

Healthcare in a Changing Climate: Understanding the Impacts on Virginians

Health Practitioners' Perspectives

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Pediatric Pulmonary
Carilion Children's

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Who is at more Risk?

LG: 8 yo AAM – Moderate Asthma

- 31 weeks birth
- Intermittent wheeze with illness
- ICS/LABA
 - FVC = 1.58 L (97%)
 - FEV1 = 1.22 L (84%)
- BMI = 28
- No outdoor play due to neighborhood

CP: 17yo WM - EIB

- Term birth, maternal smoking
- Allergic rhinitis: tree, grass, mold
- SABA prn, LTM seasonally
 - FVC = 4.45 L (83%)
 - FEV1 = 4.06 L (88%)
- BMI = 19
- Cross country team

“Near” Risks

Indoor air quality

- Homes and Schools
- Smoking, mold, other allergen, CO

Outdoor air quality

- Organic sources: pollens, organic industrial by products
- Pollution sources: local traffic, energy production, manufacturing,
- Local thermal inversion

“Far” Risks

- Regional and Global air pollution
- Greenhouse gases influences
- Extremes of heat and cold
- Floods and natural disasters
- Aeroallergens

Exercise Induced Bronchoconstriction and Environment

- Abnormal airway constriction in response to vigorous exercise
 - Airway mediators released in response to triggers
 - Triggers
 - Temperature
 - Humidity
 - Chemical irritants
 - Particulate matter
- EIB increases
- PM exposure
 - Ozone exposure
 - Low Humidity
 - NO₂ (asthmatics)
 - Glutathione depletion
 - Nitric oxide interactions

Air Pollen and Pollution Worsen Asthma Control

- *in vitro* studies show increased inflammation in sensitized cells
- Controlled pollutant exposures show negative pulmonary function
- Effect of Climate change/pollution is complicated
- Increased PM 2.5 and increased Pollen severity demonstrated poorer asthma control (Li *et al*) - PM2.5, O3, Pollen density
- Limitations
 - Patient population
 - Proximity to monitoring sites - ZIP
 - Indoor pollutants not included
 - Types of pollens/sensitization
 - Other outdoor pollutants

Li *et al.* Academic Pediatrics; 19: 615-23 (2019)

Mortality and Particulate Air Pollution

Multi-City Multi-Country Collaborative Research Network (MCC)

- 652 Urban areas in 24 countries/regions
- Environmental and health data - 1986-2015
- PM₁₀ – 598 cities
- PM_{2.5} – 499 cities
- Both – 445 cities in 16 countries
- Temperature, humidity, gaseous pollutants (ozone, NO₂, SO₂, CO)
- Estimate increase in mortality with increase PM

Mortality and Particulate Air Pollution

- Estimated *all-cause, cardiovascular, and respiratory mortality* affected by increase of PM_{2.5} and PM₁₀ (2-day moving average)
- Estimated change in mortality remained significant after adjustment for NO₂ and SO₂ (less for ozone, CO)
- Association of *all-cause mortality* stronger in locations with lower annual mean PM and higher annual mean Temperature
- Concentration-response curves flattened at high range concentration AND detectable at levels below most standards

Mortality and Particulate Air Pollution

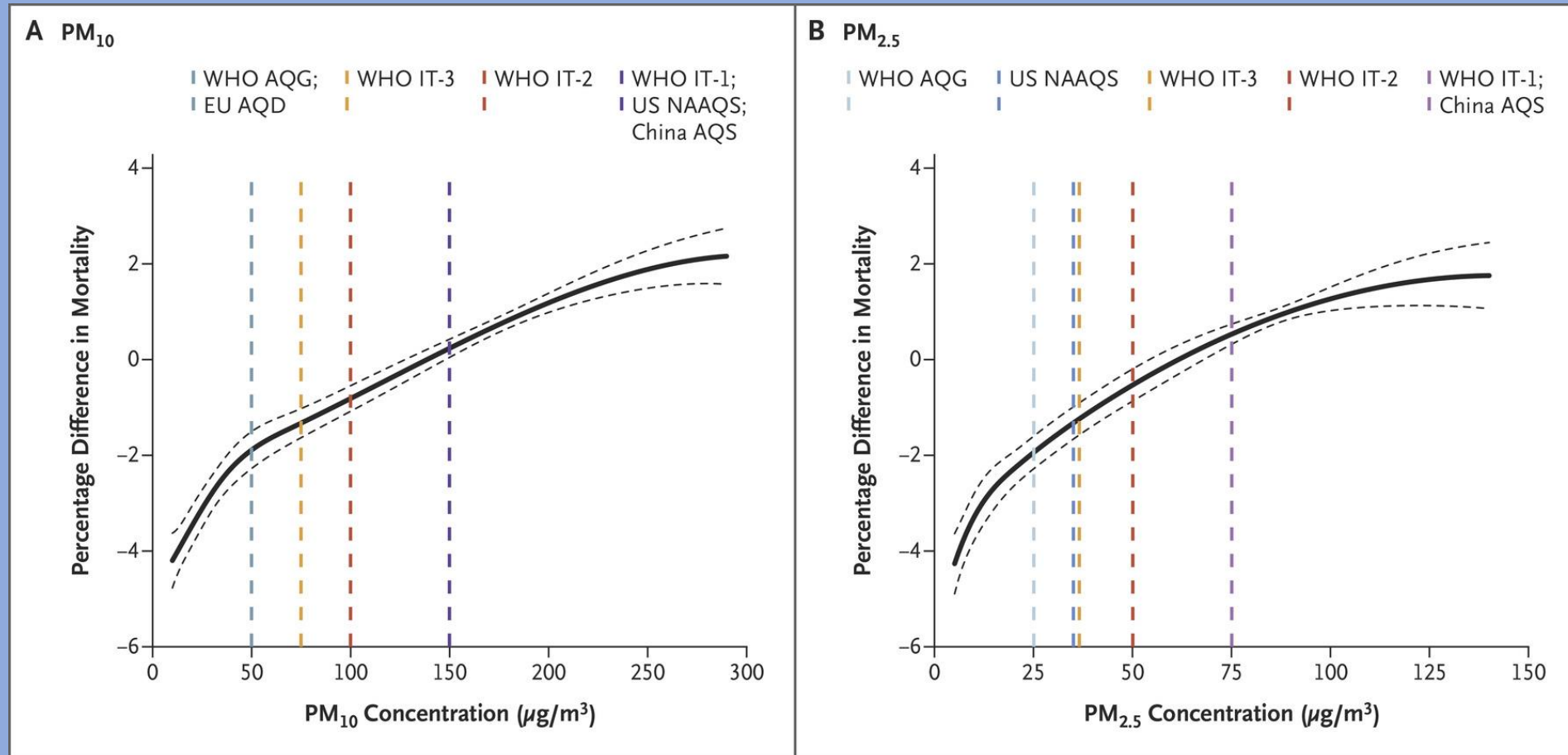


Figure 3

Asthma: Genetic susceptibility and Environmental pollutants

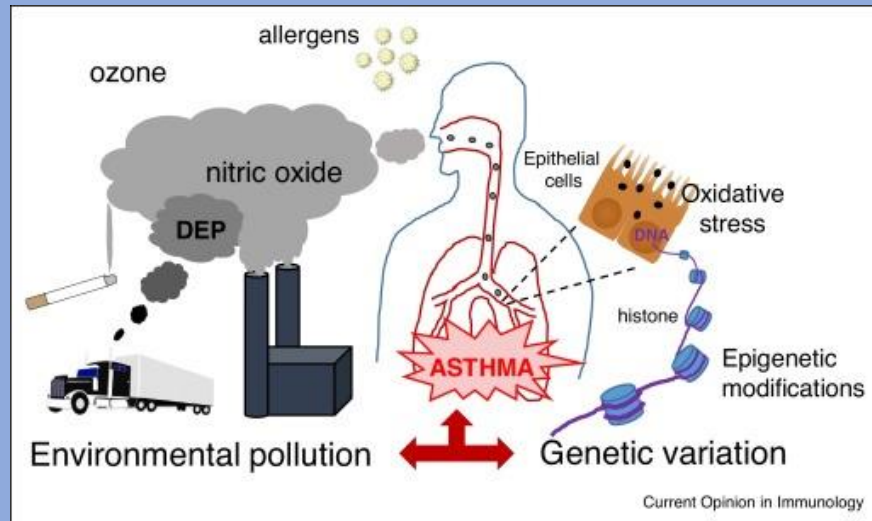


Figure 1. gene-air pollution interaction effects in asthma.

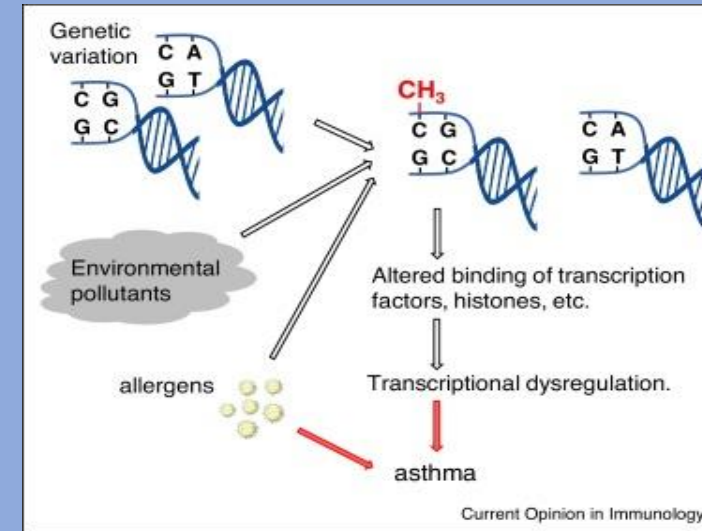


Figure 2. suggested biological mechanism for gene-air pollution interactions involving allele-specific DNA methylation of genetic loci

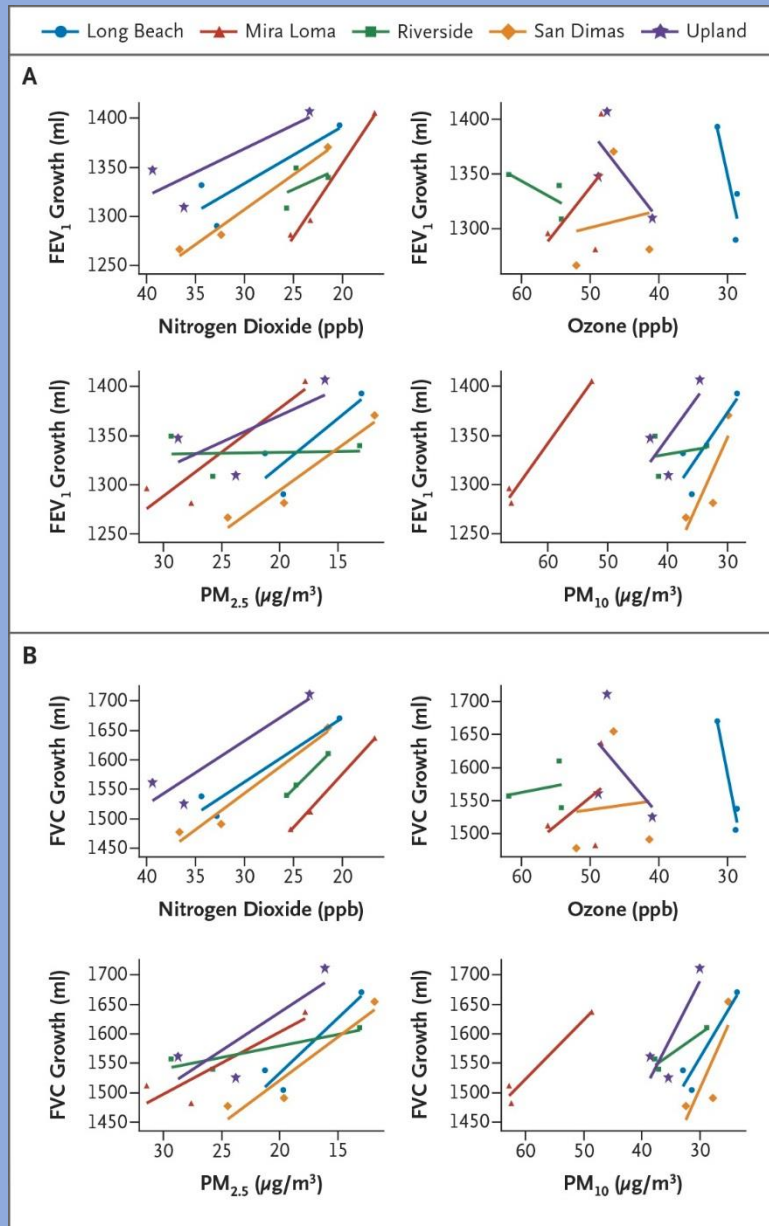


Figure 2

What Can Be Done?

- 4 year lung function in 3 cohorts
 - '94- '97, '97-2000, '07- '10
- With and without asthma
- Southern California
- ✓ Reduction in pollutants improved lung growth
- ✓ Increased proportion with normal Lung function