

# Short-term PM<sub>2.5</sub> Exposure and Acute Heart Disease Events

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California Air Resources Board

California Environmental Protection Agency

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Thank you Mr. Cackette and good morning Chairman Nichols and members of the Board. Today's health update will focus on the results of a new study that evaluates the relationship between short-term exposure to PM<sub>2.5</sub> air pollution and cardiovascular events in patients with coronary artery disease.

## Previous Results for PM2.5

- Long-term exposure
  - Atherosclerosis
  - Heart disease
  - Premature death
- Short-term exposure
  - Atherosclerosis complications
  - Premature death
- Do short-term exposures contribute to heart attacks and other coronary events?

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In past health updates we have highlighted the consistent association between particulate matter exposure and adverse health effects. Evidence was presented which suggests that long-term exposure to particulate air pollution contributes to inflammation, progression of atherosclerosis (or hardening of the arteries) and the risk of heart disease and death. Short-term ambient PM2.5 exposure has been associated with atherosclerosis complications and aggravation of heart disease including hospital readmission in heart attack survivors which can lead to premature death. The hypothesis tested in this study was that short-term exposures can contribute to heart attacks and other coronary events, especially among patients with underlying coronary artery disease.

## Study Design

- Wasatch Front, Utah (1994-2004)
- 12,865 patients with diagnosed coronary artery disease
- Endpoints:
  - Unstable heart associated chest pain
  - Stable heart associated chest pain
  - Initial heart attack
  - Subsequent heart attack
- Information on age, smoking, diabetes, body mass index, blood pressure and family history of early coronary disease

C. A. Pope et al., *Circulation* 2006;114; 2443-2448, Brigham Young University. 3

The study being highlighted today is titled "Ischemic Heart Disease Events Triggered by Short-Term Exposure to Fine Particulate Air Pollution" published in November, 2006.

The investigators analyzed the relationship between PM2.5 and heart disease events in almost 13,000 patients who lived in Utah for 10 years. Heart disease events were defined as unstable and stable heart associated chest pain and initial and subsequent heart attack. The investigators provided detailed information on a number of health variables including information on the number of severely diseased coronary arteries in each participant.

## Results

- 4.5% increased risk of coronary events for each 10  $\mu\text{g}/\text{m}^3$  increase in PM2.5
- Greatest risk with same day or average of previous 2 days exposure
- Higher risk with unstable heart disease
- More effects in patients with severe coronary artery disease

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This study found a 4.5% increase in risk of acute heart disease events associated with each 10  $\mu\text{g}/\text{m}^3$  increase in ambient PM2.5. The events that were significantly associated with PM2.5 were unstable heart associated chest pain and heart attacks. The strongest associations were with exposures on the same day or an average of the previous two days prior to the onset of the coronary event. Effects were larger for patients with unstable heart disease. Age, gender, smoking and body mass index had no influence on the risk level. Significant PM2.5 effects estimates were observed for individuals who had at least one severely diseased coronary artery compared to those who did not.

## Implications

- PM2.5 controls can reduce heart attacks in California
  - Significant PM2.5 exposures in California
  - South Coast and San Joaquin Valley Air Basins had 48 and 57 days above the standard in 2006
- Supports need for continued progress toward attaining national 24-hour PM2.5 standard of  $35 \mu\text{g}/\text{m}^3$

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In summary, the study highlighted today suggests that reducing ambient levels of PM2.5 can reduce the number of heart attacks, particularly in areas of California where the exposure to PM2.5 can be significant. For example, the monitored data from ARB shows that 48 days in the South Coast and 57 days in the San Joaquin Valley Air Basins were above the National PM2.5 standard in 2006.

A major goal of ARB's regulatory program is to reduce PM2.5 pollution, including particulates from diesel engines. The information in this study supports the Board's regulatory activities and policy decisions that affect the health of Californians, and illustrates the need to continue progress in PM2.5 reductions toward attaining the national 24hour standard.

This concludes my presentation. We will be happy to answer any questions.

Thank you very much.

Note: The highest concentration of PM2.5 averaged over 24 hours in the South Coast and the San Joaquin Valley air basins were 72 and 87  $\mu\text{g}/\text{m}^3$  in 2006.