Medical screening, diagnosis and treatment:

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2016 Silica Rule

- Lower exposure limit for respirable crystalline silica
  - AL = 25 µg/m³ and PEL = 50 µg/m³
- Exposure monitoring
- Specified exposure controls, including respirators
- Medical surveillance

Slide credit: Kristin Cummings
Medical Surveillance

- 29 CFR 1926.1153(h) and 29 CFR 1910.1053(i)
- Construction
  - September 2017: if required to wear respirator $\geq 30$ days/year
- General industry and maritime
  - June 2018: if exposed at/above PEL $\geq 30$ days/year
  - June 2020: if exposed at/above AL $\geq 30$ days/year

Slide credit: Kristin Cummings
Medical Surveillance

- At baseline and every 3 years
  - Medical and work history
  - Physical examination emphasizing respiratory system
  - Chest radiograph classified by NIOSH-certified B-reader
  - Spirometry by technician from NIOSH-approved course
  - Latent tuberculosis test (baseline and as needed)
  - Referral to specialist for B-reading of 1/0 or higher
Health Effects of Silica

- **Silicosis**
  - Chronic = after 10+ years, lower concentrations
  - Accelerated = after 5-10 years, higher concentrations
  - Acute = after weeks to years, highest concentrations
## Silicosis

Fibrotic interstitial lung disease resulting from occupational inhalation of respirable crystalline silica

<table>
<thead>
<tr>
<th>Chronic</th>
<th>Accelerated</th>
<th>Acute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate-low exposure</td>
<td>High exposure</td>
<td>High exposure</td>
</tr>
<tr>
<td>15-20 years after first exposure</td>
<td>5-10 years after exposure</td>
<td>Weeks to years</td>
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<tr>
<td>Asymptomatic</td>
<td>Asymptomatic</td>
<td>Rapid onset dyspnea, cough, weight loss, fatigue, fever</td>
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<tr>
<td>Cough and sputum production</td>
<td>Cough, dyspnea on exertion</td>
<td></td>
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<tr>
<td>Innumerable centrilobular nodules,</td>
<td>Same as chronic silicosis</td>
<td>Bilateral ggos, centrilobular nodular opacities, calcifications, lymphadenopathy</td>
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<tr>
<td>predominantly in upper lungs, emphysematous changes, calcified lymph nodes</td>
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<tr>
<td>Can develop progressive massive fibrosis</td>
<td></td>
<td>Poor prognosis, &lt;4 years</td>
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</tbody>
</table>
ILO B-read

- Pneumoconiosis classification system
- Small opacities rated on
  - Profusion (0-3)
  - Size
    - Small round: Size p (<1.5 mm), q (1.5-3mm), r (3-10mm)
    - Irregular small: s (<1.5mm), t (1.5-3mm), or u (3-10 mm)
- Large opacities (any opacity >1 cm)
  - A (<5cm), B(5-RUL size), C (larger than B)

Normal: 0/0 or 0/1
Abnormal: 1/0 or greater
## 1. Image Quality
- Overexposed (dark)
- Improper position
- Underinflation
- Underexposed (light)
- Poor contrast
- Motile
- 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
  - Secondary
- b. Zones
  - Upper
  - Middle
  - Lower
- c. Profusion
  - 0
  - 1
  - 2
  - 3

## 2C. Large Opacities
- SIZE
  - O
  - A
  - B
  - C

## 3A. Any Classifiable Pleural Abnormalities?
- YES □ Complete Sections 3B, 3C
- NO □ Proceed to Section 4A

## 3B. Pleural Plaques
(mark size, calcification, extent, and width)
- Chest wall
  - In profile
  - Face on
- Diaphragm
  - Other site(s)
- Calcification
  - O
  - R
  - L

## 3C. Costophrenic Angle Obliteration
- Proceed to Section 3D

## 3D. Diffuse Pleural Thickening
(mark size, calcification, extent, and width)
- Chest wall
  - In profile
  - Face on
- Calcification
  - O
  - R
  - L

## 4A. Any Other Abnormalities?
- YES □ Complete Sections 4B, 4C, 4D, 4E
- NO □ Complete physician info and sign form.
ICOERD classification

- 4-point categories
  - Grade rounds and irregular opacities in lungs
  - Also grades emphysema and ground glass
  - By lung zones

- Similar interobserver differences to ILO
  (PMID: 25810444)
Chest X-ray vs CT Scan

• Two Australian case series (PMID: 31407419, 33115923)
  • 35-43% of fabricators with silicosis had normal chest X-ray but abnormal CT scan

• Italian case series (PMID: 32352423)
  • Those with abnormal CT scans
  • 42% Chest X-rays were abnormal
  • 33% of spirometry were abnormal
Patient takes a deep breath and blows as hard as possible into tube

Clip on nose

Technician monitors and encourages patient during test

Machine records the results of the spirometry test
Diffusion Capacity

The diffusing capacity is a measurement of the rate of transfer of gas from the alveolus (air sac) to hemoglobin/blood.
Spirometry vs Diffusion Capacity

- Italian case series (PMID: 32352423)
  - Of those with abnormal CT scans 33% had abnormal spirometry
  - 50% had abnormal diffusion capacity
- Coal miners
  - 9% of coal miners with normal FEV1, had abnormal DLCO
  - As radiology gets worse, the diffusion gets worse too

Almberg et al., “Relationship Between Radiographic Disease, Spirometry Findings, and Diffusion Capacity in a Population of Former U.S. Coal Miners.” Am J Respir Crit Care Med 2023;207:A4363
Current Medical Screening Limitations

• CT scans and diffusion capacity more sensitive tests than current requirements
• Medical screening requirements need an update