Air Pollution and COVID-19; a biologically plausible association?

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Disclosures; Member COMEAP, Founder Doctors against Diesel
Association between short-term exposure to air pollution and COVID-19 infection: Evidence from China

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Angiotensin-converting enzyme 2 (ACE2)
ACE2 expression in airway

- Nasal
  - Goblet 1
  - Goblet 2
  - Ciliated 2
  - Basal 1
  - Basal 2
  - Ciliated 1
  - Club
  - Ionocytes
- Lower airway
  - Alveolar type I
  - Alveolar type II
- Parenchyma
- Lower airway
- Lower airway

Sungnak Nat Med 2020
Smoking and ACE2 gene expression

<table>
<thead>
<tr>
<th>Study</th>
<th>Tissue</th>
<th>Effect size (95% CI)</th>
<th>Sample size</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACE2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ever-smoker vs Non-smoker</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>GSE7895</td>
<td>healthy LAE</td>
<td>0.09 (−0.06, 0.25)</td>
<td>104</td>
<td>0.23</td>
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<tr>
<td>GSE63127</td>
<td>healthy SAE</td>
<td>0.29 (0.20, 0.38)</td>
<td>230</td>
<td>3e−09</td>
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<tr>
<td>GSE19667</td>
<td>healthy SAE</td>
<td>0.27 (0.14, 0.39)</td>
<td>116</td>
<td>6.4e−05</td>
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<tr>
<td>GSE5058</td>
<td>healthy SAE</td>
<td>0.14 (−0.15, 0.43)</td>
<td>24</td>
<td>0.36</td>
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<tr>
<td>TCGA</td>
<td>normal lung</td>
<td>0.30 (−0.20, 0.80)</td>
<td>48</td>
<td>0.24</td>
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<tr>
<td>GSE40419</td>
<td>normal lung</td>
<td>0.33 (−0.25, 0.90)</td>
<td>74</td>
<td>0.27</td>
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<tr>
<td>IUCPQ</td>
<td>normal lung</td>
<td>0.32 (0.14, 0.50)</td>
<td>194</td>
<td>0.00067</td>
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<tr>
<td>IUCPQ</td>
<td>COPD lung</td>
<td>0.27 (−0.10, 0.63)</td>
<td>244</td>
<td>0.15</td>
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<tr>
<td><strong>Meta-analysis</strong></td>
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<td>0.25 (0.19, 0.31)</td>
<td>1034</td>
<td>1.4e−16</td>
</tr>
</tbody>
</table>
ACE2

normal lung function smoker

normal control
Less ACE2 expression in children
Less ACE2 expression if allergic
QMUL Study; Marylebone Road PM$_{10}$
ACE2 expression level
Type II cells

Dose-response

ACE2 expression (MFI)

Control
1 µg/mL
2.5 µg/mL
5 µg/mL
10 µg/mL
20 µg/mL

PM$_{10}$

**
*

PM$_{10}$ expression increases with increasing concentrations of PM$_{10}$.
Type II cells

![Diagram of Type II cells]

**ACE2 expression (MFI)**

**A**

- **Control**
- **PM$_{10}$ 10 µg/mL**

**B**

- **Control**
- **PM$_{10}$ 10 µg/mL**

Statistical significance:
- **A**: ****: p < 0.01
- **B**: *: p < 0.05
Cigarette smoke extract

ACE2 expression (MFI)

- Control
- CSE 5%
summary

• ACE2 expression increased by PM$_{10}$
• cell culture helpful in screening inhaled air pollutants
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