

# School of Medicine & Health Sciences

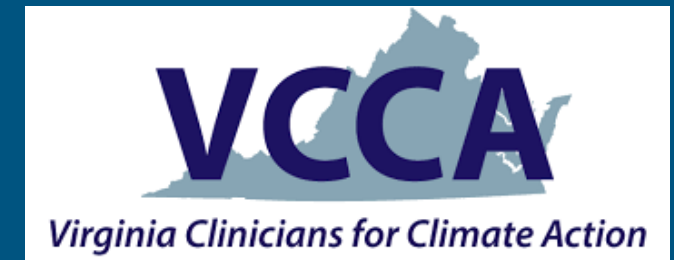
THE GEORGE WASHINGTON UNIVERSITY



## “Breathing easier for all” Particulate matter: A public health concern

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University School of Medicine and Health Sciences



“...patients are becoming the human face of  
the climate crisis.”  
–Dr. Renee Salas

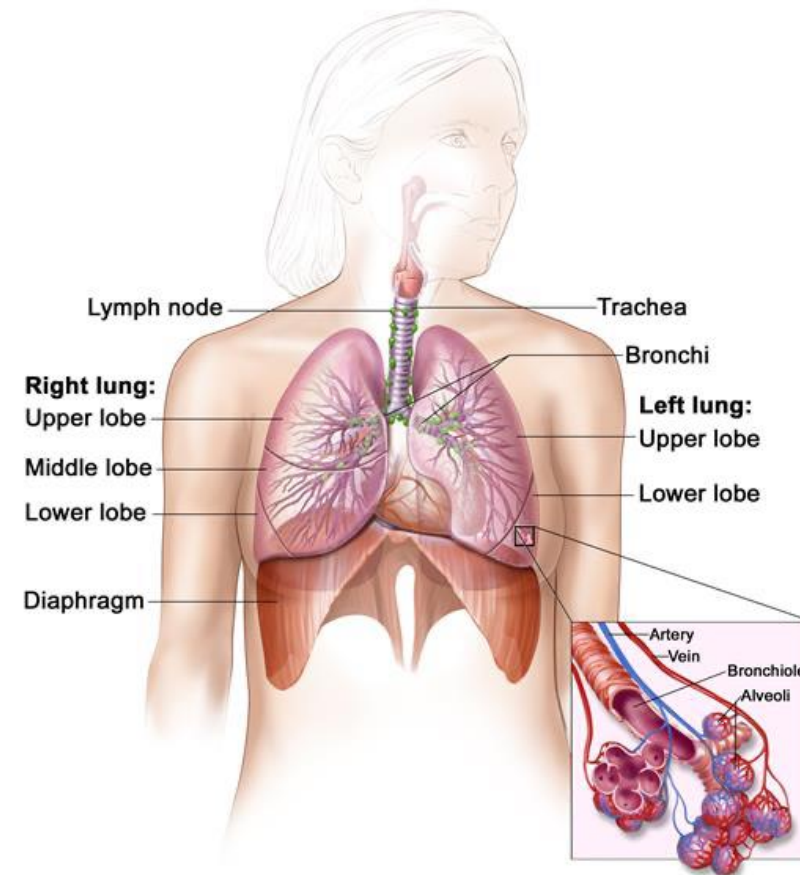
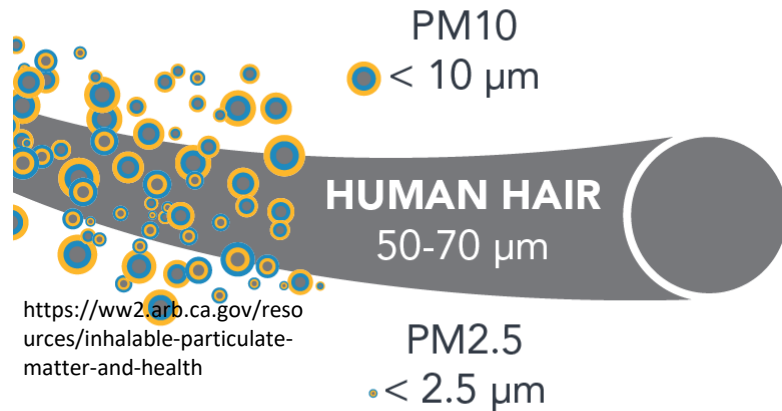
- Since the Clean Air Act was implemented in 1970
  - Emissions of major pollutants were reduced by 73% between 1990 and 2015
  - The EPA determined that 230,000 deaths were avoided per year due to lower concentrations of outdoor particulate matter
  - Economic benefits: valued at 2.0 trillion in 2020

- Nitrogen dioxide ( $\text{NO}_2$ )
- Sulfur dioxide ( $\text{SO}_2$ )
- Particulate matter
  - $<2.5 \mu\text{m}$  ( $\text{PM}_{2.5}$ )
    - Ultrafine PM
  - $<10 \mu\text{m}$  ( $\text{PM}_{10}$ )



<https://www.momscleanairforce.org/5-reasons-moms-need-a-strong-soot-standard/>

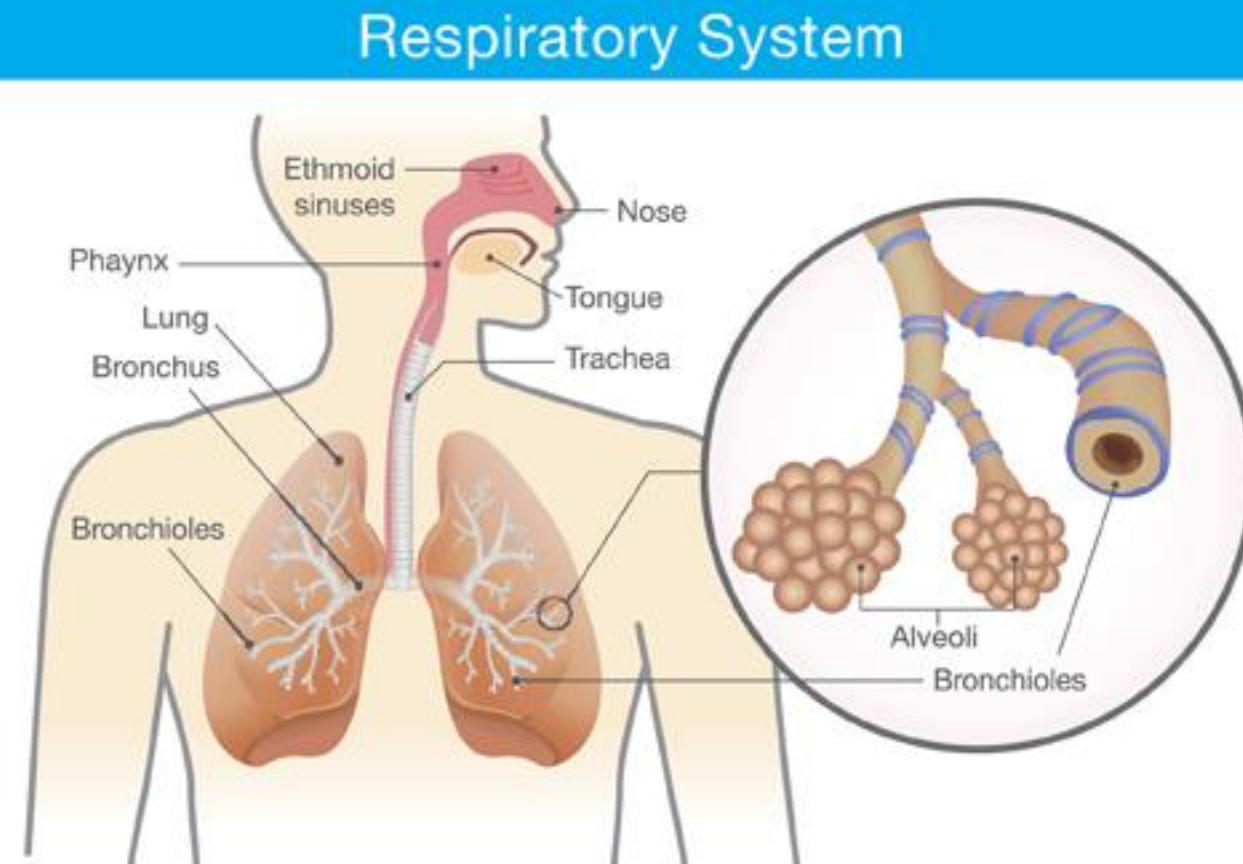
### Particulate Size Comparison



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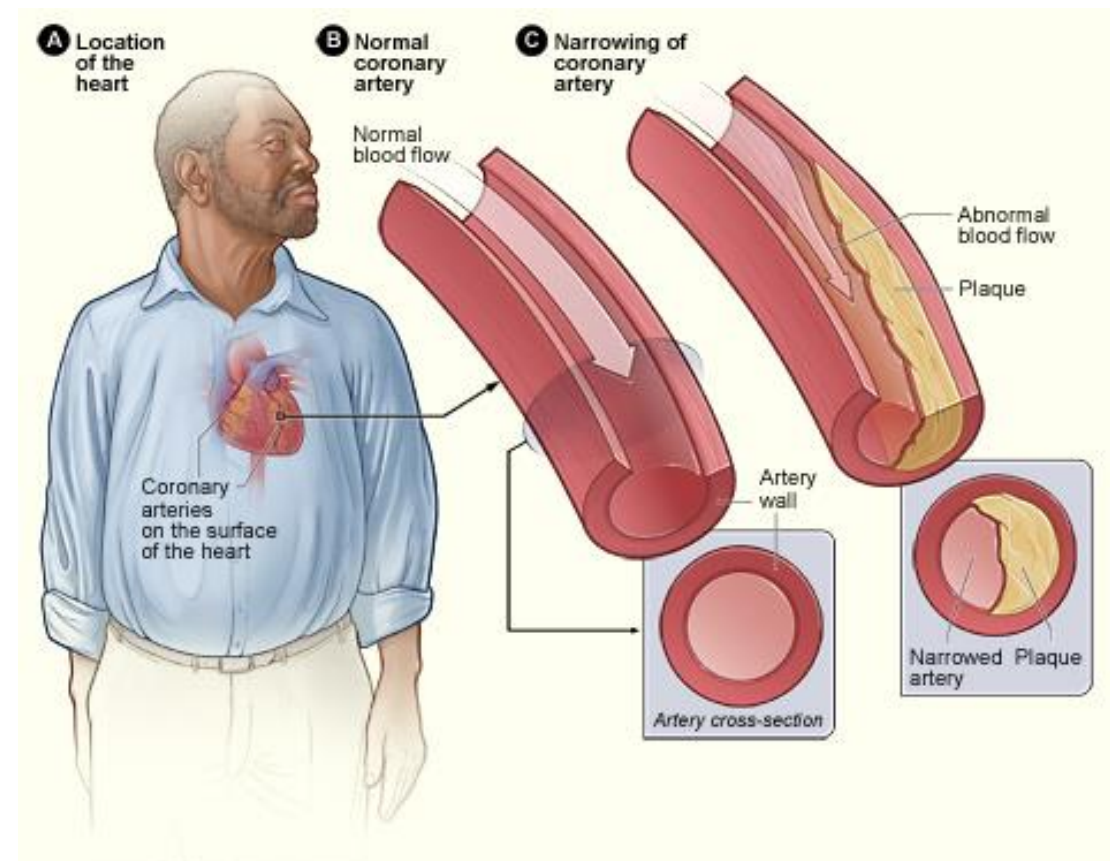
<https://www.cancer.gov/publications/dictionaries/cancer-terms/def/alveoli>

- Mechanisms
  - Oxidative Stress
  - Inflammation
    - Acute
    - Chronic
      - Airway remodeling



<https://www.elcaminohealth.org/stay-healthy/blog/understanding-lung-conditions>

- Increased cardiovascular disease
  - myocardial infarction (MI)
  - cardiac arrhythmias
  - ischemic stroke
  - vascular dysfunction
  - hypertension
  - atherosclerosis
- Mechanisms linking particulate matter and cardiovascular disease
  - Direct
  - Indirect



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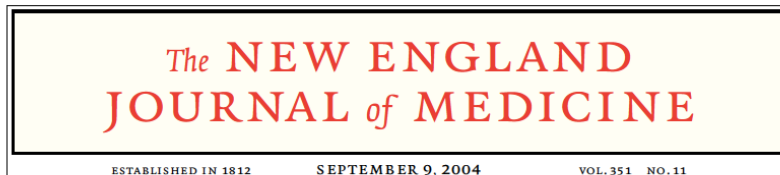
VOL. 381 NO. 8

Ambient Particulate Air Pollution and Daily Mortality in 652 Cities

C. Liu, R. Chen, F. Sera, A.M. Vicedo-Cabrera, Y. Guo, S. Tong, M.S.Z.S. Coelho, P.H.N. Saldiva, E. Lavigne, P. Matus, N. Valdes Ortega, S. Osorio Garcia, M. Pascal, M. Stafoggia, M. Scortichini, M. Hashizume, Y. Honda, M. Hurtado-Díaz, J. Cruz, B. Nunes, J.P. Teixeira, H. Kim, A. Tobias, C. Íñiguez, B. Forsberg, C. Åström, M.S. Ragettli, Y.-L. Guo, B.-Y. Chen, M.L. Bell, C.Y. Wright, N. Scovronick, R.M. Garland, A. Milojevic, J. Kyselý, A. Urban, H. Orru, E. Indermitte, J.J.K. Jaakkola, N.R.I. Rytö, K. Katsouyanni, A. Analitis, A. Zanobetti, J. Schwartz, J. Chen, T. Wu, A. Cohen, A. Gasparrini, and H. Kan

- In more than 600 cities across the globe, data shows an independent association between short-term exposure to  $PM_{10}$  and  $PM_{2.5}$  and:
  - Daily all-cause cardiovascular mortality
  - Daily all-cause respiratory mortality





The Effect of Air Pollution on Lung Development  
from 10 to 18 Years of Age

W. James Gauderman, Ph.D., Edward Avol, M.S., Frank Gilliland, M.D., Ph.D., Hita Vora, M.S.,  
Duncan Thomas, Ph.D., Kiros Berhane, Ph.D., Rob McConnell, M.D., Nino Kuenzli, M.D., Fred Lurmann, M.S.,  
Edward Rappaport, M.S., Helene Margolis, Ph.D., David Bates, M.D., and John Peters, M.D.

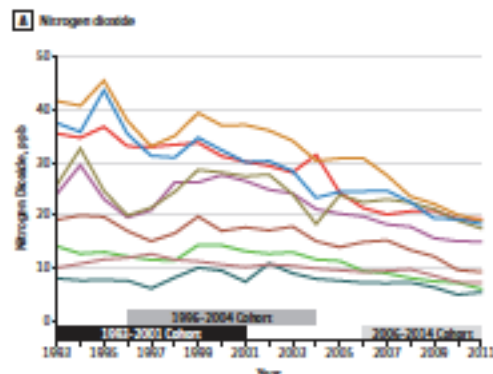
- Results of the study demonstrate that current levels of air pollution have a chronic, adverse affect on lung development in children from the ages of 10 to 18 years

JAMA | Original Investigation

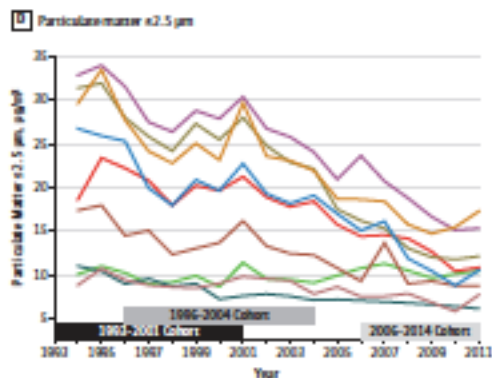
## Association of Changes in Air Quality With Incident Asthma in Children in California, 1993-2014

Erika Garcia, PhD; Kiroos T. Berhane, PhD; Talat Islam, PhD; Rob McConnell, MD; Robert Urman, PhD; Zhanghua Chen, PhD; Frank D. Gilliland, MD, PhD

NO<sub>2</sub>

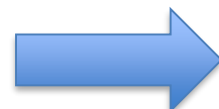
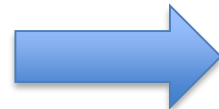
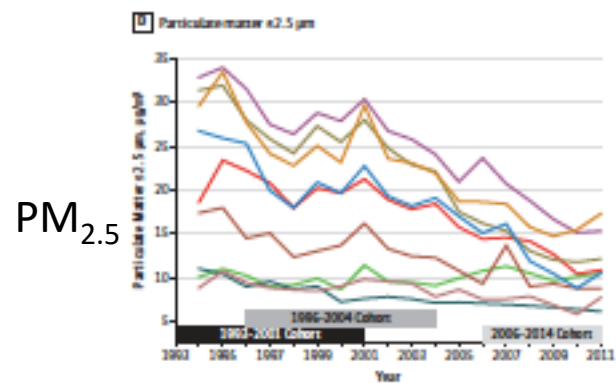
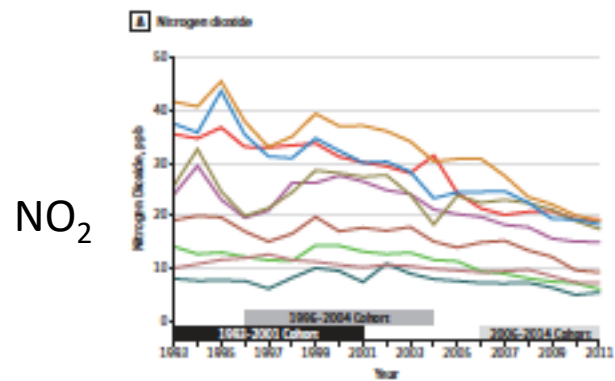


PM<sub>2.5</sub>

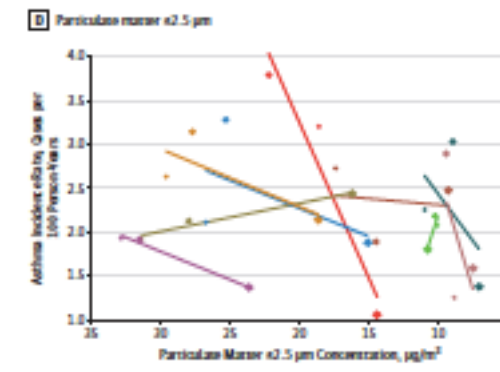
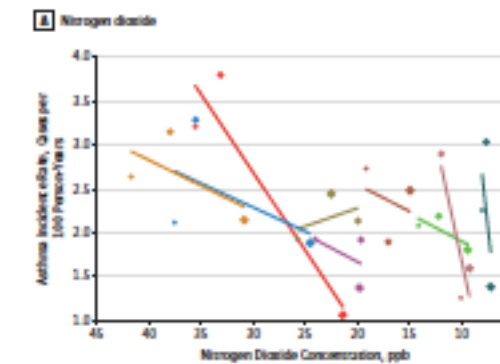


JAMA | Original Investigation  
**Association of Changes in Air Quality With Incident Asthma  
 in Children in California, 1993-2014**

Elisa Garcia, PhD; Kiroi T. Barham, PhD; Talat Islam, PhD; Rob McCormell, MD; Robert Utman, PhD;  
 Zhanghua Chen, PhD; Frank D. Gilliland, MD, PhD



## Asthma incidence



- Clean air is important for health.
- Traffic related air pollution is a public health concern.
- Electrification of vehicles is an important step in decreasing the amount of traffic related air pollution.

- Questions/future connections
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  - Instagram: @NeeluTummala
  
- Virginia Clinicians for Climate Action
  - Twitter: @VA\_Clinicians
  - Website: [www.virginiaclinicians.org](http://www.virginiaclinicians.org)

