# Joel Schwartz

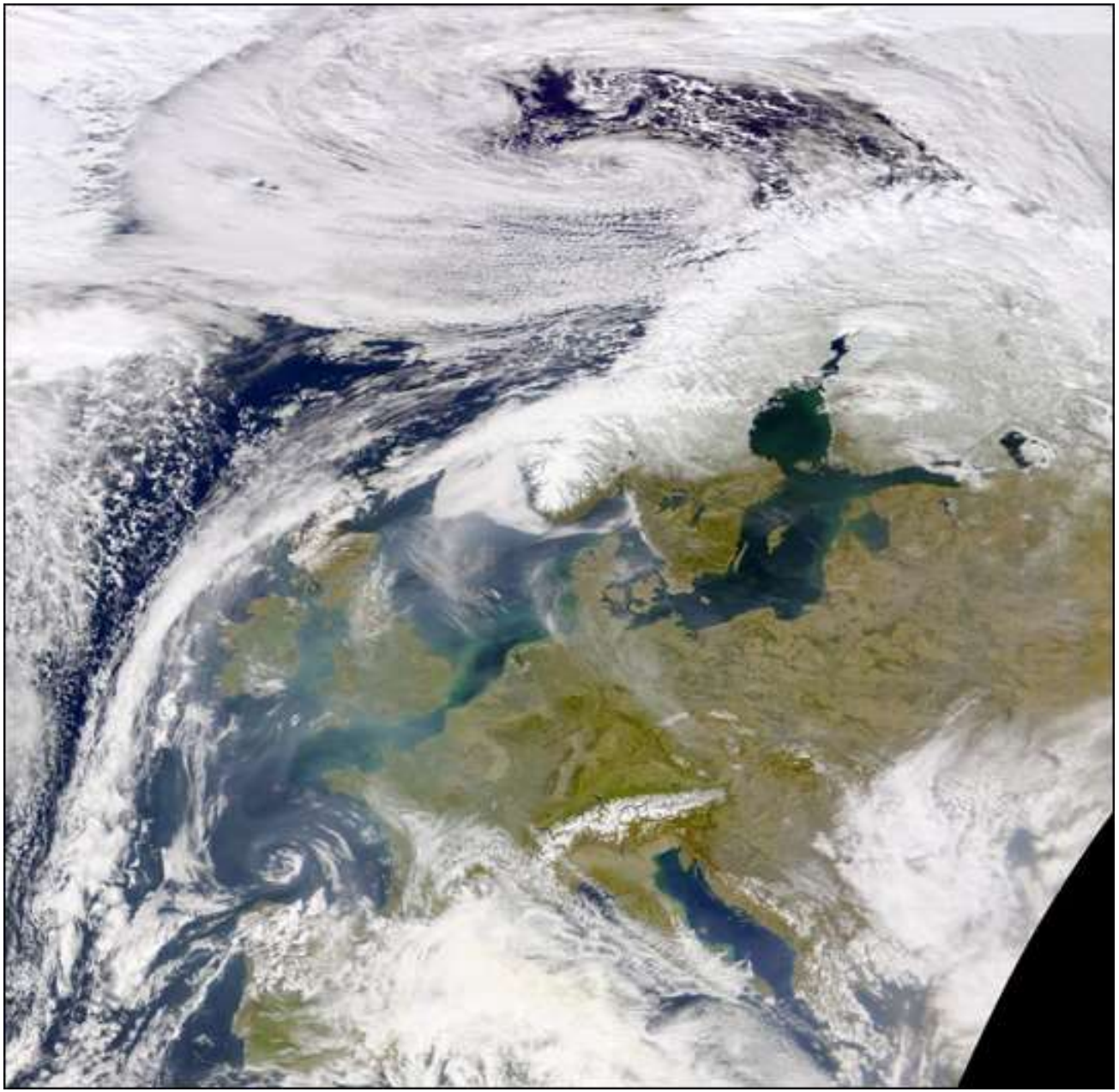
*Professore di Epidemiologia Ambientale*
*Università di Harvard, Boston (MA) USA*

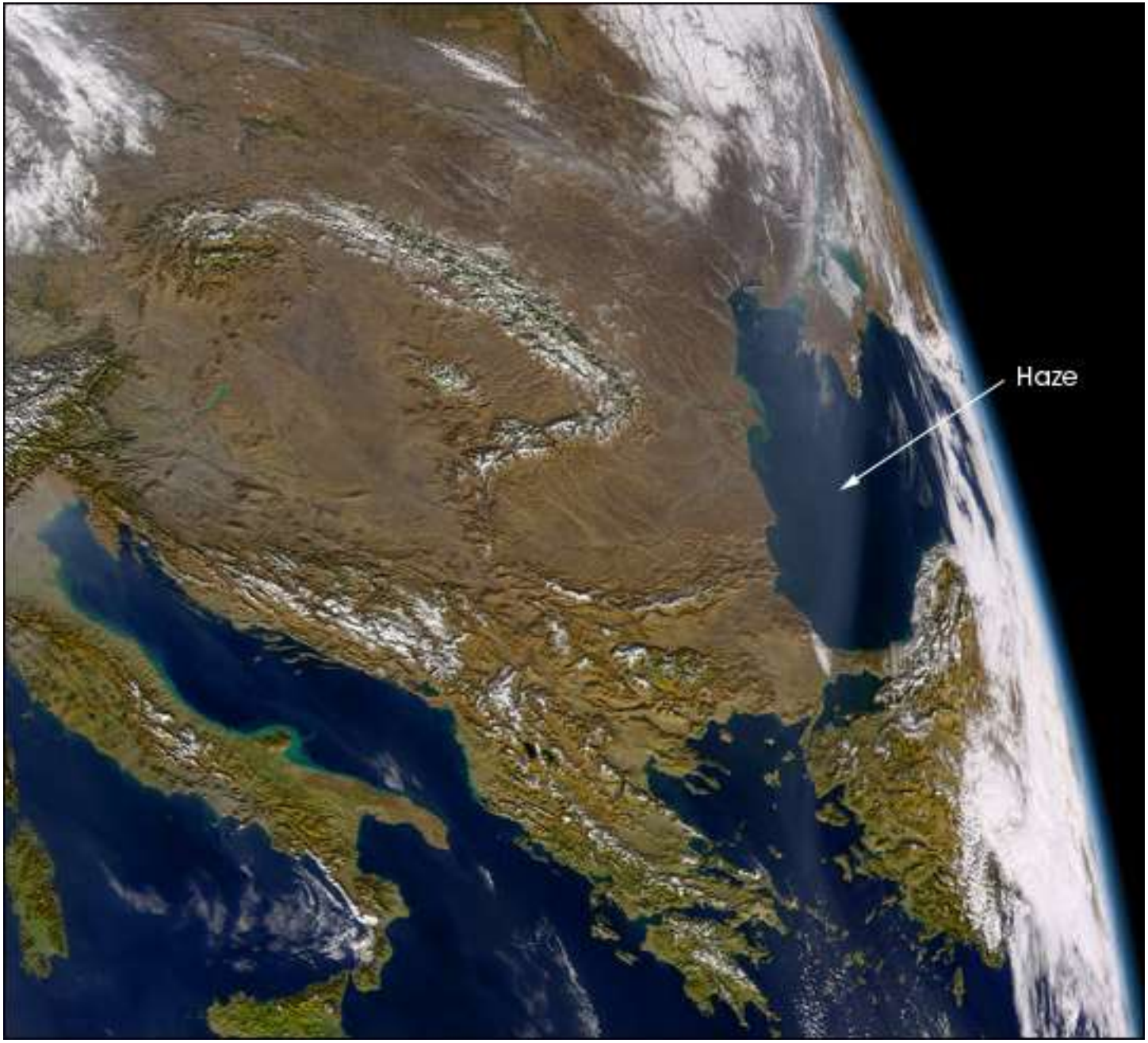
# Air Pollution in Cities

- What is it?
- Why should you care?

# What is it?

- Emissions of gases and particles from
  - cars, trucks, buses
  - Heating fuel, particularly wood burning
- Stuff from out of town that blew in
  - Why?
  - Particles from combustion are very small, and stay in the air for more than a week
  - When the air is from the north, you get particles from Milano




Haze

# By the time pollution travels hundreds of kilometers

- It is pretty uniformly spread out
- Everyone gets the same amount
- Traffic and wood smoke are different
- They result in higher pollution in streets with more traffic
- Particularly Diesel
- They result in higher pollution in neighborhoods where people burn wood

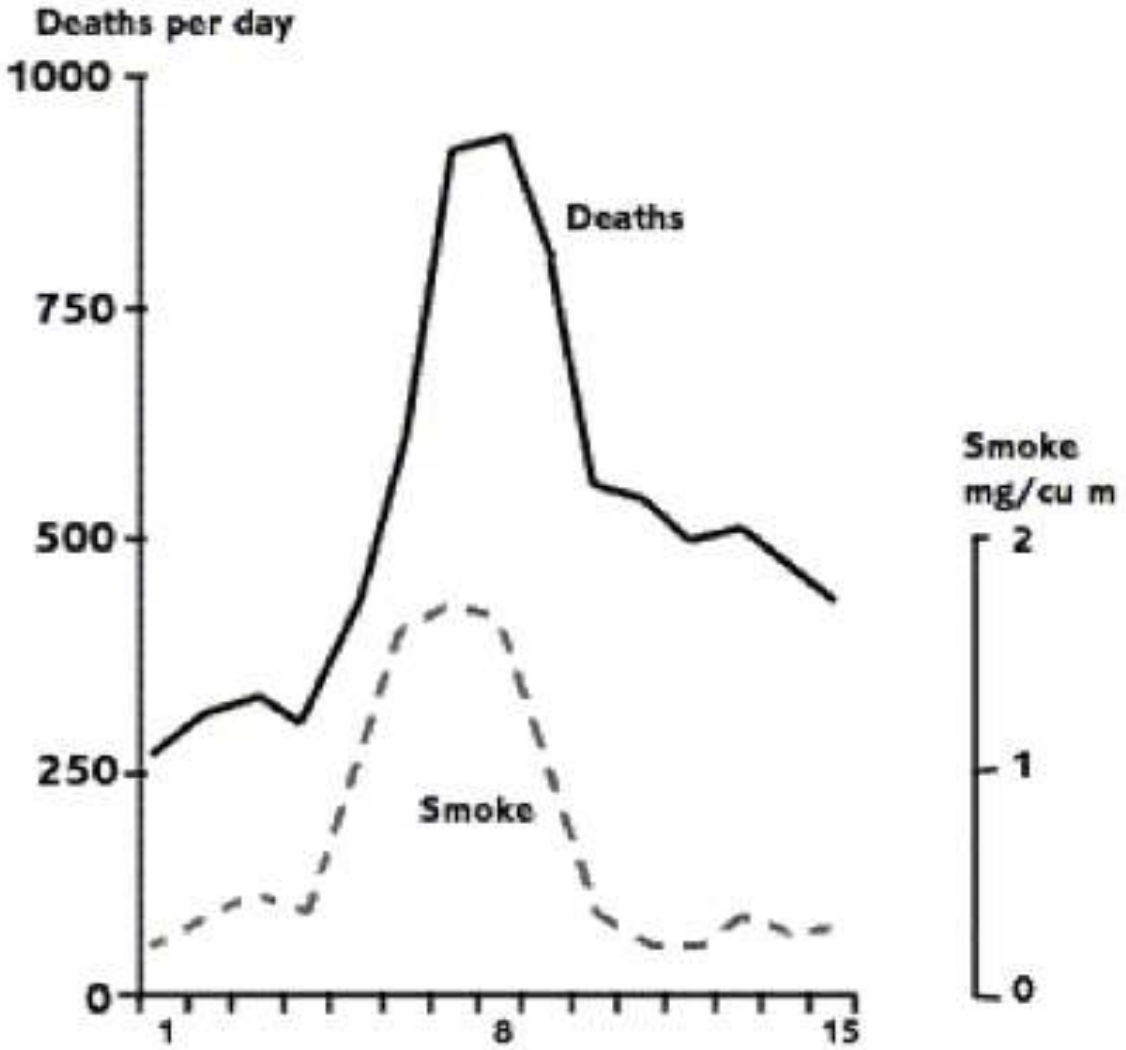
# This Local Air Pollution

- Can be three times higher in some neighborhoods than in others
- It also seems to be more toxic

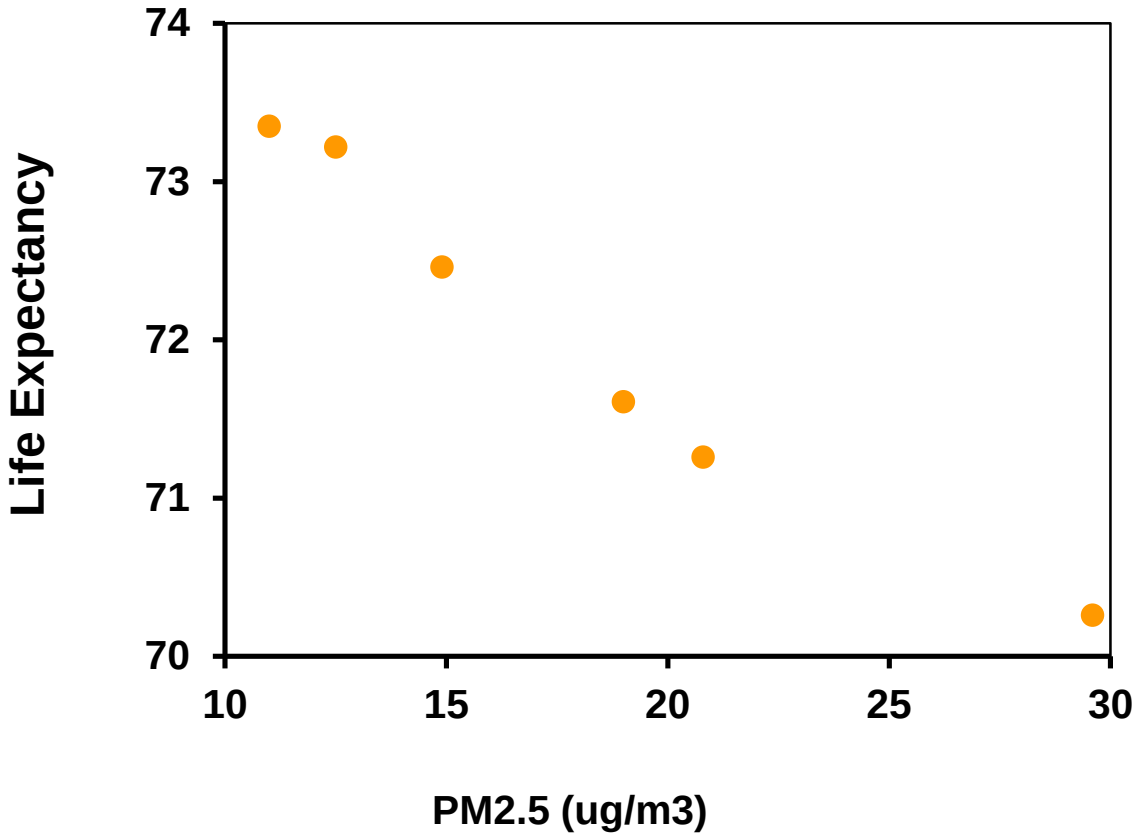
# Why should you care?

- What do we know about particles in the air and health?

# They Kill People at High Dose



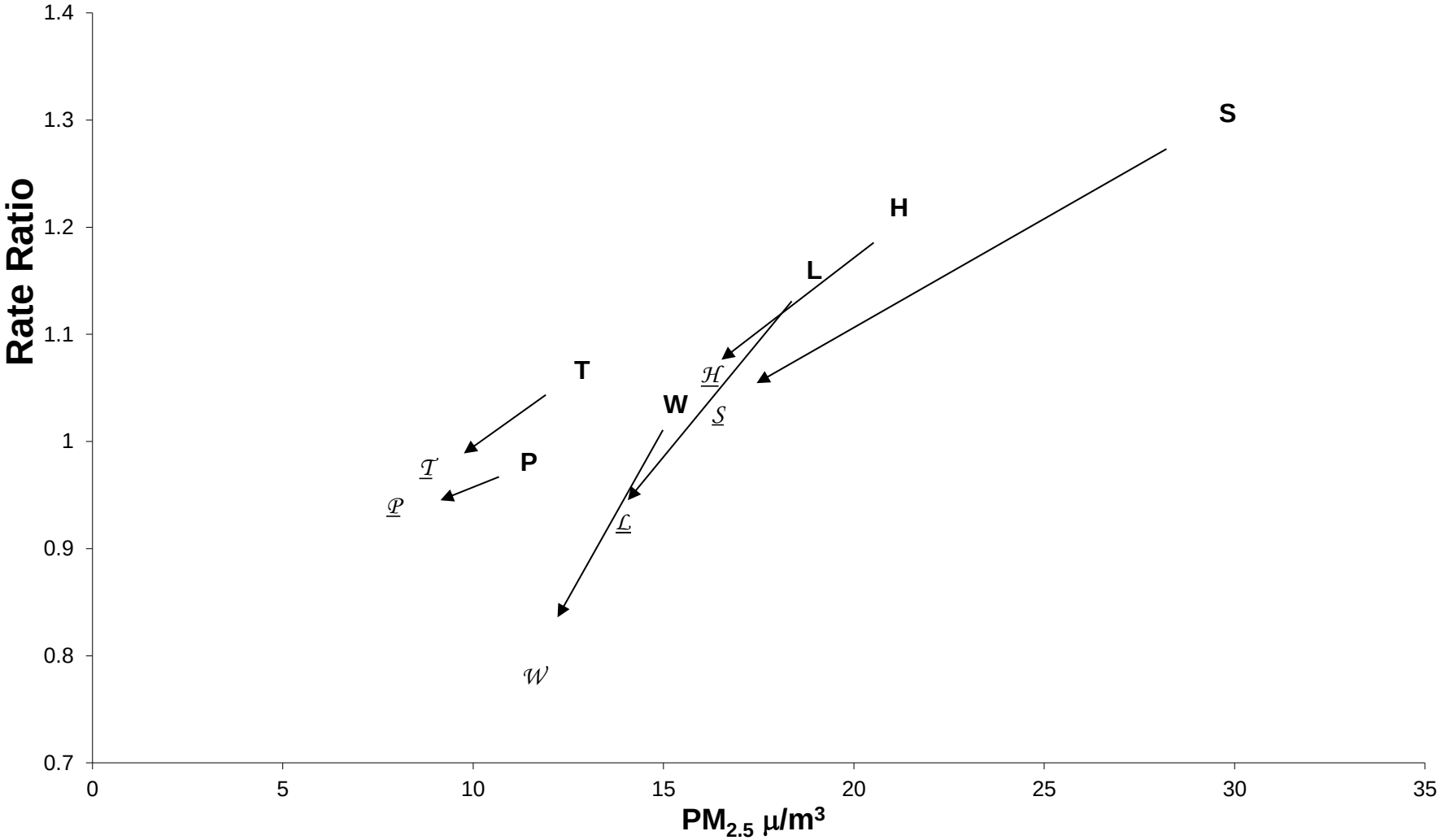
# They Kill People at Low Dose



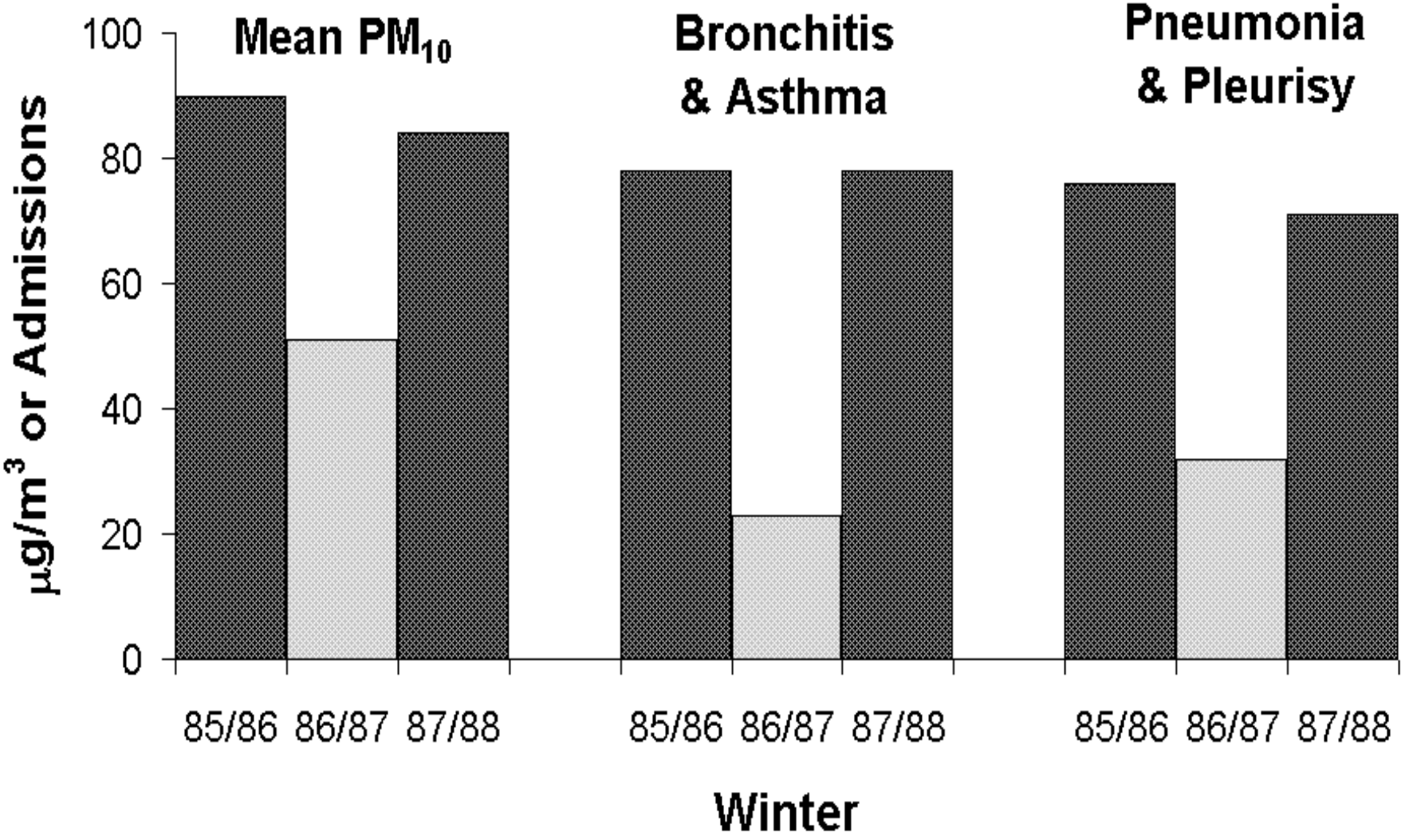
# If You Reduce Particles

- Fewer People Die

# Relative Risk of Death in Six US Cities during Two Follow-up Periods



# Utah Hospital Admissions
## Children 0-17 Year




Pope, Amer J Public Health 1989; 79: 623

# That is not all they do

- They Increase Blood Pressure
- They Increase Hardening of the Arteries
- They Increase Heart Attacks
- They Increase Asthma
- They lower Intelligence

- For Example

# Beijing Particle Mask Study

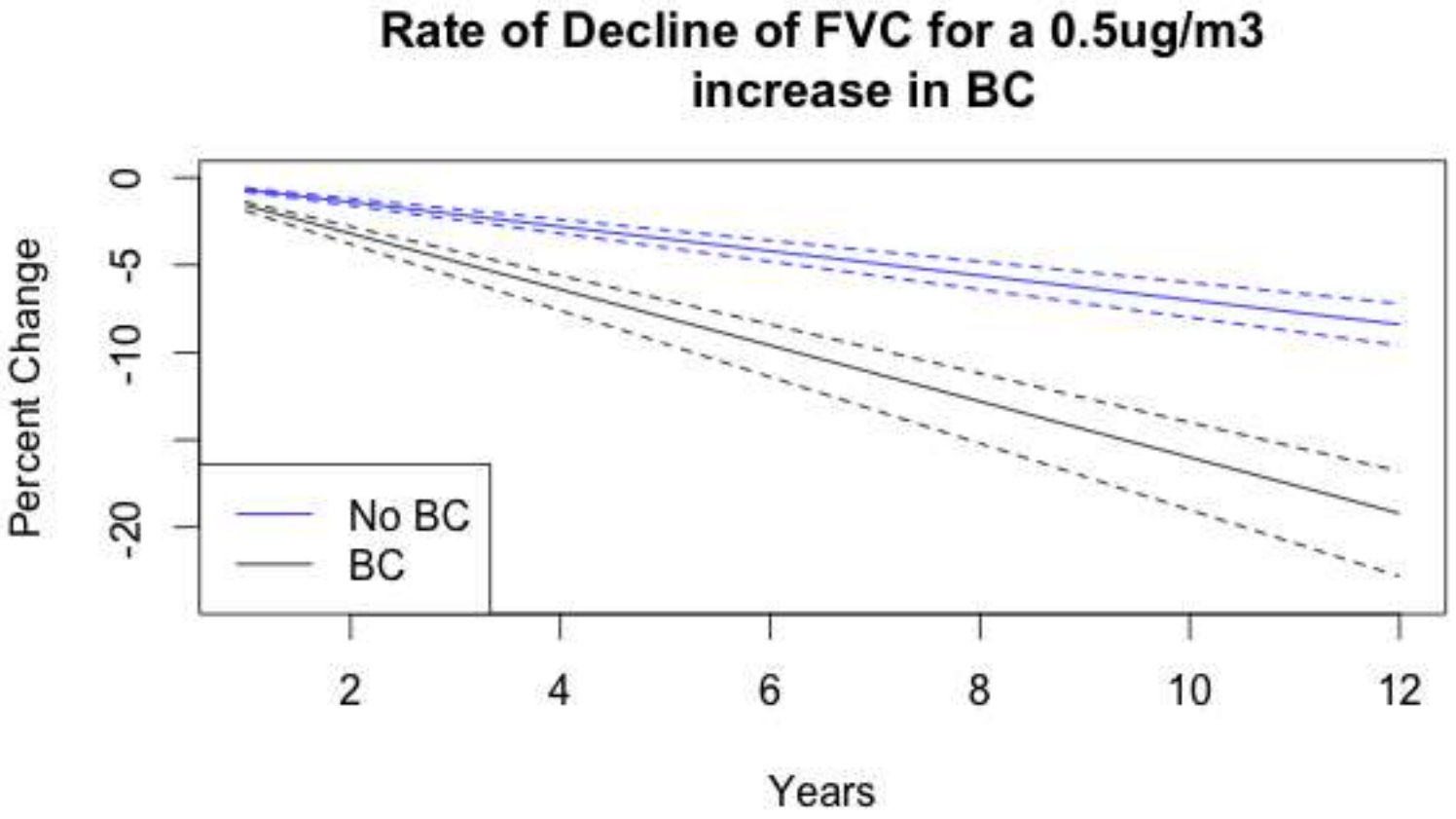
- People walked the same route twice
- Once wearing a mask that filtered out particles, once without the mask
- Blood pressure was 3 mmHg lower when they were wearing the mask
- ST segment depression less wearing mask

- Note this was Traffic Pollution

# Particles and Cognitive Ability

- Children exposed to traffic particles have lower IQ (Franco-Suglia 2008)
- Adults exposed to PM2.5 have faster rates of cognitive decline (Weuve 2012)
- Elderly exposed to traffic particles have lower cognitive ability (Power 2012)
- Animals exposed to particles have brain inflammation, particularly in the hippocampal area, which is key to memory (Campball 2005, Fonken 2011)

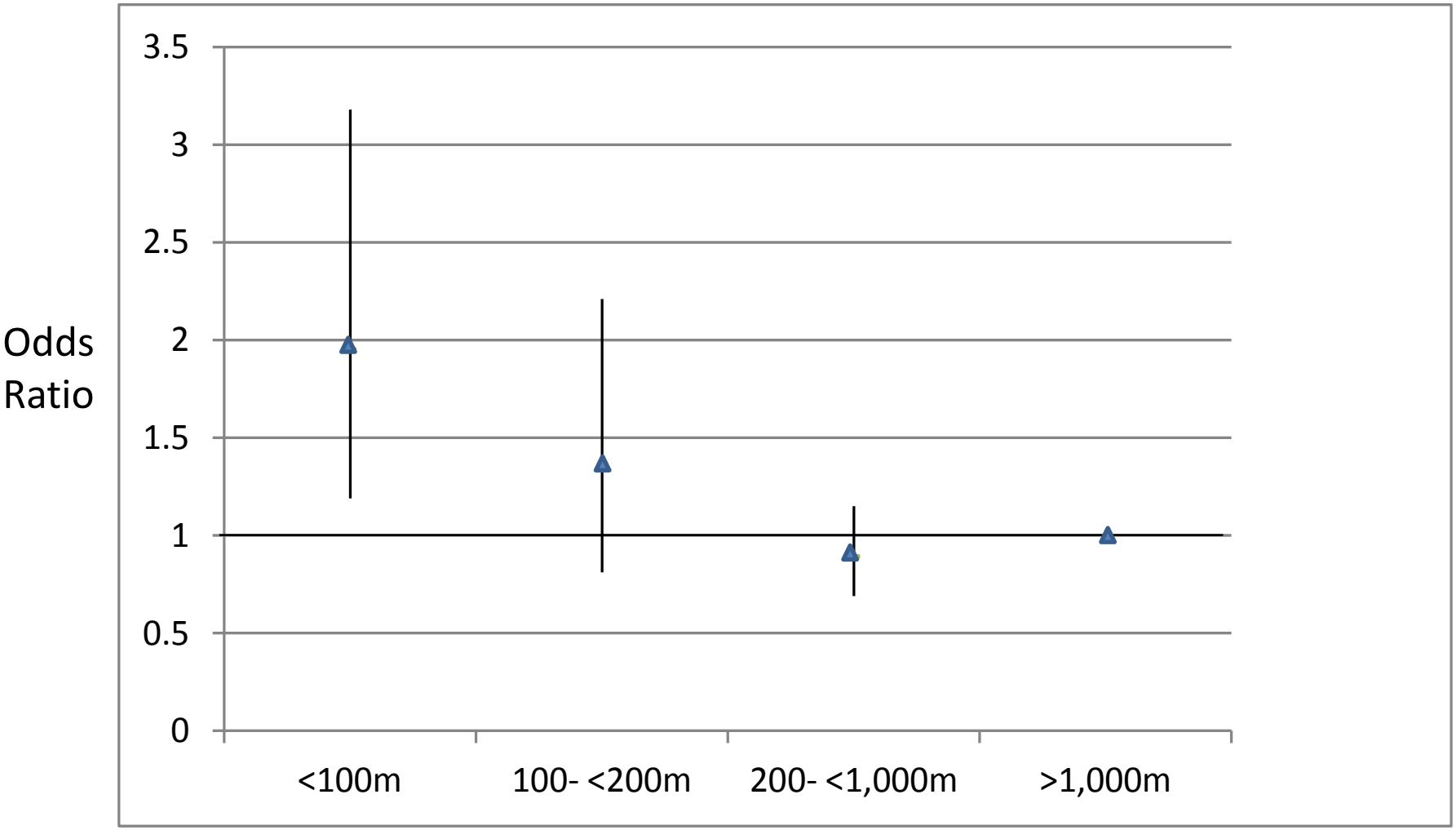
# Lung function decline according to black carbon exposure



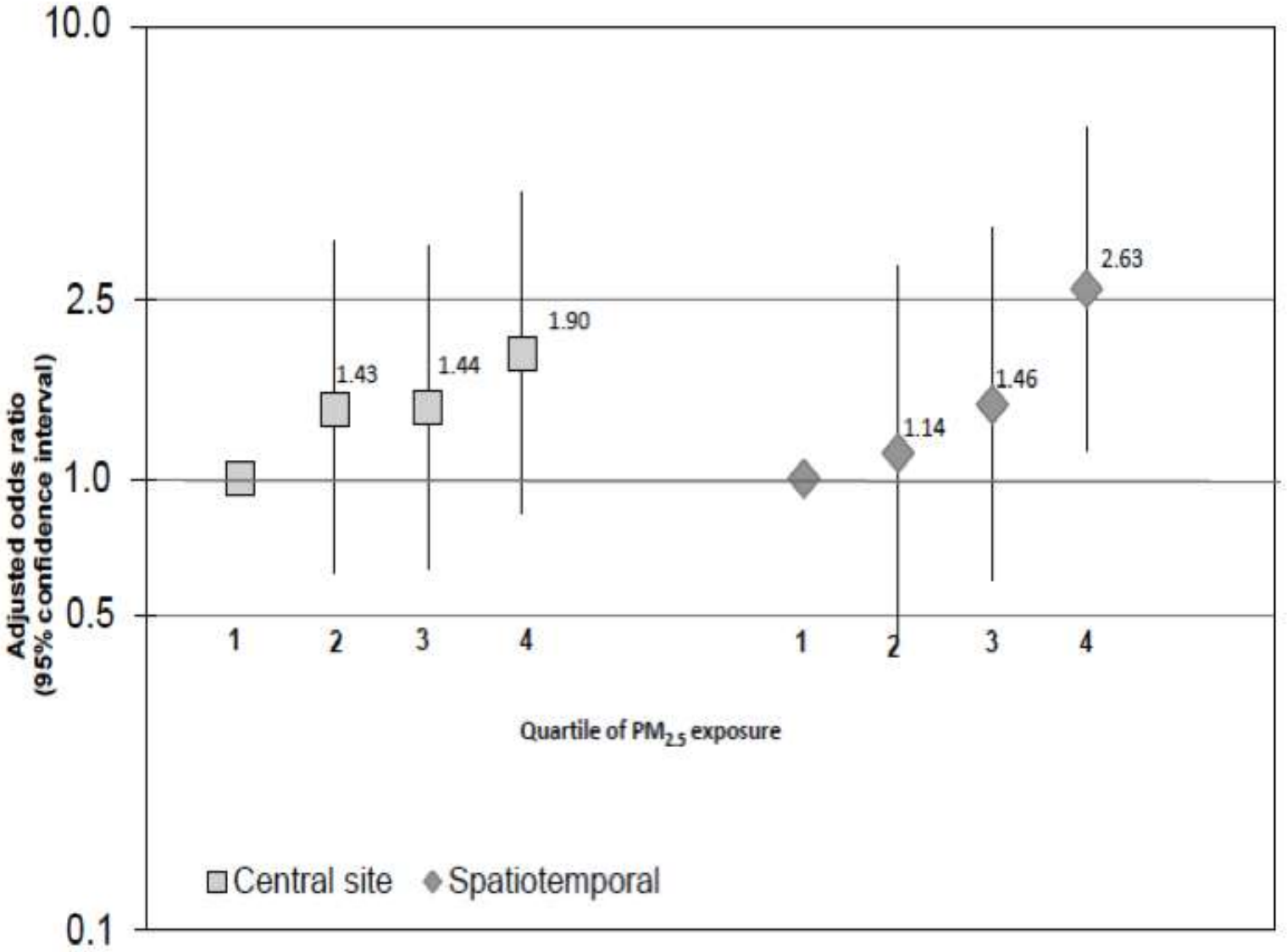

Note: Black Carbon is Diesel Particles

- Avol Lung Function Growth in Southern California Children's Cohort
  - Children who moved to more polluted areas had slower lung growth
  - Children who moved to less polluted areas had faster lung growth
- Downs looked at 11 years of lung function decline in Adults and Particles at residential address
  - Twice as high a rate between most and least polluted location

# Viva Birth Cohort: Distance to Roadway and Odds of Serious Respiratory Infection before age 2



# Odds Ratio for Impaired Glucose Tolerance during pregnancy



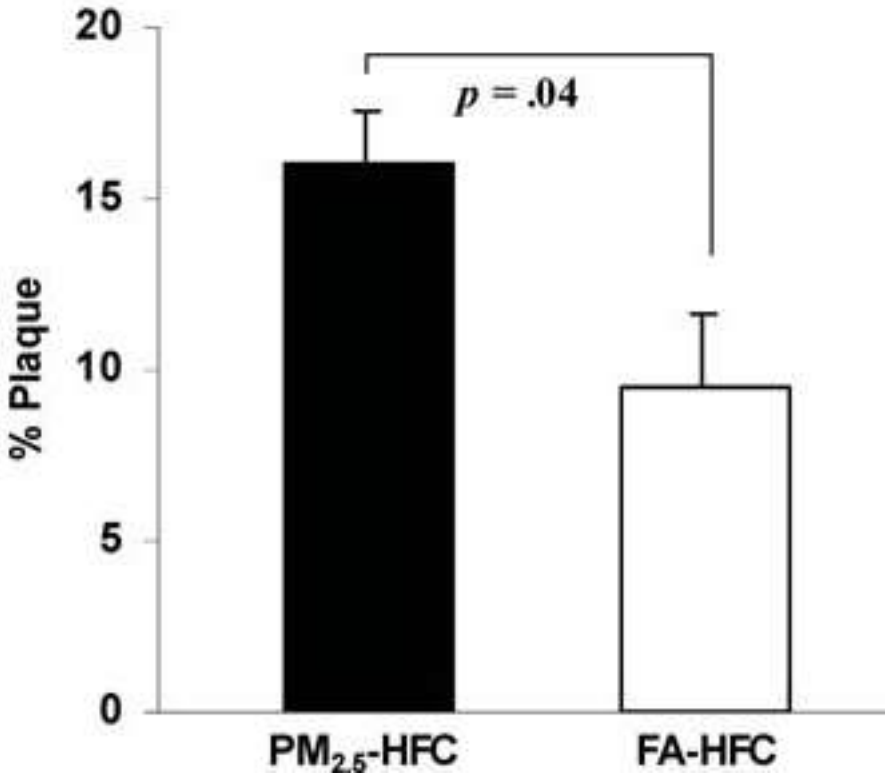
# Tonne et al (EHP 2007)

- Case-Control study of Heart Attack Registry in Worcester MA
- 5000 cases, 10000 controls
- 4% increase (95% CI 2,7) in risk of Heart attacks per interquartile range change in traffic density within 100m of home
- 5% increase (95% CI 3-6) per kilometer closer to major roadway

# How can this be Happening?

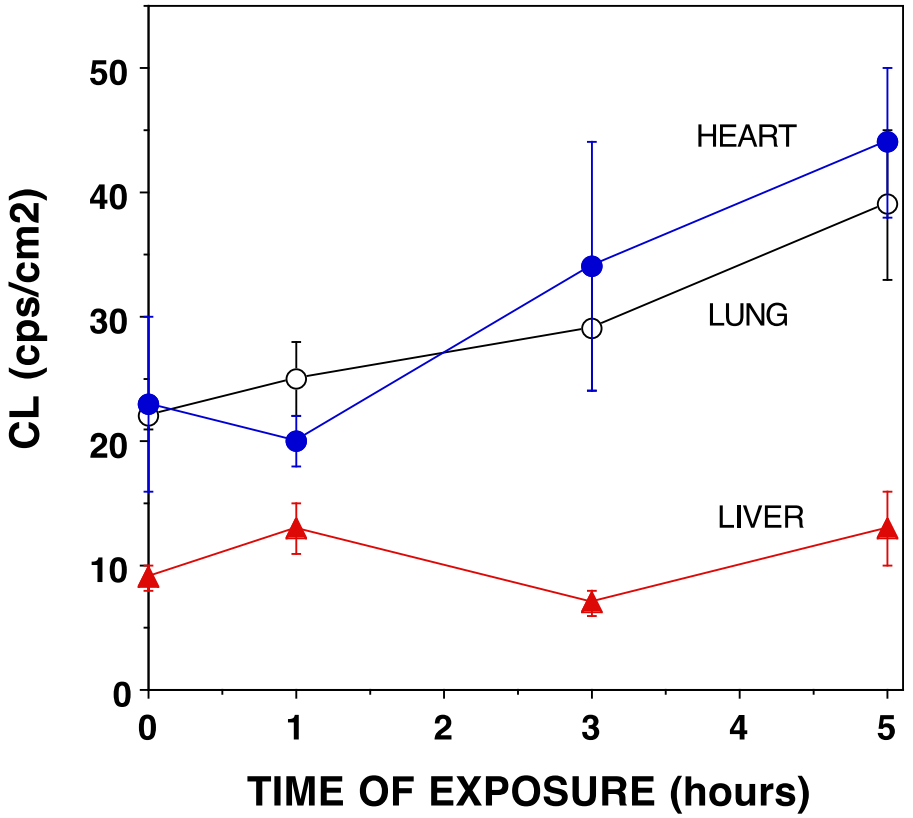
# Non-Smokers Lungs

# Percent of Aorta with plaque



# Particles Induce oxidants in the Heart and Lung

– Gurguera et al EHP 2003)




Chemiluminescence (CL) of lung, heart, and liver after various durations of Particle exposure.

# There is also evidence for NO2

- So what is the conclusion?

- Particles, particularly traffic particles, are associated with serious health effects
- Traffic particles vary strongly with distance to busy roads, amount of traffic, amount of Diesel
- Other traffic related gases are also a problem

# Solutions?

- More controls
  - E.g. only Euro 5 or 6 Diesel engines allowed in cities
  - Natural gas powered buses
- Less emissions
  - Less traffic
  - Ban wood burning in and near urban areas