

# MESA Air Pollution Study

A New Prospective Cohort Study of Air  
Pollution and Cardiovascular Disease



# A New Prospective Cohort Study of Air Pollution and Cardiovascular Disease

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- Prior studies compelling but had limitations
- Importance of long-term exposures on effects
- Hypothesis that ambient fine particulates accelerate atherosclerosis
- New developments in exposure assessment
- Newly validated measures of subclinical atherosclerosis

# Applying Recent Lessons to a New Cohort Study

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- NHLBI Multi-Ethnic Study of Atherosclerosis (MESA): Cohort Creation
  - *Exposure heterogeneity*: Population-based cohort recruited from areas near Los Angeles, Chicago, St. Paul, New York City, Baltimore, Winston-Salem
  - *At risk*: 45-84 yrs old, without clinical CV dz
  - Sampling strategy to include populations with varying ethnicity (African-American, Hispanic, Asian)

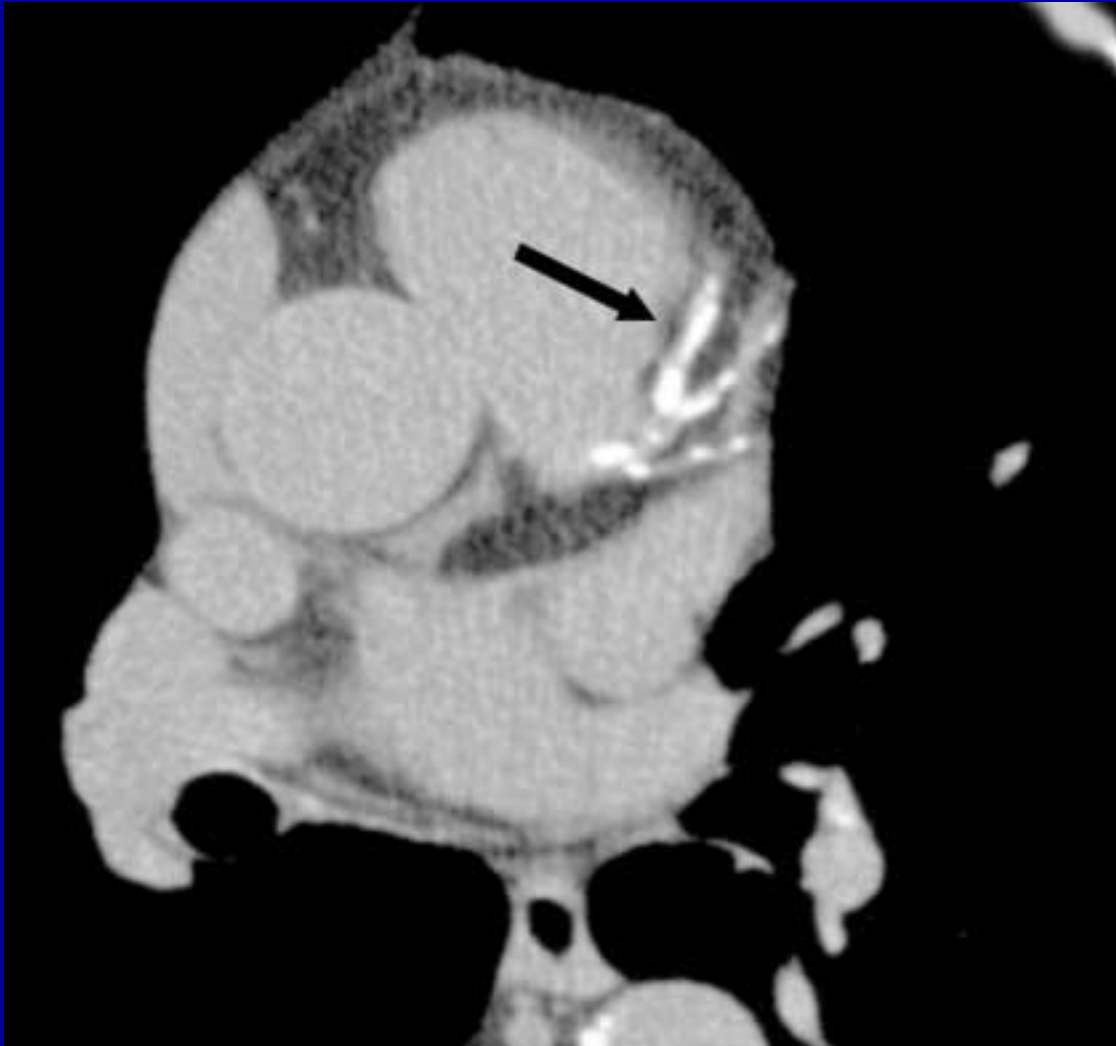
# Multi-Ethnic Study of Atherosclerosis (MESA)

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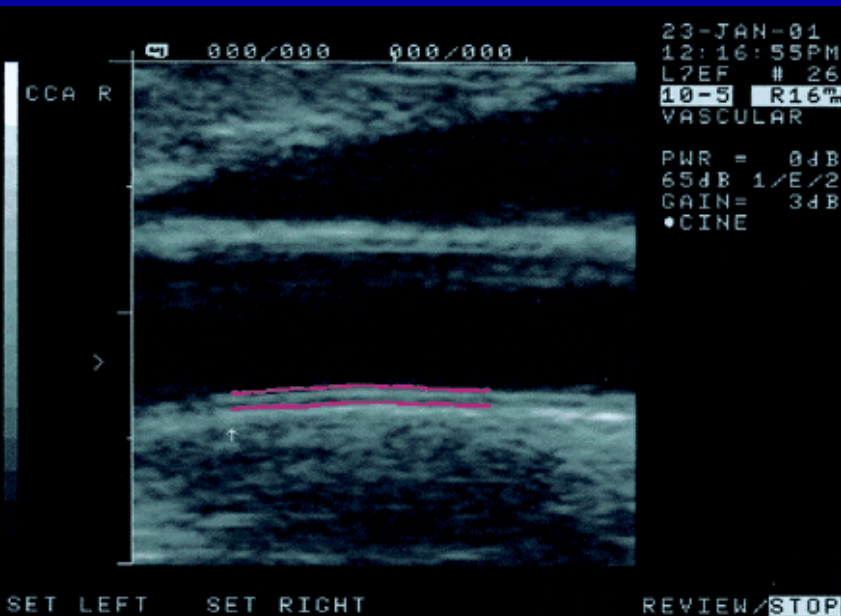
- Designed to assess risk factors for progression of atherosclerosis as measured by:
  - Coronary Artery Calcification by CT
  - Carotid Artery Intima Medial Thickness by Ultrasound
  - Clinical Events

# Coronary Artery Calcification by EBCT

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# Carotid intima-medial thickness (IMT)



A 2x2-cm B-mode ultrasound digital still image of the common carotid artery and its adjacent structures as depicted by a 5 to 10 MHz linear array transducer. The white triangle on top is the sternocleidomastoid muscle; the black triangle over the common carotid is the jugular vein. The common carotid near and far arterial walls are clearly shown. The common carotid segment is defined as the arterial wall proximal (to the right) of the carotid dilatation (small white arrow). The lumen-intima and the media-adventitia interfaces are illustrated in red.

# MESA and Air Pollution: Exposure Heterogeneity

Exposure Characteristics of Communities

	Alhambra	Santa Monica*	Rubidoux/ Riverside*	St. Paul	Chicago	Manhattan/ Bronx	Rockland County*	Baltimore	Winston- Salem
PM2.5	H	M	VH	L	M	M	L	M	M
PM10	H	M	VH	M	H	H	M	M	L
CO	H	M	H	M	M	H	L	L	M
NO2	H	H	VH	L	M	H	L	L	L
Ozone	H	M	VH	L	M	M	M	H	VH
SO2	L	L	L	M	M	H	H	M	M
Urban contribution	+	+	+	-	+	+	-	+	-
Long-Range Transport	-	-	-	+	+	+	+	+	+

L=Low, M=Medium, H=High, VH=Very High

e.g., for PM2.5: L= (~10 µg/m<sup>3</sup>), M= (~15 µg/m<sup>3</sup>), H = (~22µg/m<sup>3</sup>), VH= (~30 µg/m<sup>3</sup>) annual averages

# MESA Air

## Proposed Exposure Assessment

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- Individual-Level Exposure Assignments to Specific Ambient-Derived Air Pollutants
- Applying Results of Recent Research
  - Dutch Cohort Study Models
    - 3-components models
      - Regional
      - Urban background
      - Proximity to source/highway
    - Personal Exposure Studies
    - Advanced Geostatistical Methods

# MESA Air

## Proposed Exposure Assessment

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Integrating Information from:

- community-scale monitoring
- outdoor spatial variation
- subject proximity to sources such as highways
- residential characteristics including pollutants' infiltration efficiencies
- personal time-activity records

# MESA Air

## Proposed Exposure Assessment

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- Inputs for Spatio-temporal Outdoor Concentration Model
  - Fixed Outdoor Exposure Monitoring
    - Monitors deployed by compliance agency
    - Monitors deployed by researchers
  - Mobile Gradient Monitoring
  - Home Outdoor Monitoring
  - Traffic Volume Data
  - Other Exposure Source Data

# MESA Air

## Proposed Exposure Assessment

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- Individual-level adjustments to Spatio-temporal Outdoor Concentration Model
  - Time-location records
  - Infiltration efficiency
- Validation with small scale personal exposure monitoring study

# Scientific Opportunities

## *Principal Study Objectives*

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- Air Pollution and Subclinical Atherosclerosis
  - CAC and IMT
- Air Pollution and Clinical Cardiovascular Disease
- Individual-level Exposure Assessment for Air Pollutants

# Scientific Opportunities

## *Other Major Study Objectives*

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- Air pollutants and plasma markers of inflammation, fibrinolysis, oxidative stress, endothelial activation
- Evaluating air pollution measures other than particulate mass
  - Identify toxic components, consider sources
- Evaluating acute and long-term air pollution exposure-effect relationships
  - Joint and/or independent effects?

# MESA Air Pollution

- EPA Grant RD831697
- Project Period 8/1/04 – 7/31/13
  
- Although the research described in this presentation has been funded wholly or in part by the United States Environmental Protection Agency through RD831697 to the University of Washington, it has not been subjected to the Agency's required peer and policy review and therefore does not necessarily reflect the views of the Agency and no official endorsement should be inferred.

