COMPARISON OF INTERPRETATION PROTOCOLS IN SPIROMETRY TESTING OF FORMER DOE WORKERS IN IOWA

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BACKGROUND

• Former Worker Medical Screening Program (FWP)
• 1993 Defense Authorization Act
• Department of Energy (DOE)
• Health issues relate to prior work at DOE facility
• All former DOE Federal, contractor and subcontractor employee from all DOE sites
• UI-College of Public Health in 2000
• Iowa Army Ammunition Plant, Burlington, IA
• 1949-1975
• Nuclear weapons – assemble, disassemble, and refurbish weapons
• Line 1/Division B
IAAP
EXPOSURES

Asbestos
Beryllium
High Explosives
Barium
Cadmium
Nickel
Mercury
Lead
Radiation
STUDY GOAL

To study the association between spirometric abnormalities defined by two currently used protocols and smoking status, date of first hire and the potential for exposure to known respiratory toxicants based on job titles.
SPIROMETRY

• Pulmonary Function Tests (PFTs)
• Lung function measurement
• Volume and/or flow (speed) of air that can be inhaled and exhaled
• Normal versus abnormal (obstructive, restrictive, mixed)
METHODS

• Spirometry - ATS standards
• Interpretation
  – % predicted (80% cut-off for FVC and FEV1%Pred)
  – Lower limit of normal (LLN)

• Job categories – historical 3x5 employment cards
  – Production workers – potential for exposure to asbestos, beryllium, high explosives
## RESULTS - % Predicted

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Total Screened N=1,188</th>
<th>Normal N=567 (47.7%)</th>
<th>Abnormal N=621 (52.3%)</th>
<th>p-value</th>
<th>OR 95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Smoking</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ever Smoker</td>
<td>784</td>
<td>331</td>
<td>453 (57.8%)</td>
<td>&lt;0.000001</td>
<td>1.97 (1.53-2.51)</td>
</tr>
<tr>
<td>Never Smoker</td>
<td>397</td>
<td>234</td>
<td>163 (41.1%)</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Job Category</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>546</td>
<td>244</td>
<td>302 (55.3%)</td>
<td>0.03726</td>
<td>1.28 (1.02-1.61)</td>
</tr>
<tr>
<td>Non Production</td>
<td>612</td>
<td>311</td>
<td>301 (49.2%)</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Date of First Hire</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before 1960</td>
<td>538</td>
<td>233</td>
<td>305 (56.7%)</td>
<td>0.001318</td>
<td>1.36 (1.08-1.71)</td>
</tr>
<tr>
<td>After 1960</td>
<td>590</td>
<td>312</td>
<td>278 (47.1%)</td>
<td></td>
<td>1.0</td>
</tr>
</tbody>
</table>

* % Predicted = 1983 reference standards (% predicted FVC and FEV1 adjusting for age, race, sex and height)
# RESULTS - LLN

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Total Screened N=909</th>
<th>Normal N=609 (67.0%)</th>
<th>Abnormal N=300 (33.0%)</th>
<th>p-value</th>
<th>OR 95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Smoking</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ever Smoker</td>
<td>586</td>
<td>357</td>
<td>229 (39.1%)</td>
<td>&lt;0.0000001</td>
<td>2.31 (1.69-3.16)</td>
</tr>
<tr>
<td>Never Smoker</td>
<td>317</td>
<td>248</td>
<td>69 (21.8%)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td><strong>Job Category</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>411</td>
<td>261</td>
<td>150 (36.5%)</td>
<td>0.03749</td>
<td>1.36 (1.03-1.80)</td>
</tr>
<tr>
<td>Non Production</td>
<td>475</td>
<td>334</td>
<td>141 (29.7%)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td><strong>Date of First Hire</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before 1960</td>
<td>424</td>
<td>278</td>
<td>146 (34.4%)</td>
<td>0.2345</td>
<td>1.20 (0.90-1.60)</td>
</tr>
<tr>
<td>After 1960</td>
<td>431</td>
<td>300</td>
<td>131 (30.4%)</td>
<td>1.0</td>
<td></td>
</tr>
</tbody>
</table>

* LLN = Lower Limit of Normal (1999 NHANES III based formula)
CONCLUSIONS

• Smoking and exposure potential to asbestos, beryllium and high explosives associated with abnormal spirometric results regardless of interpretation protocol used

• Distribution of spirometric results different between two protocols
  – Abnormal per % predicted >> LLN
  – No gold standard available in this study to estimate sensitivity
ACKNOWLEDGEMENT

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Jill Welch

Everyone on the FWP project
THANK YOU