

School of Medicine & Health Sciences

THE GEORGE WASHINGTON UNIVERSITY



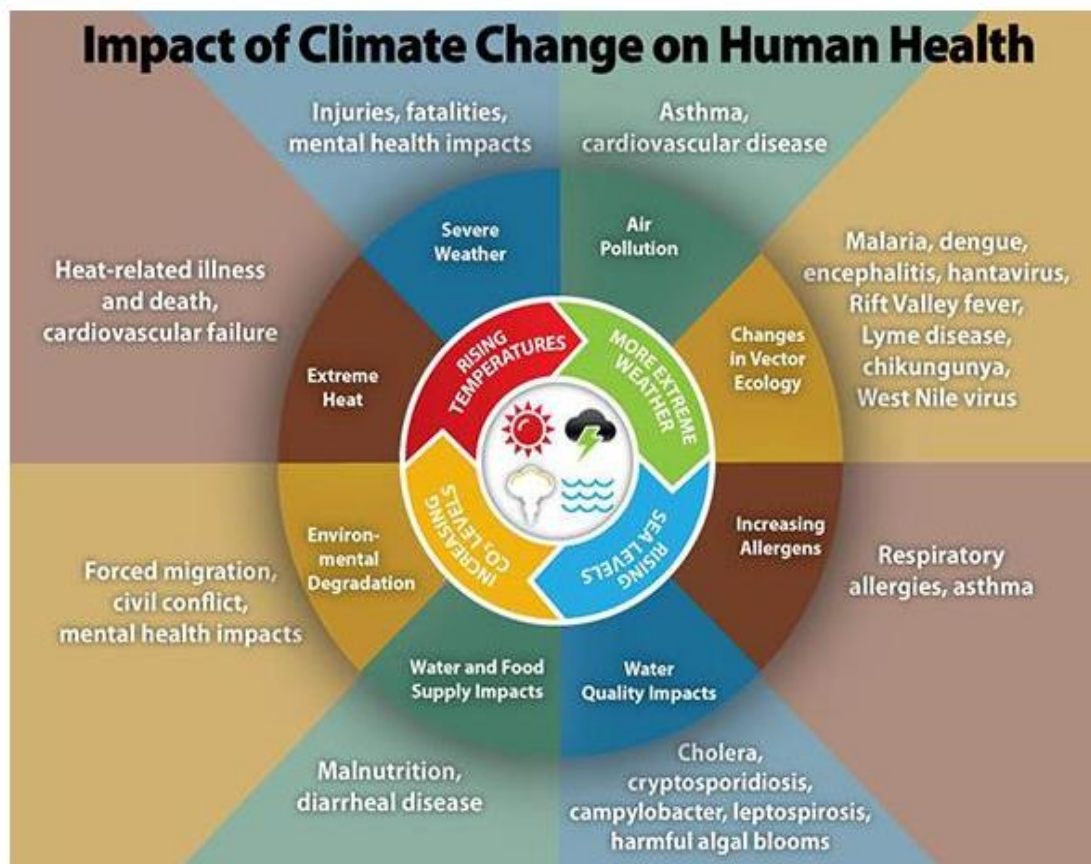
Climate Change and Health

Neelu Tummala, MD

Clinical Assistant Professor of Surgery at George Washington
University School of Medicine and Health Sciences

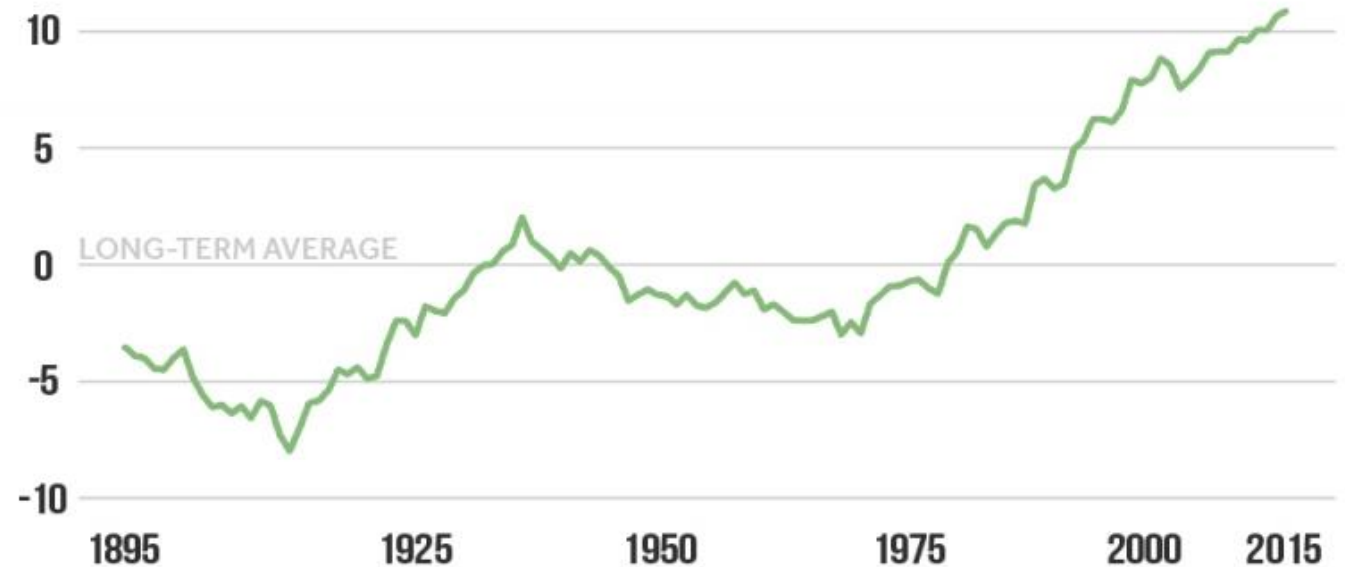
“...patients are becoming the human face of
the climate crisis.”
–Dr. Renee Salas

Impact of Climate Change on Human Health (CDC)



- Longer pollen season
- Increased production and potency of pollen
- Introduction of new allergen-producing plant species

Longer U.S. Growing Season More Days Above Freezing

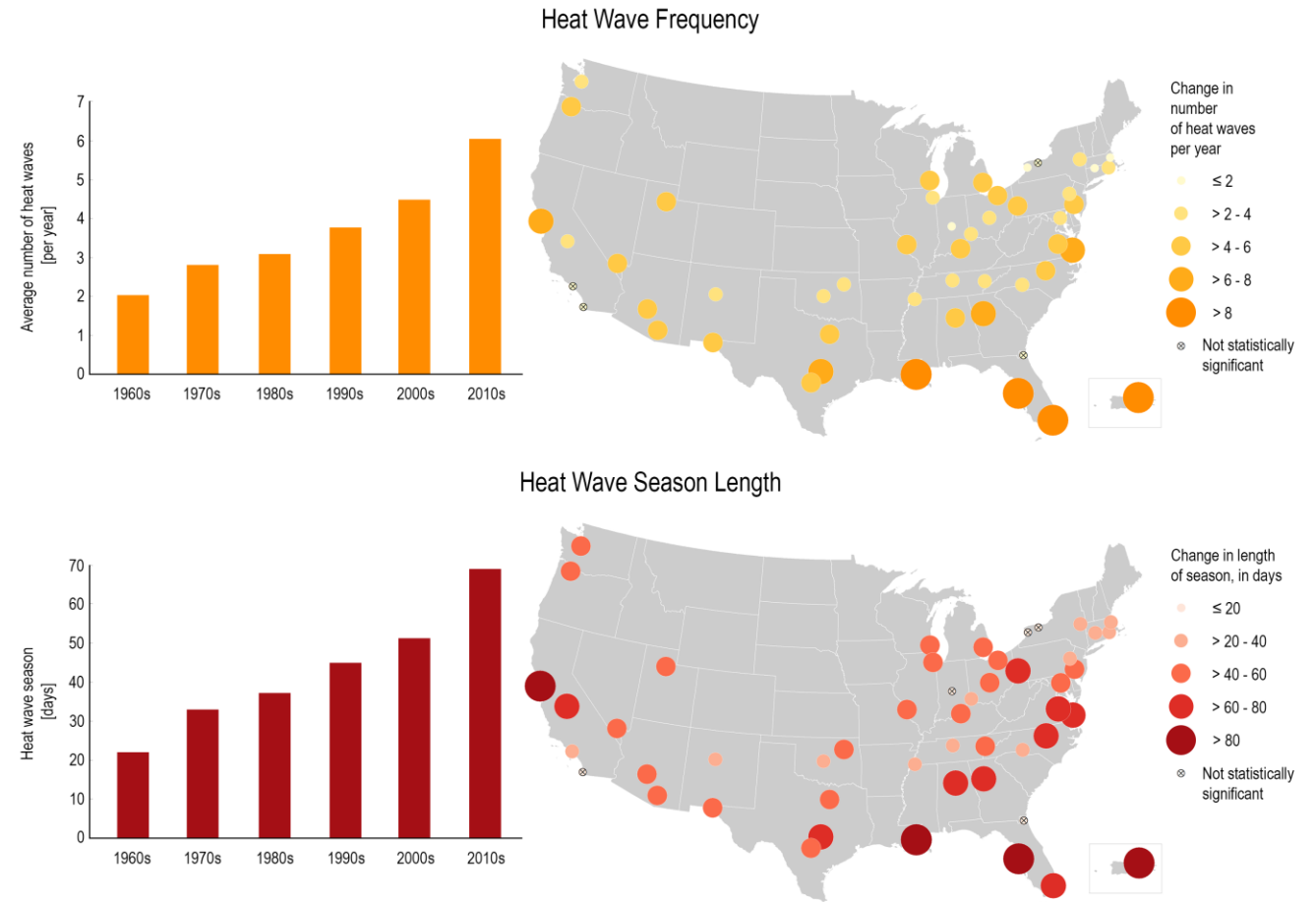


Source: EPA/Kunkel 2016
Derivation from average days, based on frost-free season

<https://www.climatecentral.org/news/report-pollen-allergies-climate-change>

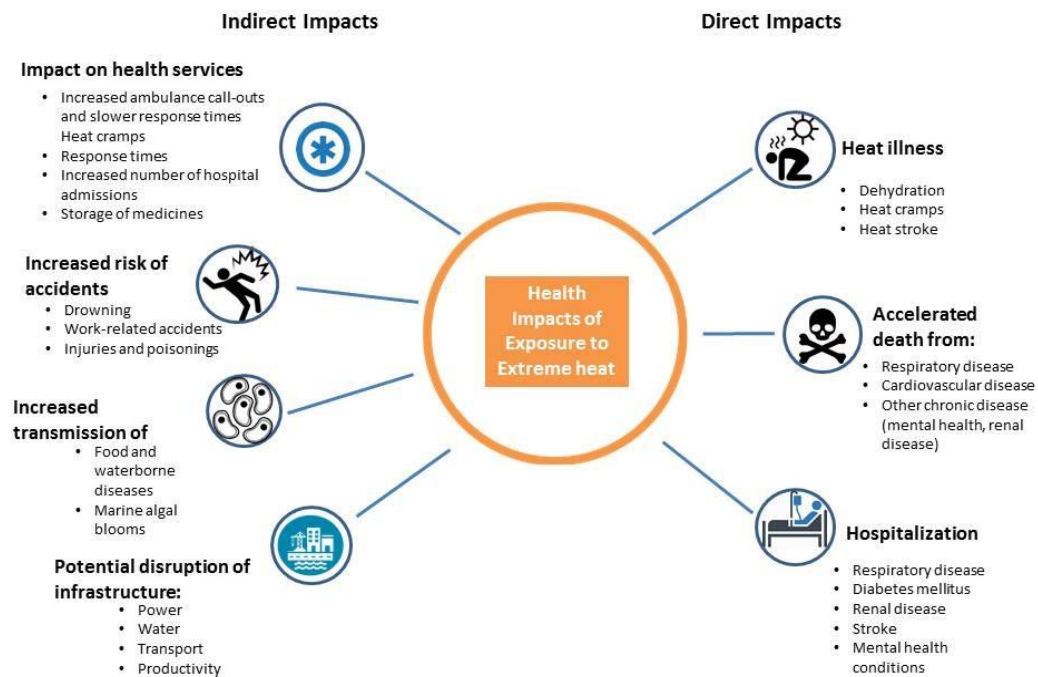
- Heat is the top killer among all types of weather hazards, including hurricanes and tornadoes.

Heat Wave Characteristics in 50 Large U.S. Cities, 1961-2018

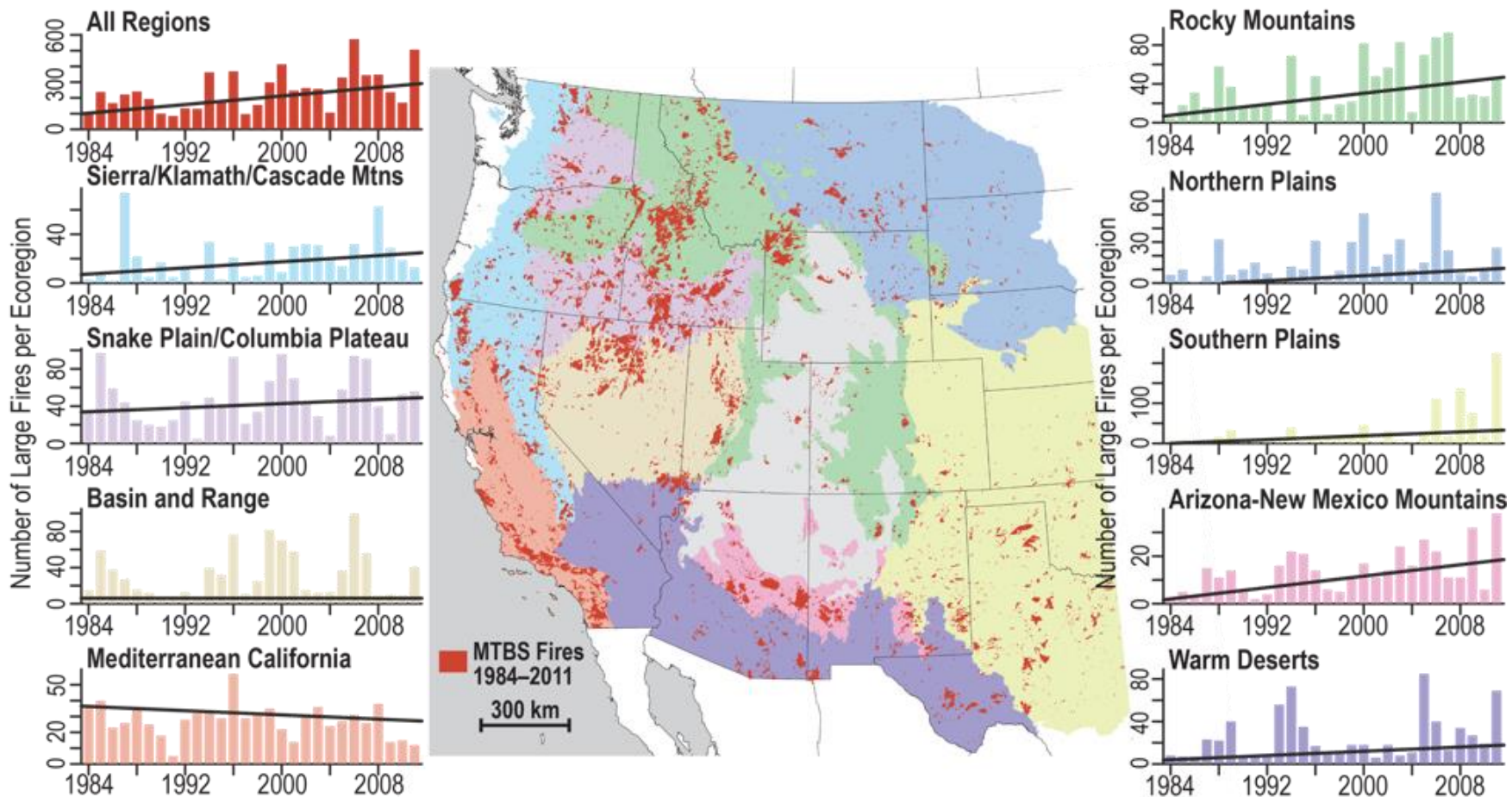


<https://www.globalchange.gov/browse/indicators/us-heat-waves>

Multiple vulnerabilities increase the risk of health impacts:



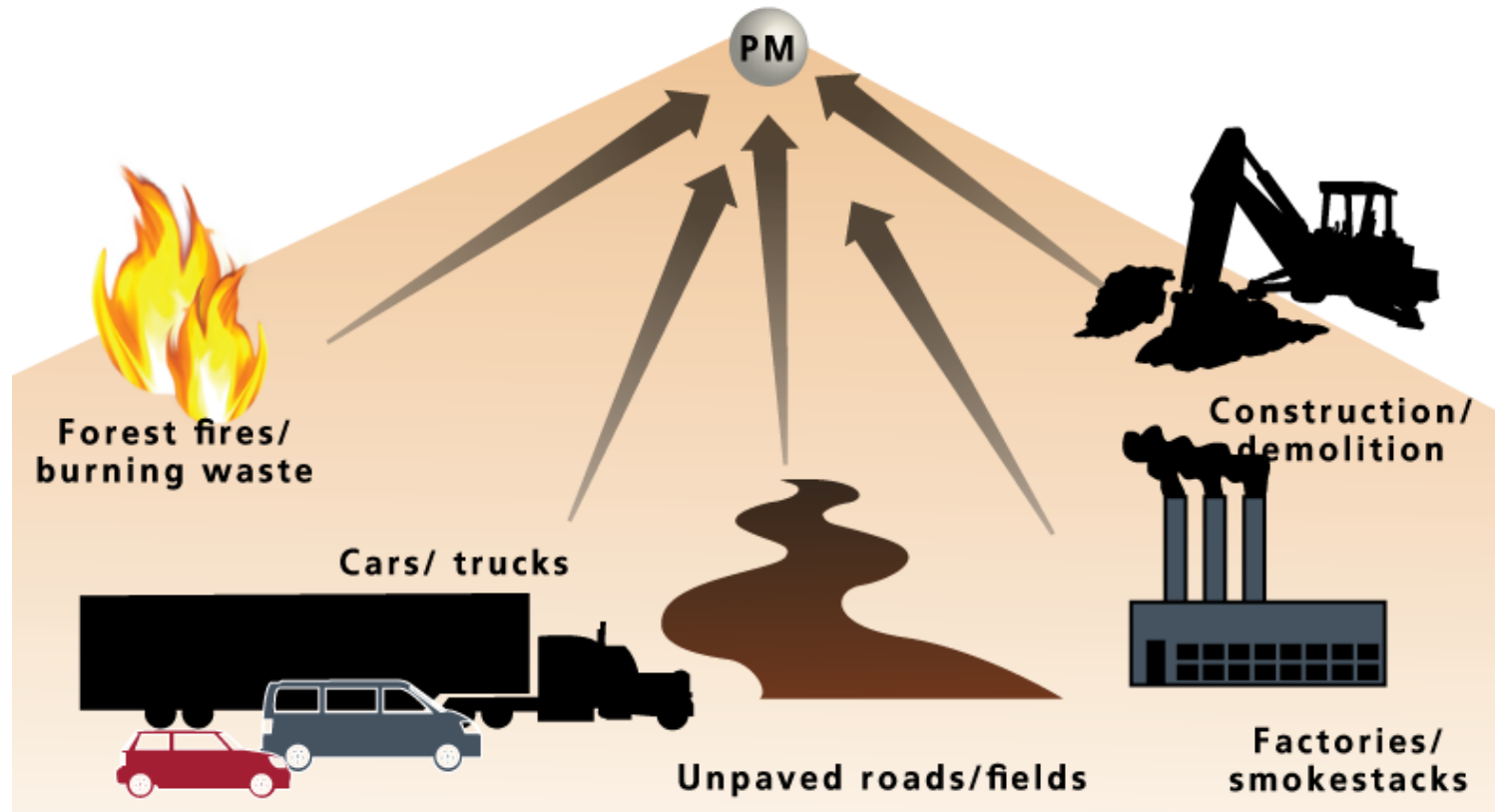
Increase in wildfires



- 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

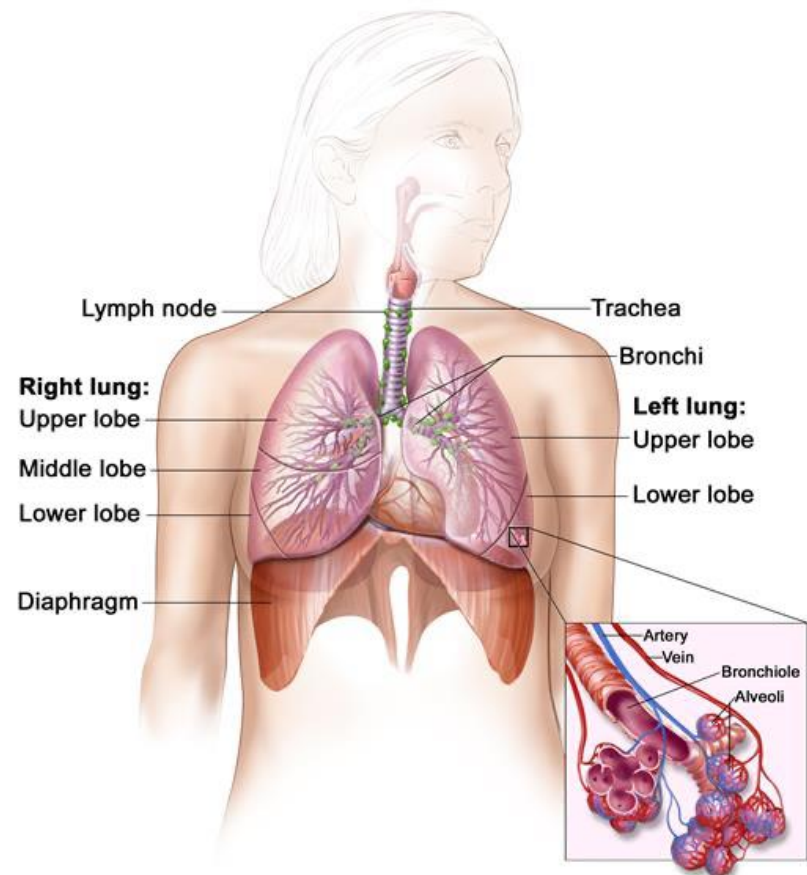
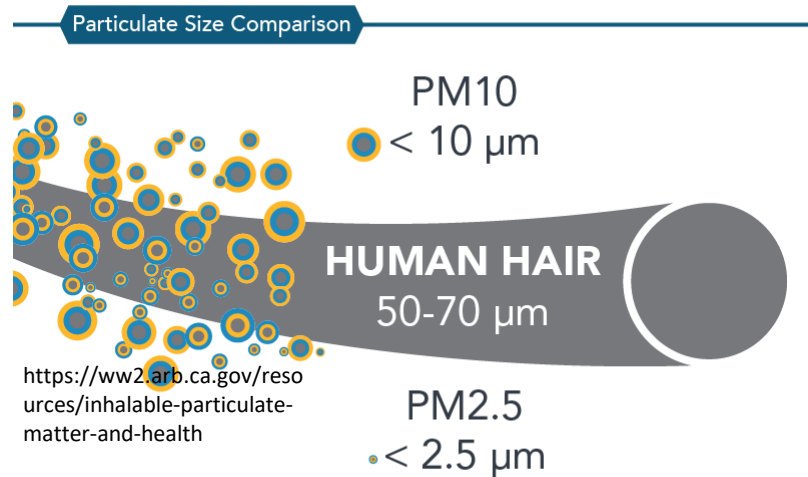
PRIMARY PARTICULATE MATTER

Emitted directly from a source into the atmosphere.



<https://eschool.iaspaper.net/air-pollution/particulate-pollutants/>

Size of particulate matter impacts health



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

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

- Mechanisms linking particulate matter and cardiovascular disease
 - Direct
 - Indirect

The NEW ENGLAND
JOURNAL *of* MEDICINE

ESTABLISHED IN 1812

AUGUST 22, 2019

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. Iñiguez, 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. Kysely, 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

- Data shows an independent association between short-term exposure to PM_{10} and $PM_{2.5}$ and daily all-cause, cardiovascular, and respiratory mortality in more than 600 cities across the globe.

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ESTABLISHED IN 1812 SEPTEMBER 9, 2004 VOL. 351 NO. 11

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., Kiro 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

Review article

Exposure to traffic-related air pollution and risk of development of childhood asthma:
A systematic review and meta-analysis



Results from this meta-analysis indicate a statistically significant association of exposure to black carbon, nitrogen dioxide, PM_{2.5}, and PM₁₀ and risk of asthma development.

Original Investigation | Environmental Health

Association of Air Pollution and Heat Exposure With Preterm Birth, Low Birth Weight, and Stillbirth in the US A Systematic Review

Bruce Bekkar, MD; Susan Pacheco, MD; Rupa Basu, PhD; Nathaniel DeNicola, MD, MSHP



Climate Change Tied to Pregnancy Risks, Affecting Black Mothers Most
Women exposed to high temperatures or air pollution are more likely to have premature, underweight or stillborn babies, a look at 32 million U.S. births found. (*The New York Times*)

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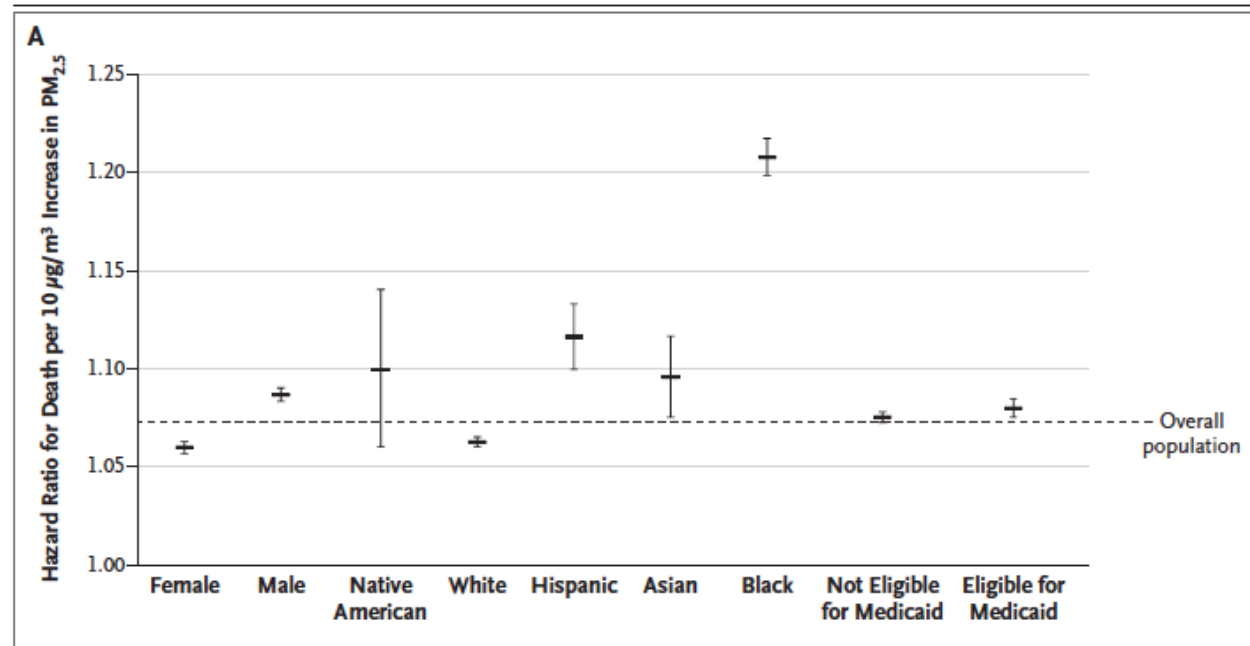
ESTABLISHED IN 1812

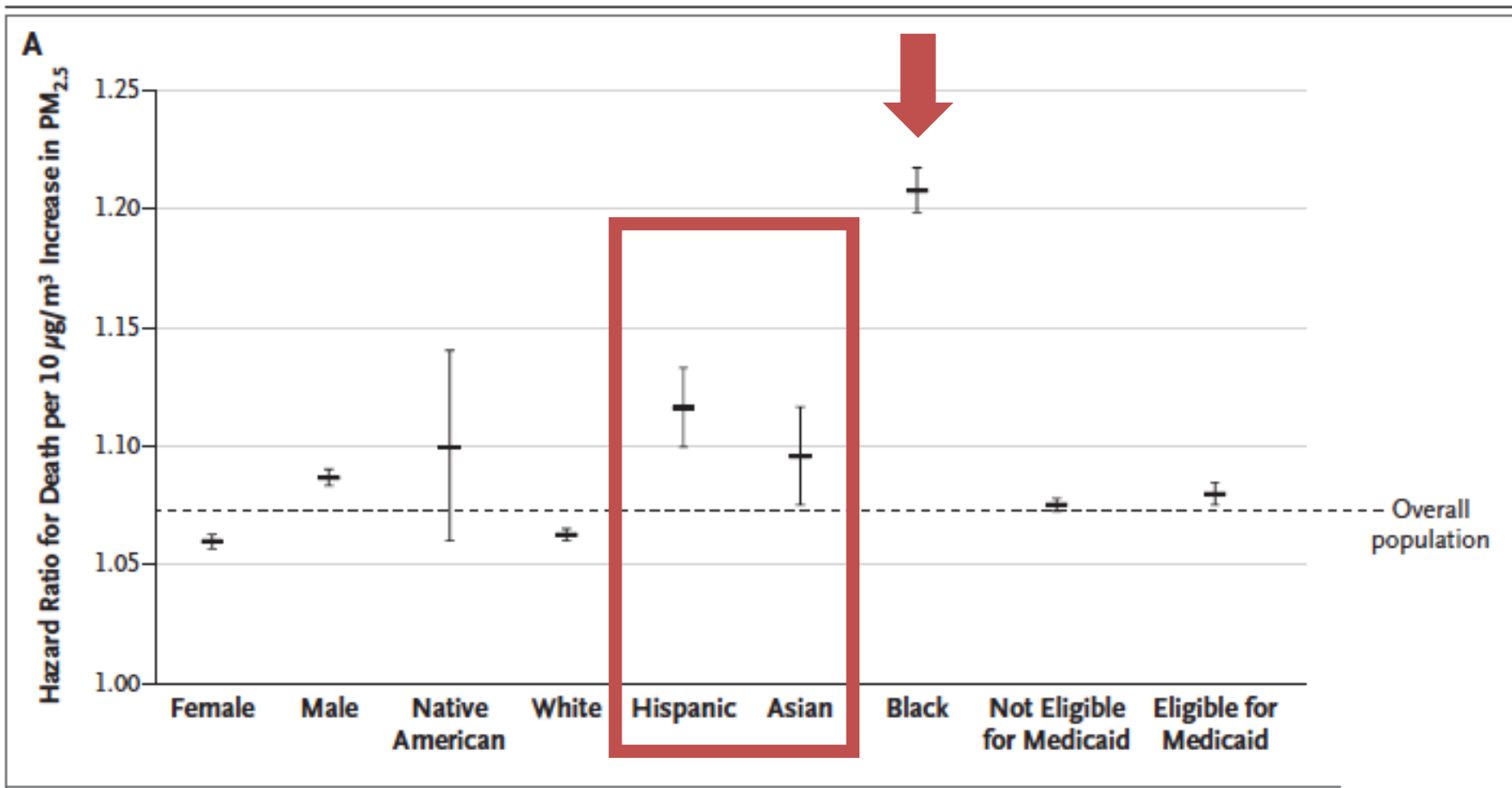
JUNE 29, 2017

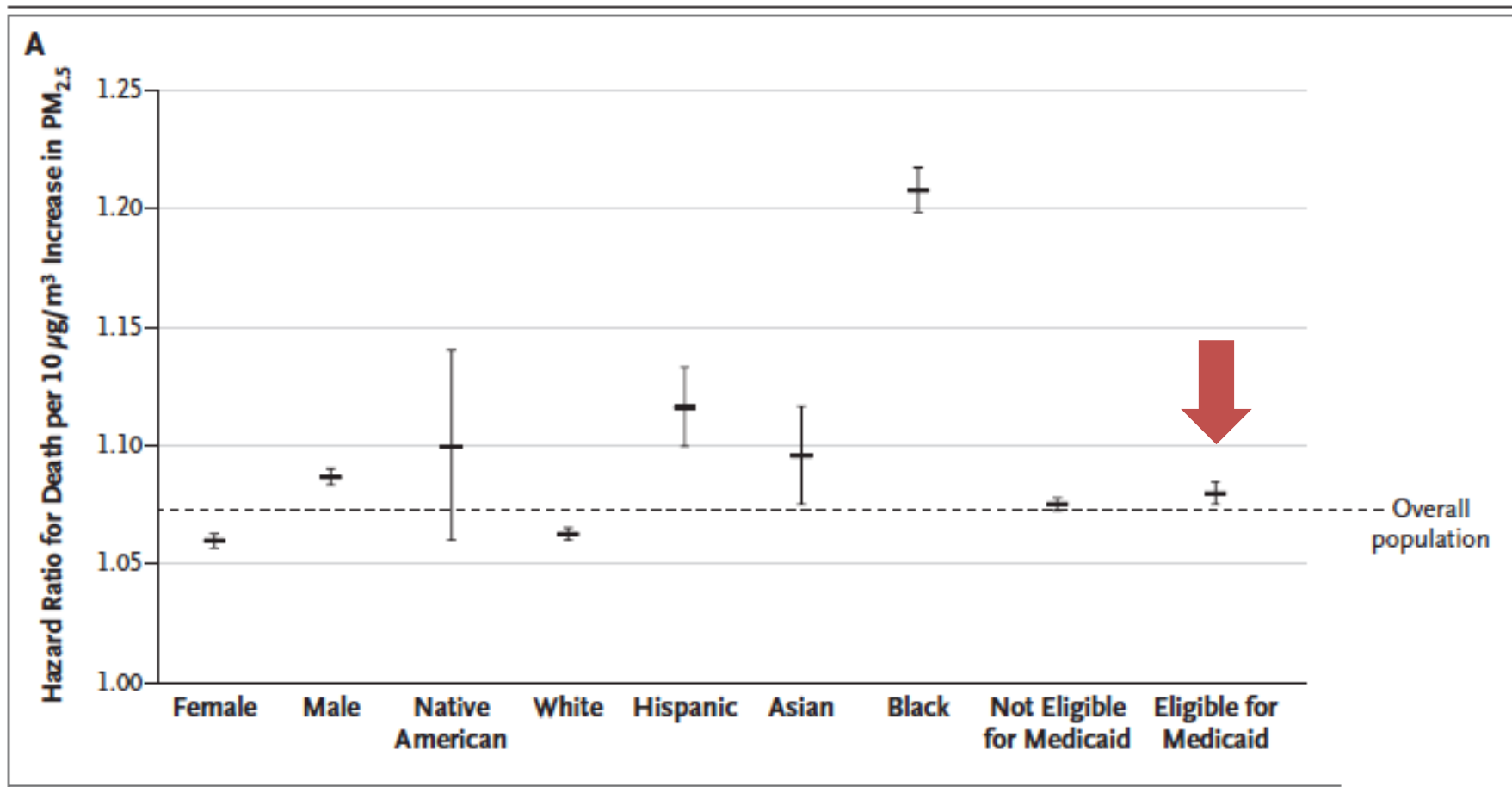
VOL. 376 NO. 26

Air Pollution and Mortality in the Medicare Population

Qian Di, M.S., Yan Wang, M.S., Antonella Zanobetti, Ph.D., Yun Wang, Ph.D., Petros Koutrakis, Ph.D.,
Christine Choirat, Ph.D., Francesca Dominici, Ph.D., and Joel D. Schwartz, Ph.D.





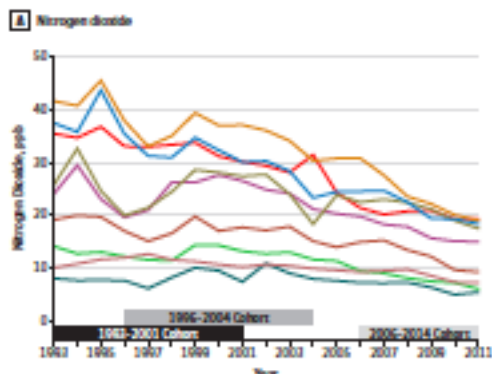


JAMA | Original Investigation

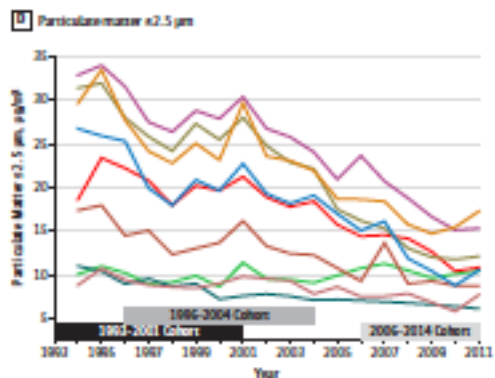
Association of Changes in Air Quality With Incident Asthma in Children in California, 1993-2014

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

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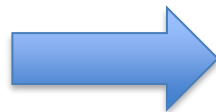
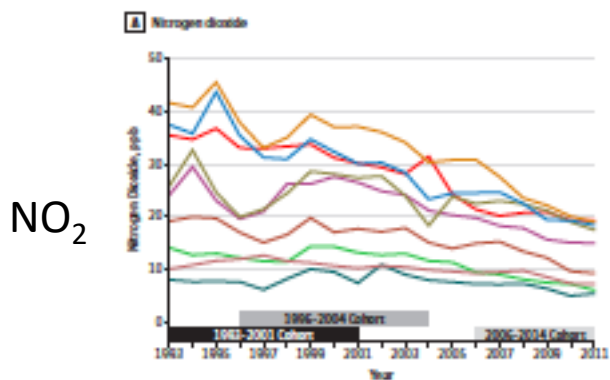


PM_{2.5}

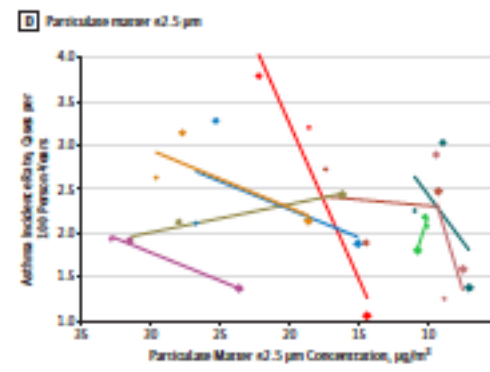
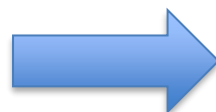
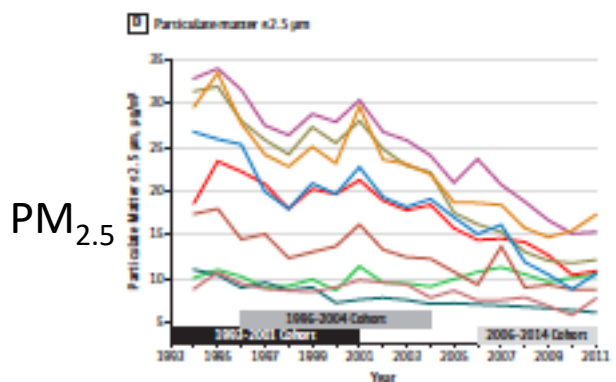
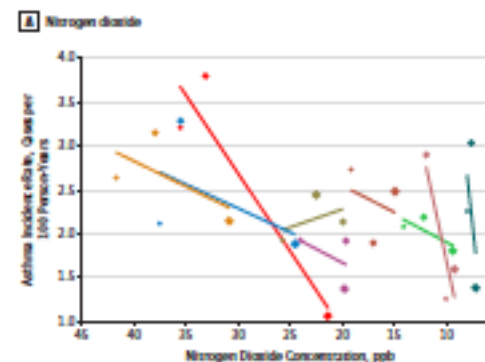


JAMA | Original Investigation
**Association of Changes in Air Quality With Incident Asthma
 in Children in California, 1993-2014**

Erica 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



- **Mitigation**
 - **Become an advocate**
 - **Promote sustainability practices in healthcare settings**
 - **Teach patients about climate change**
- **Adaptation**
 - **Teach vulnerable populations about coping with heat/natural disasters**
 - **Ensure patients have adequate disaster preparedness plans in place**

- Questions/future connections
 - Twitter: @NeeluTummala