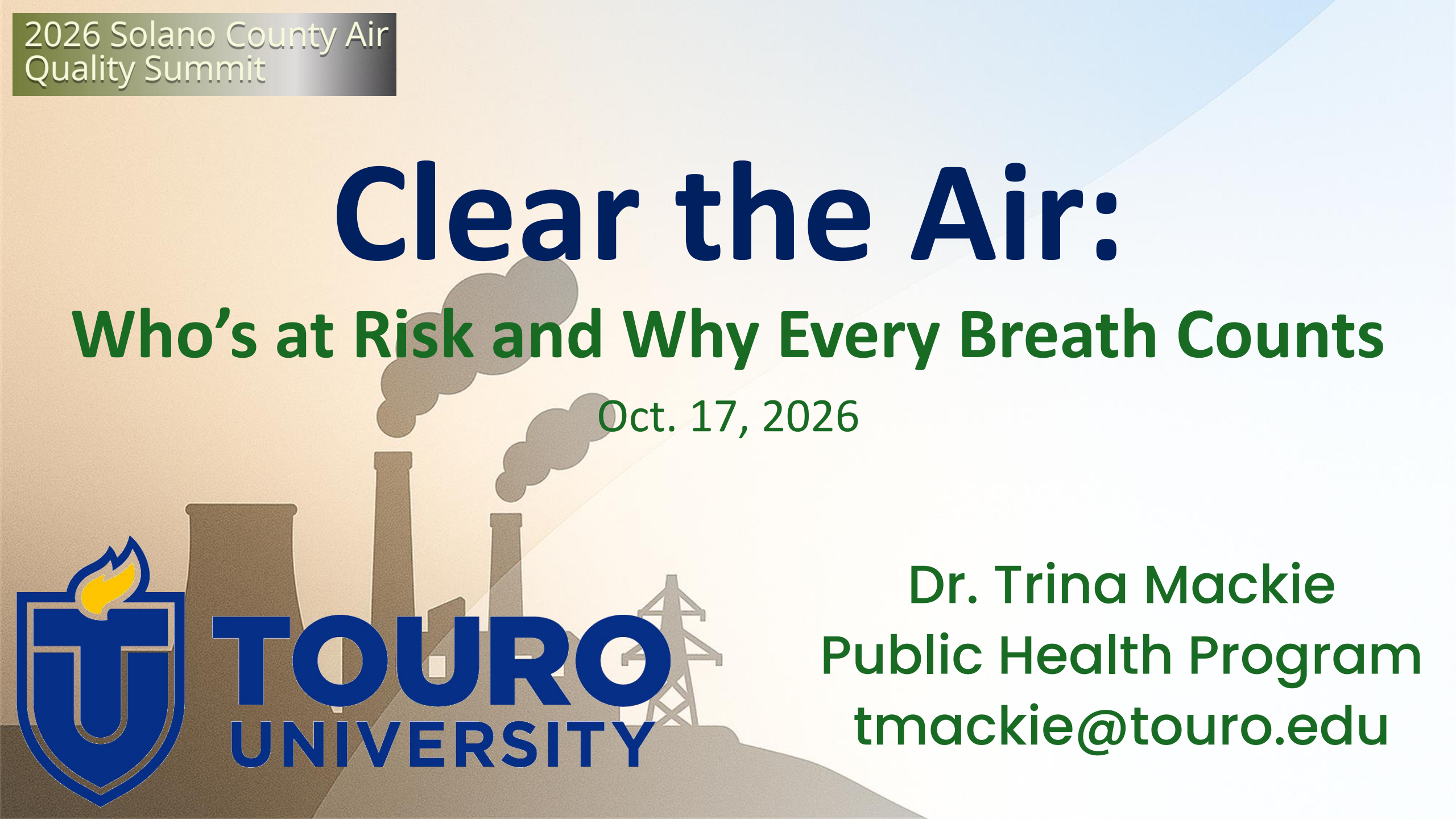
2026 Solano County Air Quality Summit

Clear the Air:

Who's at Risk and Why Every Breath Counts

Oct. 17, 2026



TOURO UNIVERSITY

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Public Health Program
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Learning Objectives

Health effects of air pollution

The impact of air pollution on our communities

Who is most vulnerable

Big Picture – Health Burden of Air Pollution (GLOBAL)

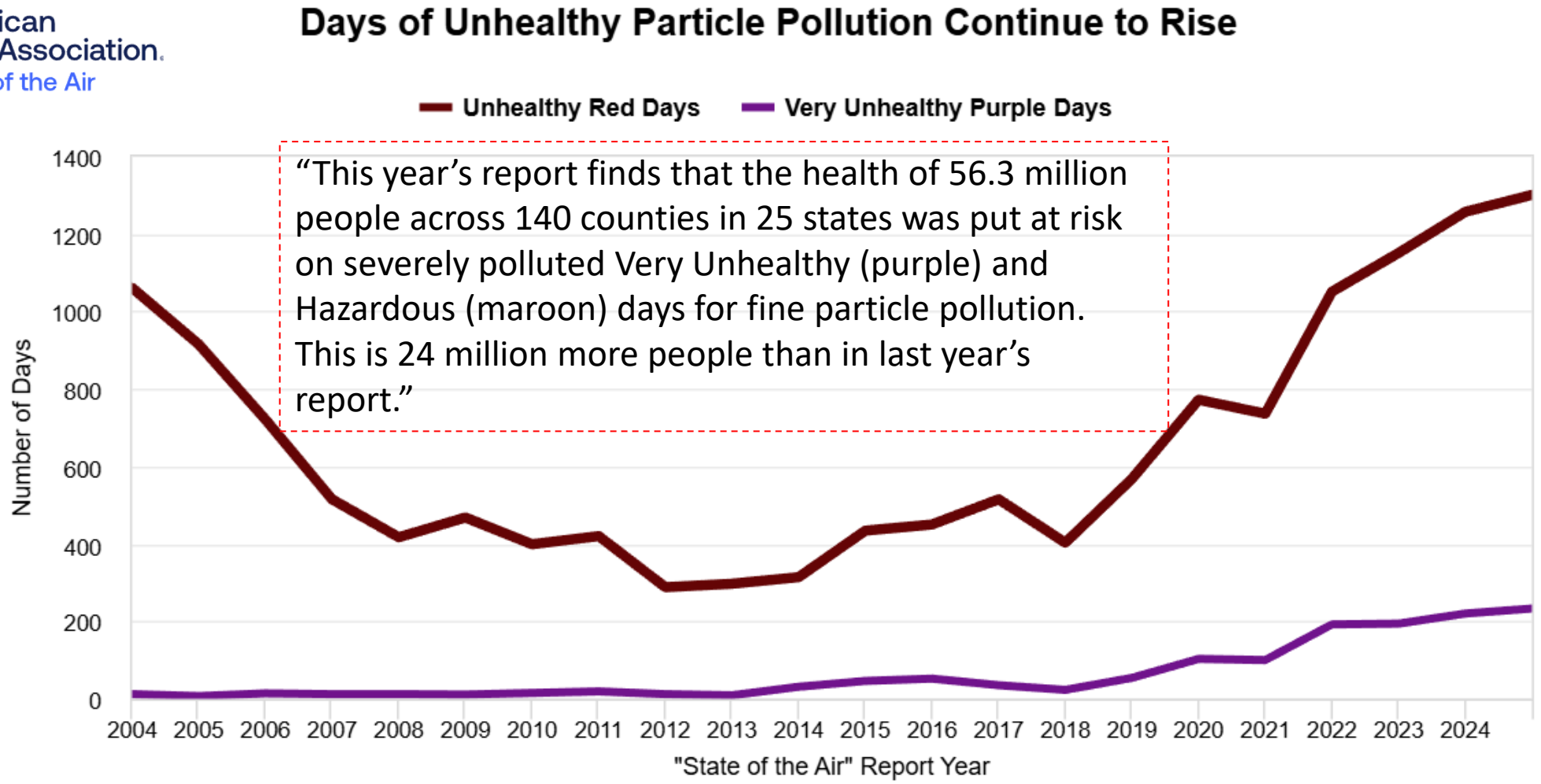


- In 2022 over 4-million deaths worldwide were attributable to $PM_{2.5}$
- 370,000 deaths related to environmental ozone exposure.
- 70% of these in middle to low income countries

Wallbanks et al. 2024

Big Picture – Health Burden of Air Pollution (Global)

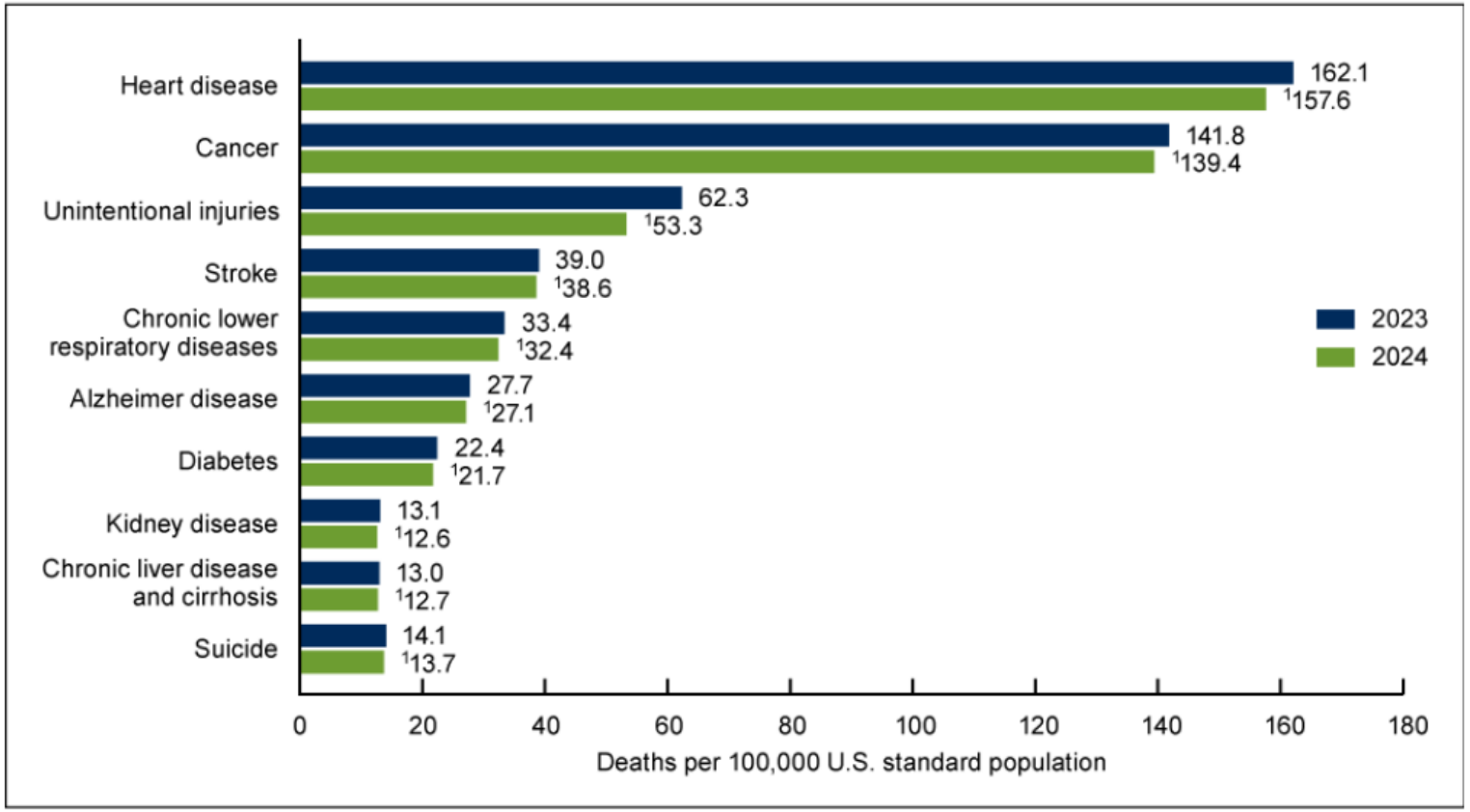
American Lung Association.
State of the Air
2025



https://www.lung.org/research/sota/key-findings/short-term-particle-pollution

Big Picture – Health Burden of Air Pollution (U.S.)

Figure 4. Age-adjusted death rate for the 10 leading causes of death in 2024: United States, 2023 and 2024



[1]Statistically significant decrease from 2023 to 2024 ($p < 0.05$).
NOTES: A total of 3,072,666 resident deaths were registered in the United States in 2024. The 10 leading causes of death accounted for 70.9% of all U.S. deaths in 2024. Causes of death are ranked according to number of deaths in 2024. Rankings for 2023 data are not shown.
SOURCE: National Center for Health Statistics, National Vital Statistics System, mortality data file.

Xu JQ, Murphy SL, Kochanek KD, Arias E. Mortality in the United States, 2024. NCHS Data Brief. 2026 Jan;(548):1–14. DOI: https://dx.doi.org/10.15620/cdc/174641. https://www.cdc.gov/nchs/products/databriefs/db548.htm



A changing climate is making the job of cleaning up the air more difficult

https://www.lung.org/research/sota/key-findings/short-term-particle-pollution

- **A person inhales approximately 35 pounds of air per day**
  - Roughly 6 times more than the food and drink consumed per day
- **Exposure to air pollutants is constant**
- **Respiratory system vulnerable**
  - Large surface area
  - Interface between environmental air and circulation

Wallbanks, S., Griffiths, B., Thomas, M., Price, O. J., & Sylvester, K. P. (2024). Impact of environmental air pollution on respiratory health and function. *Physiological reports*, *12*(16), e70006. https://doi.org/10.14814/phy2.70006

Share out...

Think about answers to the questions on the right. We will go over them as a group



What harmful health effects are associated with air pollution?

PollEv.com/trinamackie049

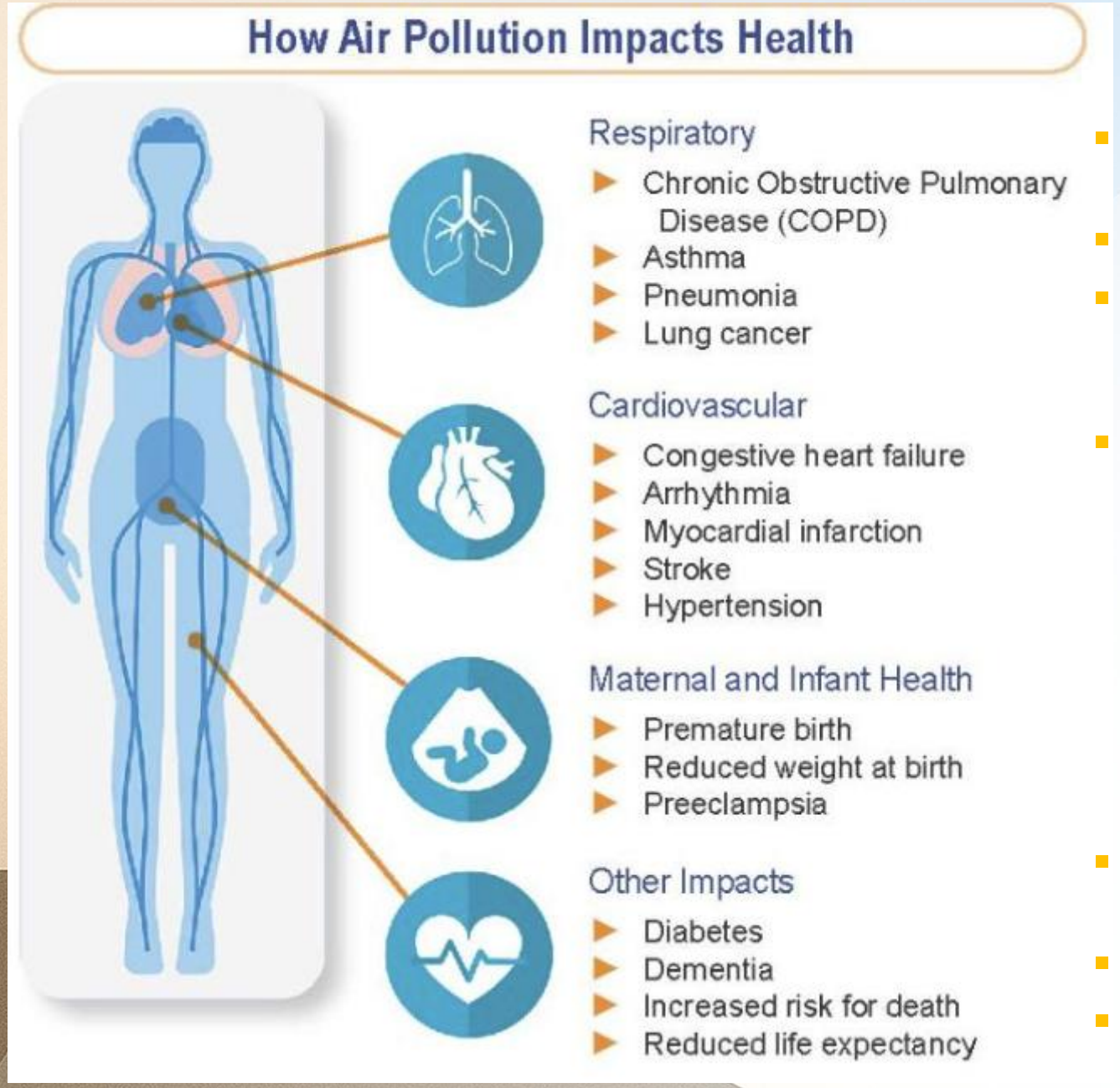
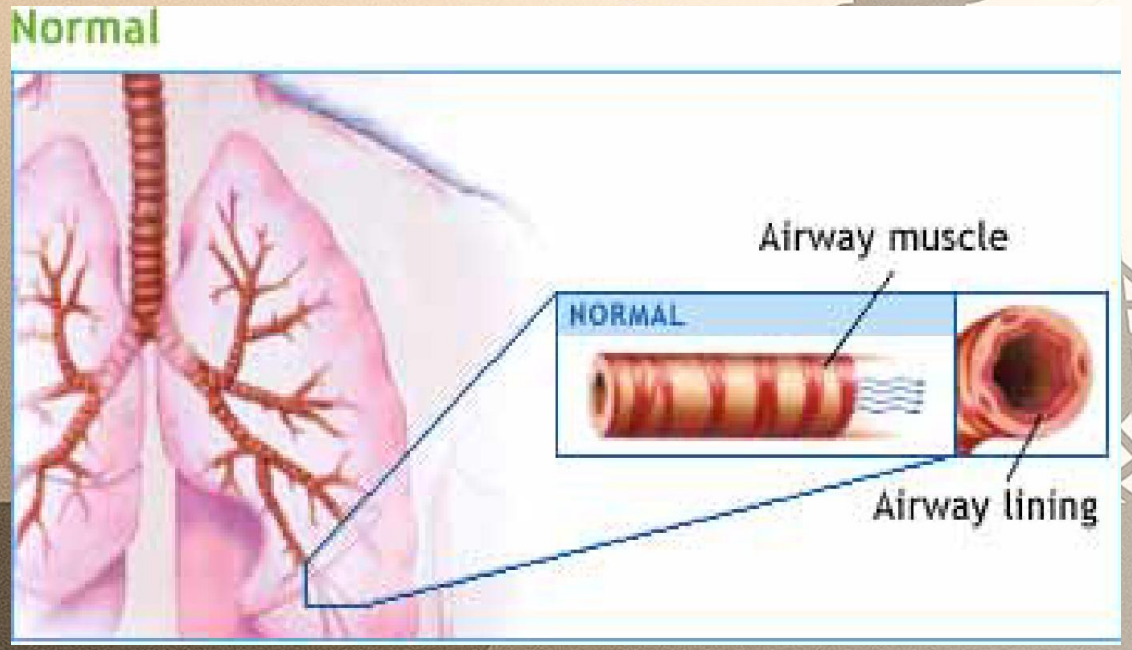


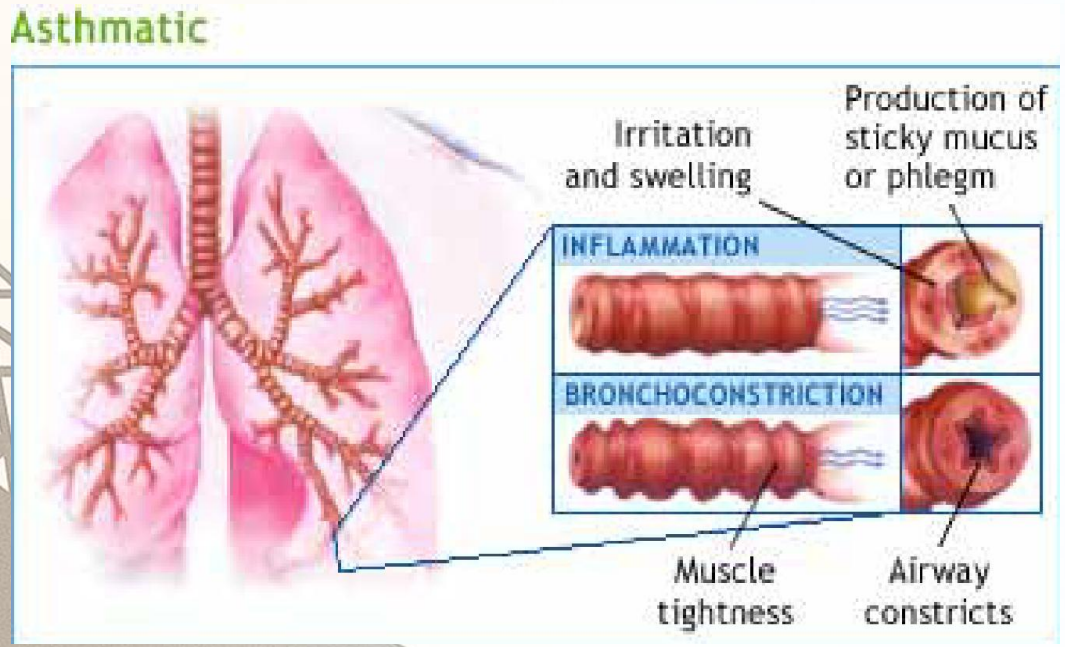
Image Source: https://www.stateofglobalair.org/resources/storymap/air-pollution-and-health

- Other lung disease (Acute bronchitis, etc.)
- Reduced lung function
- Permanent lung damage (inflammation and damage to cells that line the lung)
- Increased susceptibility for resp. infection

- Obesity and systemic inflammation
- Alzheimer's
- Increased ER visits and hospitalization.

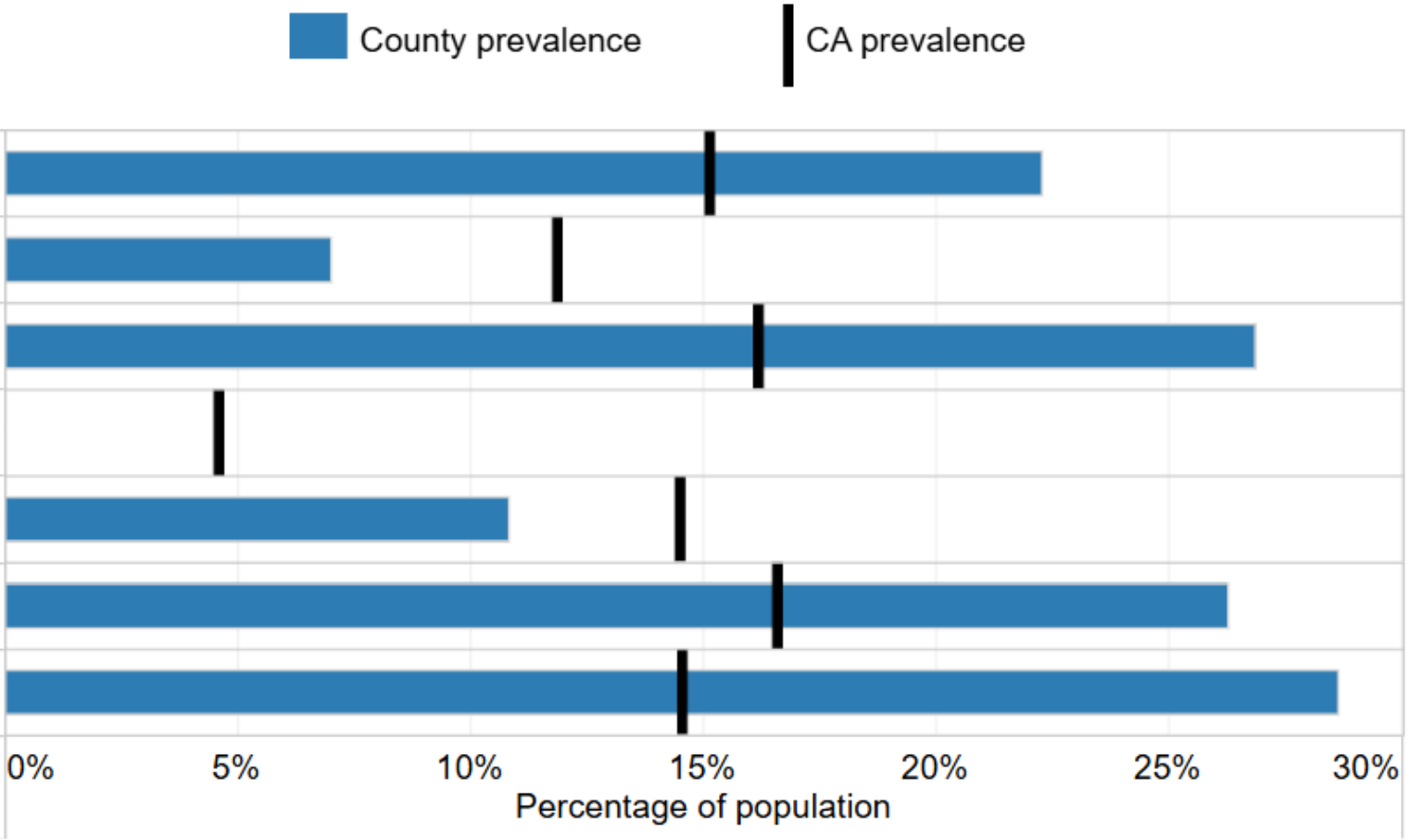
ASTHMA/RESPIRATORY VOLUME





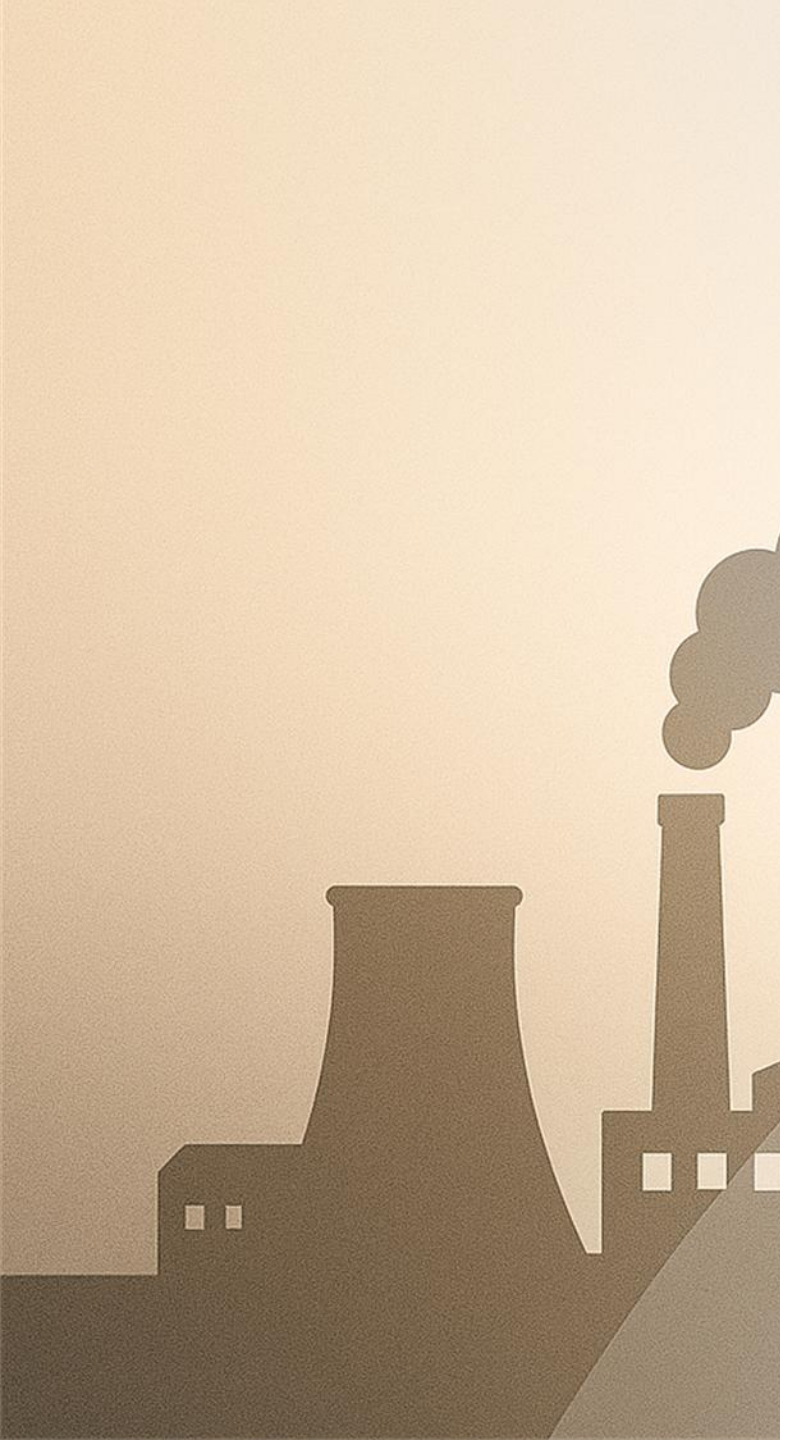
Percentage ever diagnosed with asthma in Solano County, by age group (2019–2020)

Comparison	Group	% of County Population	% of CA Population
Total population	All ages	22.3%	15.1%
Children vs. adults	0–17 years	7.0%	11.9%
	18+ years	26.9%	16.2%
Age group	0–4 years	Not available	4.6%
	5–17 years	10.8%	14.5%
	18–64 years	26.3%	16.6%
	65+ years	28.6%	14.6%



Bars are missing on chart and values are marked as "Not available" when not enough data are available to calculate prevalence.

Source: California Asthma Dashboard
https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHIB/CPE/Pages/CaliforniaBreathingCountyAsthmaProfiles.aspx

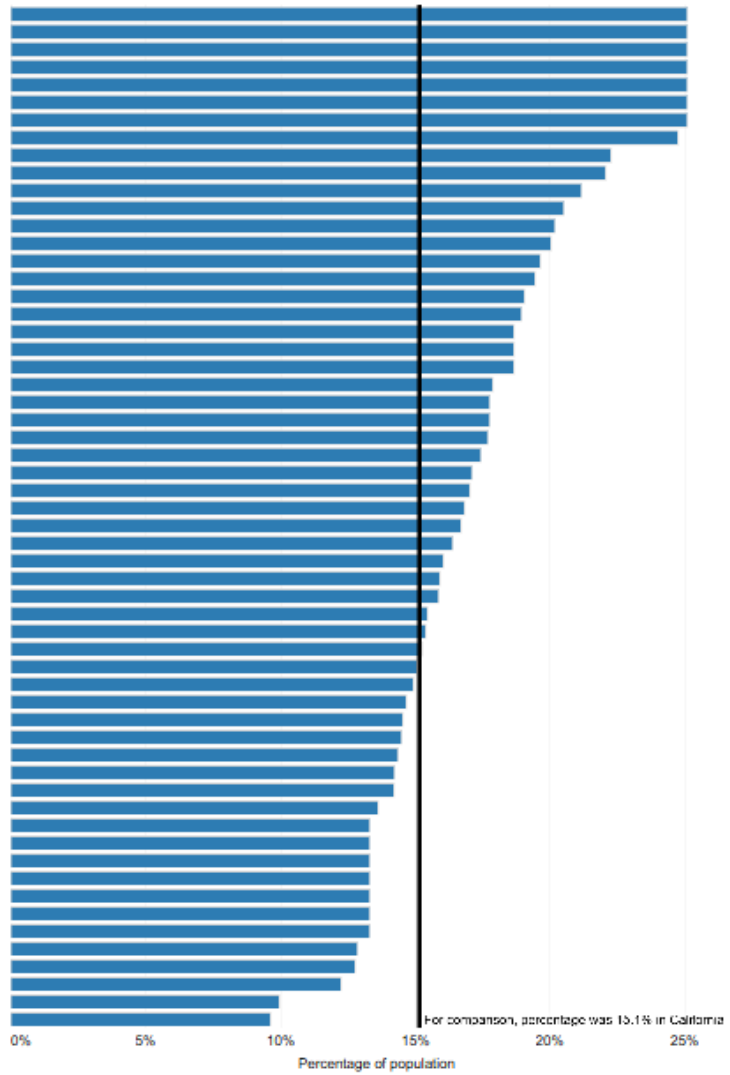


Asthma Prevalence Across Counties

Make selection: Age group: All ages

Percentage ever diagnosed with asthma among residents of all ages, by county (2019–2020)

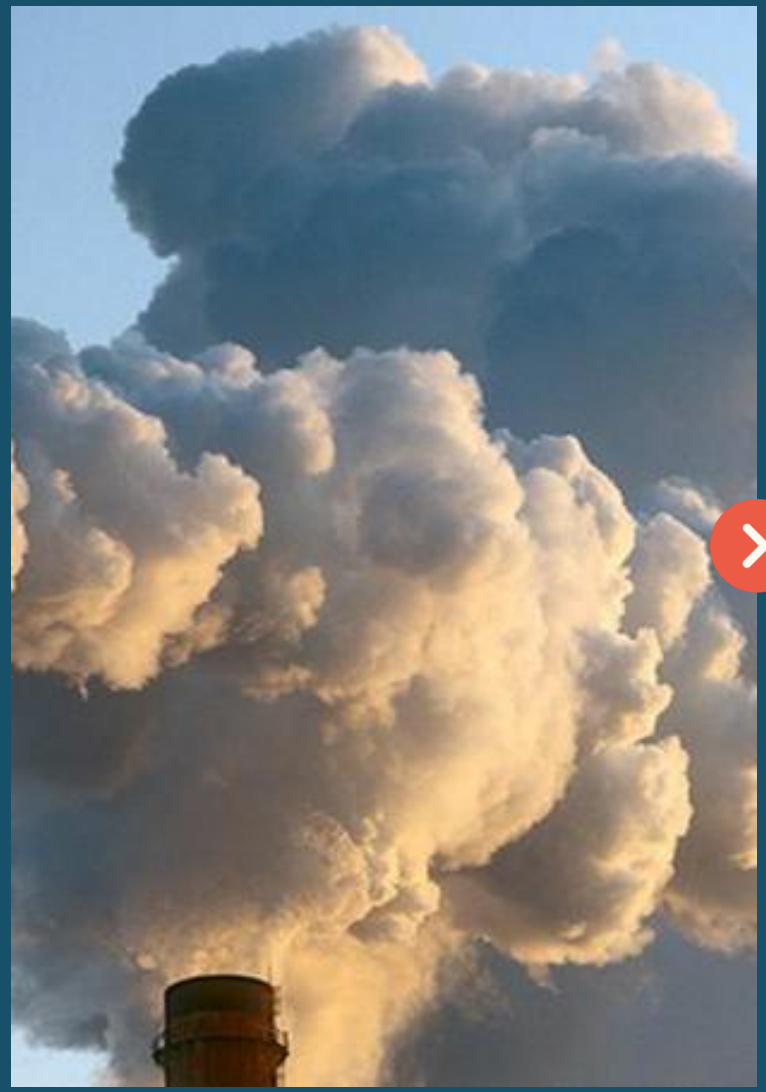
County	% of County Population
Alpine	25.1%
Amador	25.1%
Calaveras	25.1%
Inyo	25.1%
Mariposa	25.1%
Mono	25.1%
Tuolumne	25.1%
Yolo	24.7%
Solano	22.3%
Napa	22.0%
Kings	21.2%
Shasta	20.5%
Butte	20.2%
Fresno	20.0%
Marin	19.6%
Madera	19.4%
Lake	19.0%
Merced	18.9%
Colusa	18.6%
Glenn	18.6%
Tehama	18.6%
Contra Costa	17.9%
Kern	17.7%
Placer	17.7%
Sonoma	17.7%
El Dorado	17.4%
San Mateo	17.1%
Stanislaus	17.0%
Humboldt	16.8%
Sutter	16.7%
San Benito	16.4%
Sacramento	16.0%
San Joaquin	15.9%
Imperial	15.9%
San Luis Obispo	15.4%
San Francisco	15.4%
Santa Cruz	15.2%
Yuba	15.0%
Alameda	14.9%
Los Angeles	14.6%
Santa Clara	14.5%
Nevada	14.5%
Monterey	14.4%
San Diego	14.2%
Orange	14.2%
Mendocino	13.6%
Del Norte	13.3%
Lassen	13.3%
Modoc	13.3%
Plumas	13.3%
Sierra	13.3%
Siskiyou	13.3%
Trinity	13.3%
San Bernardino	12.8%
Ventura	12.8%
Riverside	12.2%
Tulare	9.9%
Santa Barbara	9.6%



Bars are missing on chart and values are marked as "Not available" when not enough data are available to calculate prevalence.

Certain counties with small populations are grouped together for analysis of prevalence data:
- Alpine, Amador, Calaveras, Inyo, Mariposa, Mono, and Tuolumne counties are combined
- Colusa, Glenn, and Tehama counties are combined
- Del Norte, Lassen, Modoc, Plumas, Sierra, Siskiyou, and Trinity counties are combined

Source:
California Asthma Dashboard
https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHIB/CPE/Pages/CaliforniaBreathingCountyAsthmaProfiles.aspx



Asthma Impacts

- Most common chronic illness in children
- Leading cause of hospital admissions for children.
- Childhood asthma associated with >10 million missed school days annually in U.S.
- Asthma-related missed school associated with lower academic performance

PM Health Effects

Diabetes

- Air pollution causes an inflammatory response in the body, and this has an important role in type 2 diabetes.
- ~ 1/5 of the global burden of type 2 diabetes was attributable to $PM_{2.5}$ exposure (1/10 in high-income countries)
- Long-term exposure to air pollution contributes more to the risk of diabetes than physical inactivity.

Source: GBD 2019 Diabetes and Air Pollution Collaborators (2022). Estimates, trends, and drivers of the global burden of type 2 diabetes attributable to $PM_{2.5}$ air pollution, 1990-2019: an analysis of data from the Global Burden of Disease Study 2019. *The Lancet. Planetary health*, *6*(7), e586–e600.

PM Health Effects

Prenatal Exposure

- Adverse birth outcomes
- increased risk of childhood pneumonia and asthma

Source: Johnson, N.M., Hoffmann, A.R., Behlen, J.C. *et al.* Air pollution and children's health—a review of adverse effects associated with prenatal exposure from fine to ultrafine particulate matter. *Environ Health Prev Med* 26, 72 (2021).

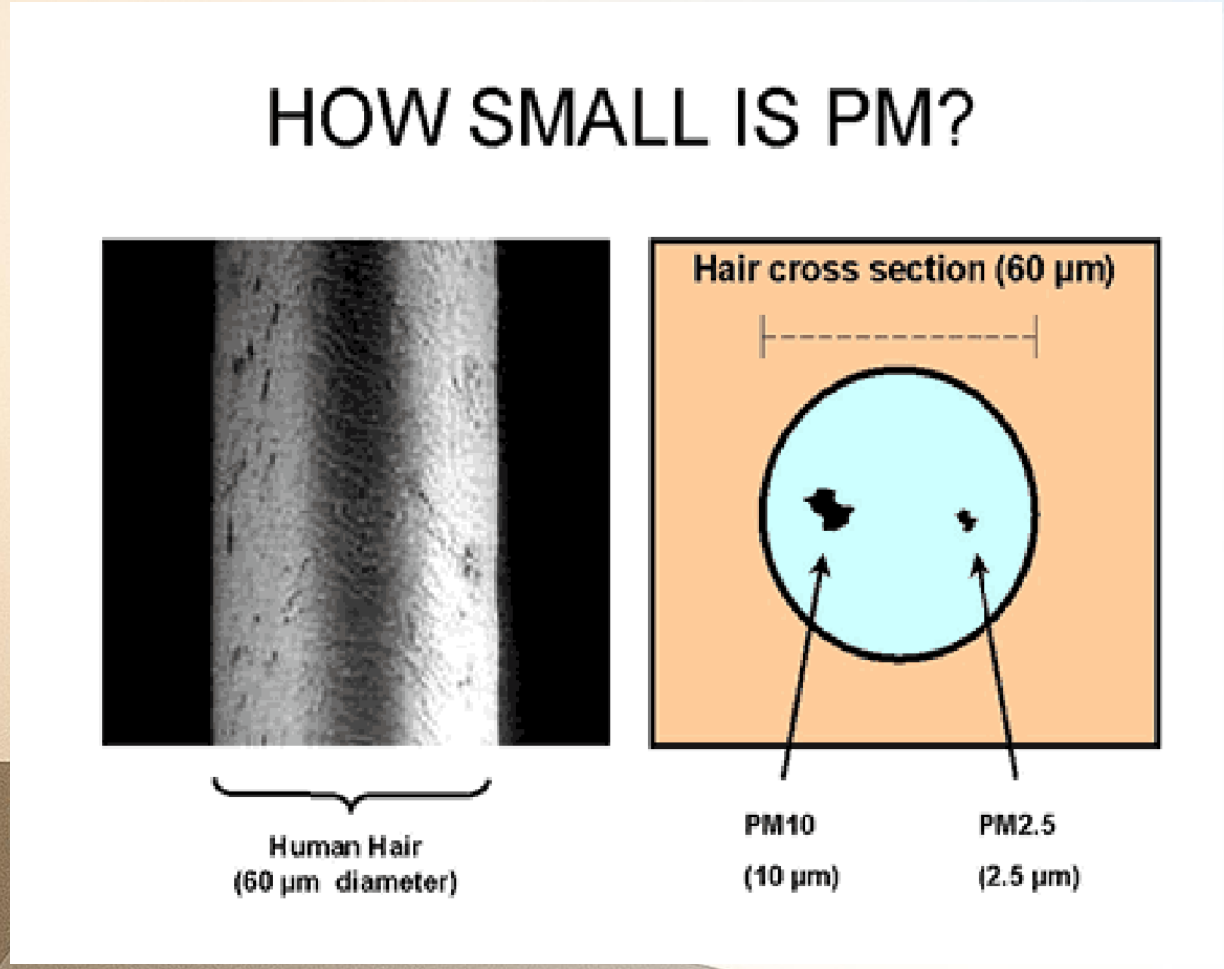
PM Health Effects

Respiratory Infections

- **Increased susceptibility to respiratory infections, even months after smoke exposure.**

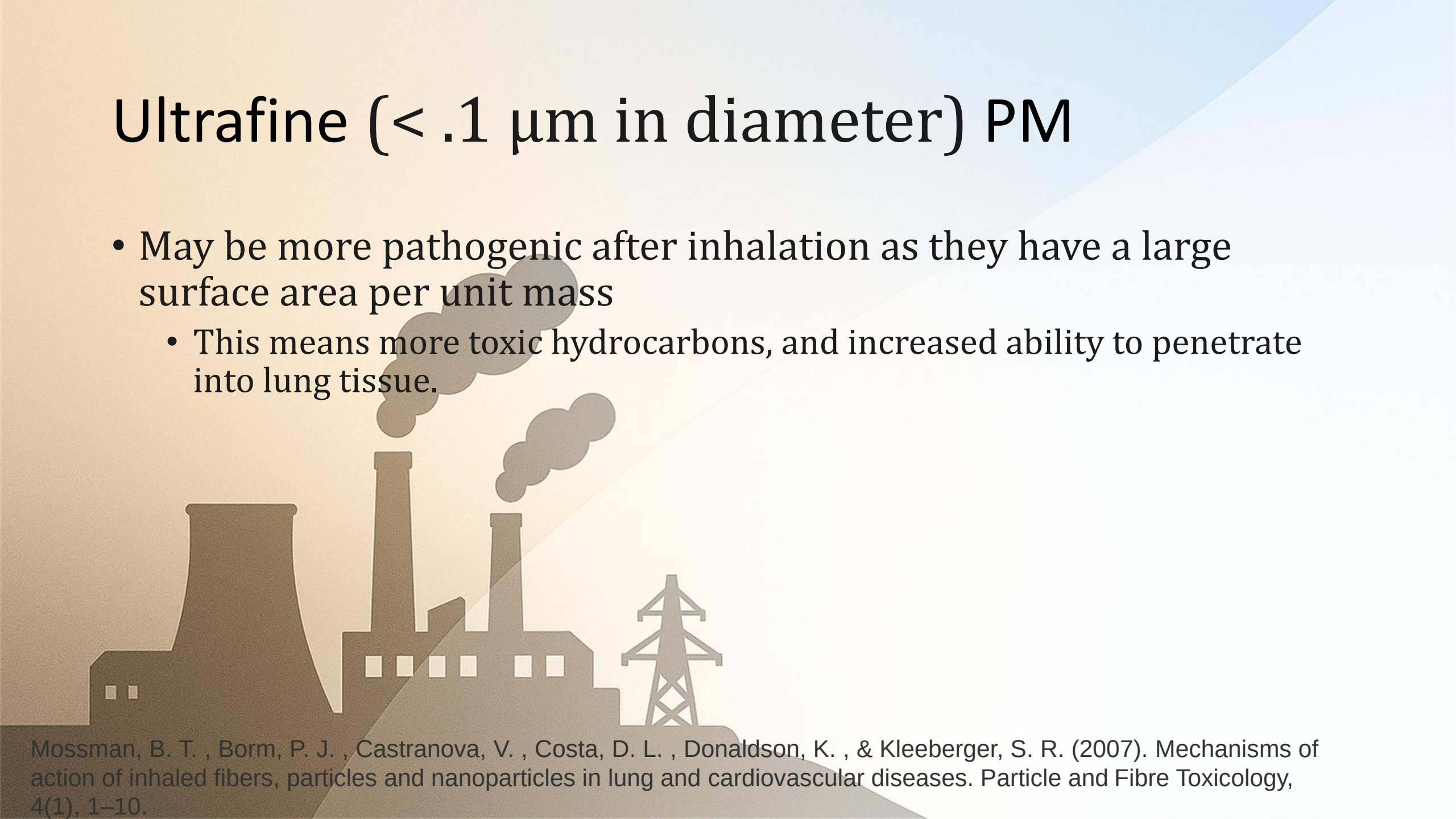
- Wu X, Nethery RC, Sabath BM, et al. Exposure to air pollution and COVID-19 mortality in the United States: A nationwide cross-sectional study. Epidemiology 2020. doi:10.1101/2020.04.05.20054502
- Landguth EL, Holden ZA, Graham J, *et al.* The delayed effect of wildfire season particulate matter on subsequent influenza season in a mountain west region of the USA. *Environment International* 2020;**139**:105668. doi:10.1016/j.envint.2020.105668

Particle Size



Ultrafine (< .1 μm in diameter) PM

- May be more pathogenic after inhalation as they have a large surface area per unit mass
  - This means more toxic hydrocarbons, and increased ability to penetrate into lung tissue.



Mossman, B. T. , Borm, P. J. , Castranova, V. , Costa, D. L. , Donaldson, K. , & Kleeberger, S. R. (2007). Mechanisms of action of inhaled fibers, particles and nanoparticles in lung and cardiovascular diseases. Particle and Fibre Toxicology, 4(1), 1–10.

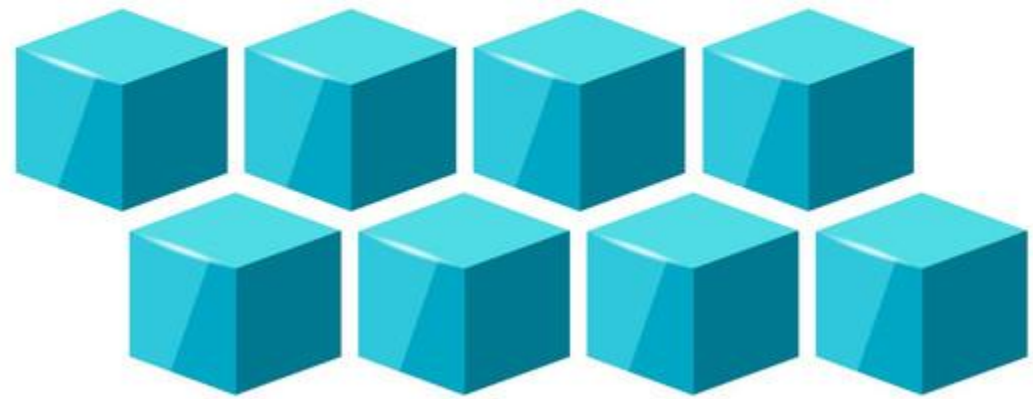
Small surface area
in one large block

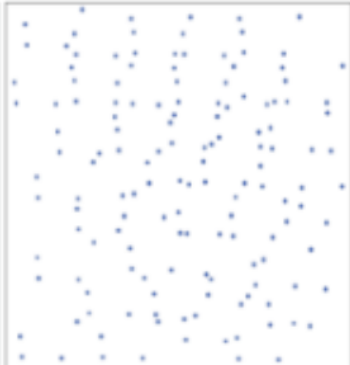


Increased surface area



Large surface area in
lots of smaller blocks

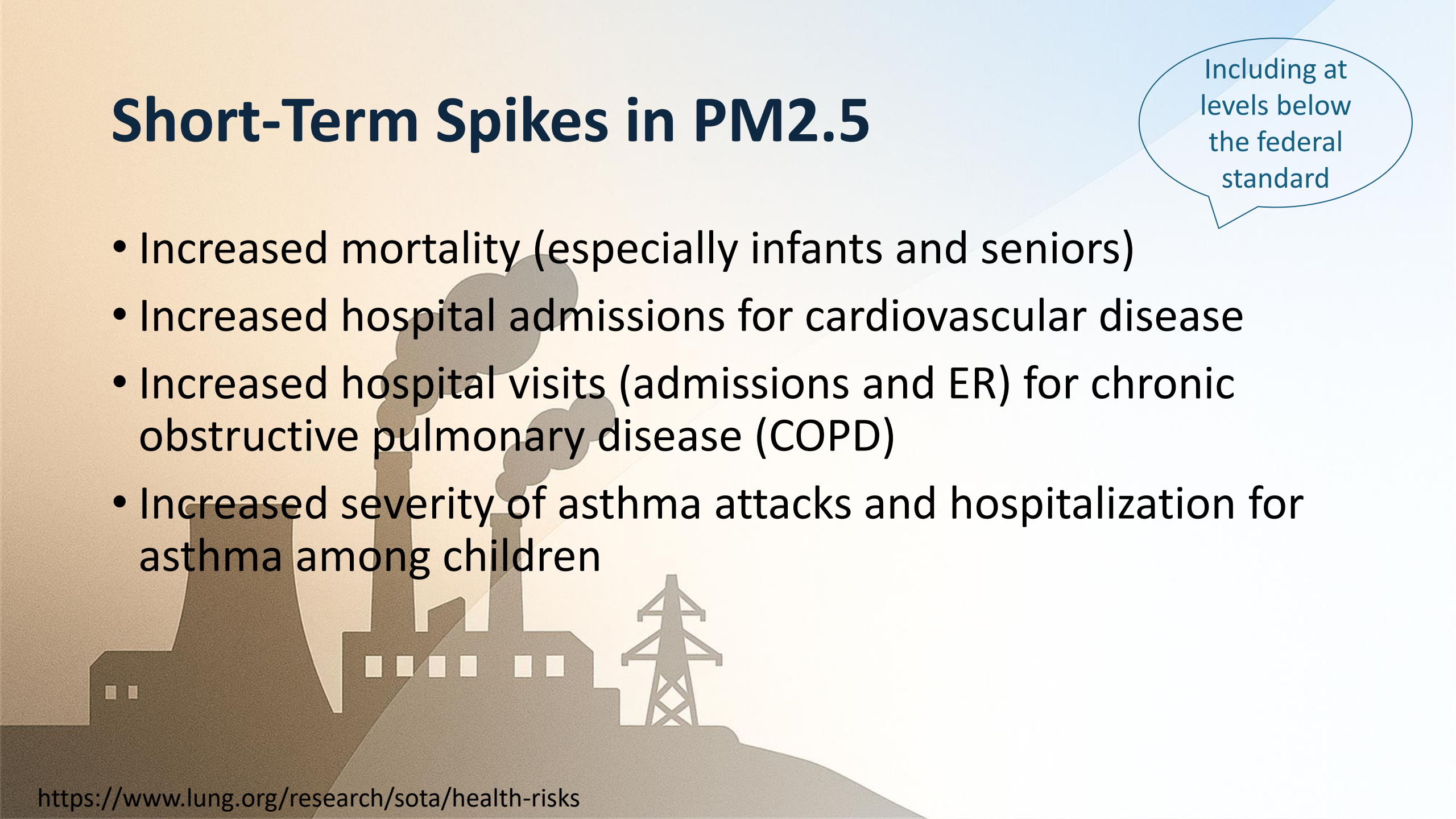


	10 µm (Coarse)	2.5 µm (Fine)	0.1 µm (Ultrafine)
			
Total mass	1	1	1
Particle number	1	64	1,000,000
Surface area per particle	1	0.0625	0.0001
Total surface area per mass	1	4	100
	• Filtered in proximal airway • May irritate skin, mucosa	• Reaches peripheral airway • Cannot enter systemic circulation	• Higher adsorbed toxic material on surface • May enter systemic circulation

Short-Term Spikes in PM2.5

Including at levels below the federal standard

- Increased mortality (especially infants and seniors)
- Increased hospital admissions for cardiovascular disease
- Increased hospital visits (admissions and ER) for chronic obstructive pulmonary disease (COPD)
- Increased severity of asthma attacks and hospitalization for asthma among children



https://www.lung.org/research/sota/health-risks

Long-Term Year Round PM2.5 (in kids)

- Increased risk of preterm birth and low birth weight
- Increased fetal and infant mortality
- Impaired neurological development and cognition
- Reduced lung development and impaired lung function in children
- Higher likelihood of children developing asthma
- Increased susceptibility to respiratory infections



https://www.lung.org/research/sota/health-risks

Long-Term Year Round PM2.5 (in adults)

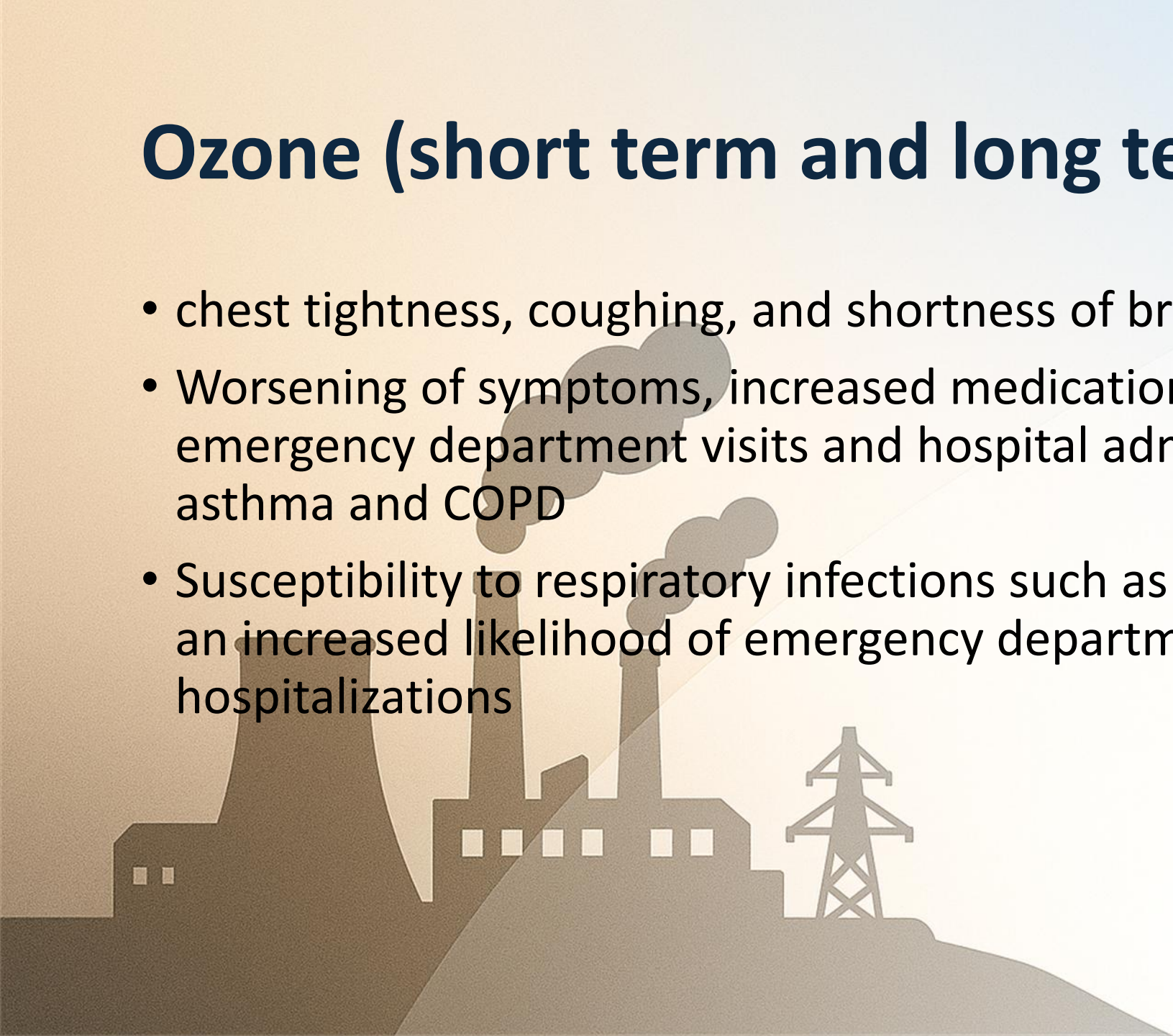


- Increased risk from existing cardiovascular and respiratory disease, including a worsening of heart disease, atherosclerosis and COPD
- Higher likelihood of developing diabetes and subsequent complications
- Higher likelihood of getting lung cancer and of dying from it
- Impaired cognitive functioning and an increased risk of Parkinson's disease, Alzheimer's disease and other dementias later in life
- Increased risk of clinical depression and anxiety
- Increased susceptibility to respiratory infections

https://www.lung.org/research/sota/health-risks

Ozone (short term and long term)

- chest tightness, coughing, and shortness of breath
- Worsening of symptoms, increased medication use, and increased emergency department visits and hospital admissions for people with asthma and COPD
- Susceptibility to respiratory infections such as pneumonia, resulting in an increased likelihood of emergency department visits and hospitalizations



Ozone (short term and long term)

- New cases of asthma in children
- Damage to the airways, leading to the development of COPD
- Increased allergic response



Risk Variation

The health burden of air pollution is not evenly shared. Some people are more at risk of illness and death from air pollution than others. Several key factors affect an individual's level of risk:

- **Exposure**
- **Susceptibility**
- **Access to healthcare**
- **Socioeconomic factors**



Some People Suffer a Heavier Burden

The toll of air pollution is not borne equally by everyone. Some people face worse pollution exposure or more severe health impacts, most often through no fault of their own.

Where you live and work

People who spend more time breathing polluted air are more likely to become sick from it. Those working outdoors and living in more polluted countries, cities, and neighborhoods face a higher risk of health problems.

Your stage of life

Children, older adults, and pregnant people face higher health risks from air pollution. At these stages of life, people can suffer worse health problems from the same amount of pollution.

Your health status

People with existing chronic diseases can be more vulnerable to health effects of air pollution.

Socioeconomic factors

People who face disadvantages related to socioeconomic status or race/ethnicity often have higher pollution exposures, more underlying health problems, and less access to health care — which makes them more likely to become seriously ill.

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Thank You