 18 major recommendations and road map
- Training and QC major factors
- Need to restore confidence in medical advice to miners
- Wider implications: other hazards/industries
- Well known that occ diseases poorly recognised

Well designed respiratory screening is no substitute for effective dust control, but provide useful additional information about control and medical status

"A Past forgotten

is a Future repeated"