Particulate Matter Air Pollution and Cardiovascular Health

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Outline

• Background
  – What effect does PM have on the cardiovascular health?

• Current Investigation
  – How does PM affect cardiovascular health?

• Future Investigation
  – Can the cardiovascular effects of PM be mitigated?

• Questions
What Effect does PM have on Health?

- Along Wasatch Front, an increase in PM pollution is associated with an increased risk of death

- Many of these deaths were related to cardiovascular complications…
  - ↑ admittance to E.R. for Heart Attack or Chest Pain
  - Alterations in Blood Pressure

(Pope, 1992; Pope 2012, Wellnius 2012)
How Does PM Affect Cardiovascular Health?

- **Endothelium**
  - Responds to changes in blood flow and content
  - Causes artery to dilate or constrict

- **Nitric Oxide (NO)**
  - Gas released by endothelium
  - Causes dilation and ↑ blood flow
  - Inhibits plaque formation
  - Inhibits clot formation

- **Inflammation and Oxidative Stress**
  - Unpaired electron
  - Excessive Cause Oxidative Stress
    - Scavenges NO
    - Prevents Dilation
    - Increased Risk of Atherosclerosis
    - Damages tissue and DNA
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Methods:
Subjects and Exposure

Subjects
• 10 Healthy, Older Individuals (70 ± 3 yrs)

Exposure
• Low PM$_{2.5}$
  • >72 hours of clean air (PM$_{2.5}$ = 3.3±1 μg/m$^3$)
• High PM$_{2.5}$
  • >24 hours of polluted air (PM$_{2.5}$ = 50.0±1 μg/m$^3$)

Tests
• Pulmonary Function
• Blood Draw
• Vascular Function
  • Flow Mediated Dilation (FMD)
  • Passive Leg Movement (PLM)
Does Acute Exposure to PM Result in a Systemic Immune Response?

[Graph showing the change in White Blood Cells and Monocytes with Low PM2.5 and High PM2.5 exposure.]

* denotes statistical significance.
Does Acute Exposure to PM Impair Vascular Endothelial Function?

<table>
<thead>
<tr>
<th>Condition</th>
<th>FMD (% Dilation)</th>
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<tbody>
<tr>
<td>Old (Low PM)</td>
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<tr>
<td>Old (High PM)</td>
<td></td>
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<tr>
<td>COPD (Low PM)</td>
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Conclusions and Future Directions

$\text{PM}_{2.5}$

↑ Inflammation
↑ Oxidative Stress

↓ Endothelial Function
↓ Nitric Oxide

Antioxidant

↓ CV Health
Can Treatment with Antioxidant Minimize the Effect on Vascular Function?
Interested in Participating?
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References