**MOSES Part 1: Study Design**

**MOSES Part 2: Specific Aims**

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<td>Controlled O3 exposure effects on pre-term biomarker changes (Aim 1), modified by increased ambient O3 or other pollutants</td>
<td>Using MOSES biomarker and subject data, personal concentrations of O3 and NO2 in the 72 hours before the pre-exposure visit, and hourly ambient concentrations of multiple pollutants (including O3 in the 96 hours before the pre-exposure visit, measured at ambient air quality monitoring sites near each of the 3 clinical centers.</td>
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<td><strong>Aim 2:</strong></td>
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<td>Controlled O3 exposure effects on pre-term biomarker changes (Aim 1), modified by increased ambient O3 or other pollutants</td>
<td>Determined whether increased personal O3 and NO2 concentrations in the 72 hours before the pre-exposure visit, and increased ambient O3 and other pollutant concentrations in the 1-96 hours before the pre-exposure visit confounded the MOSES 1 controlled O3 exposure effects on pre-term biomarker changes.</td>
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<td><strong>Aim 3:</strong></td>
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<td>Controlled O3 exposure effects on systolic blood pressure (mmHg), after adjustment for PES and ambient pollutants</td>
<td>Determined whether increased personal O3 and NO2 concentrations in the 72 hours before the pre-exposure visit were associated with changes in each biomarker from pre-term to post-term, independent of the controlled O3 exposure.</td>
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<td><strong>Aim 4:</strong></td>
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<td>Controlled O3 exposure effects on FeNO and PES NO2 levels, after adjustment for personal O3 and NO2 concentrations</td>
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**Part 1: Results and Conclusions**

**Aim 3:**

- **Cardiovascular function:**
  - Heart rate (HR), blood pressure (SBP, DBP), and FMD were not measured 22 hours post-exposure.

**Aim 4:**

- **FeNO** was not measured 22 hours post-exposure.

**Part 2: Controls**

- **MOSES Part 2: Specific Aims**
  - Using MOSES biomarker and subject data, personal concentrations of O3 and NO2 in the 72 hours before the pre-exposure visit, and hourly ambient concentrations of multiple pollutants (including O3 in the 96 hours before the pre-exposure visit, measured at ambient air quality monitoring sites near each of the 3 clinical centers. |
  - Determined whether increased personal O3 and NO2 concentrations in the 72 hours before the pre-exposure visit, and increased ambient O3 and other pollutant concentrations in the 1-96 hours before the pre-exposure visit confounded the MOSES 1 controlled O3 exposure effects on pre-term biomarker changes. |
  - Determined whether increased personal O3 and NO2 concentrations in the 72 hours before the pre-exposure visit were associated with changes in each biomarker from pre-term to post-term, independent of the controlled O3 exposure. |

**Abstract**

**BACKGROUND**

The Multi-center Ozone Study of oldEr Subjects (MOSES) was a multicenter study evaluating whether short-term controlled exposure of older, healthy individuals to low levels of ozone (O3) and other pollutants on cardiovascular and pulmonary function. However, other pollutant exposures before the study may have confounded or modified these effects.

**STUDY DESIGN**

In MOSES-2, we used a longitudinal panel study design. MOSES-1 cardiopulmonary biomarker data, active personal exposure samplers (PES) for ozone and ambient NO2, and ambient air pollution measurements in the 96 hours before the pre-exposure visit. Using this design, increased ambient O3 and NO2 concentrations were associated with acute effects on cardiovascular and pulmonary function, with “recovery” during exposure visits. However, there was no evidence for acute effects of ozone on cardiovascular function or systemic inflammation.

**RESULTS**

- **Health Endpoints**
  - MaxFMD, brachial artery diameter (BAD), and velocity time integral (VTI) were not measured 22 hours post-exposure.

- **Endothelial and vascular function**
  - Blood pressure (SBP, DBP), and FMD were not measured 22 hours post-exposure.

- **Prothrombotic markers:**
  - vWF, IL-6, IL-8, s-ENaC, aIF, CC16, IL-6, IL-8, s-ENaC, aIF, CC16, and CD40 ligand.

- **Cardiovascular function:**
  - Heart rate (HR), blood pressure (SBP, DBP), and FMD were not measured 22 hours post-exposure.

In MOSES-2, we used a longitudinal panel study design. MOSES-1 cardiopulmonary biomarker data, active personal exposure samplers (PES) for ozone and ambient NO2, and ambient air pollution measurements in the 96 hours before the pre-exposure visit. Using this design, increased ambient O3 and NO2 concentrations were associated with acute effects on cardiovascular and pulmonary function, with “recovery” during exposure visits. However, there was no evidence for acute effects of ozone on cardiovascular function or systemic inflammation.

In Part 1 of this multicenter clinical study of older subjects, ozone exposure biomarker changes were modified by ambient NO2, and CO, and PES NO2, with reductions observed only when pollutant concentrations were “Medium” or “High” in the 72 hours before the pre-exposure visit. There was no modification of the controlled O3 exposure effect on any other biomarker. Changes in ozone used a longitudinal panel study design. MOSES-1 cardiopulmonary biomarker data, active personal exposure samplers (PES) for ozone and ambient NO2, and ambient air pollution measurements in the 96 hours before the pre-exposure visit. Using this design, increased ambient O3 and NO2 concentrations were associated with acute effects on cardiovascular and pulmonary function, with “recovery” during exposure visits. However, there was no evidence for acute effects of ozone on cardiovascular function or systemic inflammation.