

Wildfire smoke, population health, and the Canadian climate future

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BC Centre for Disease Control



National Collaborating Centre
for Environmental Health

Centre de collaboration nationale
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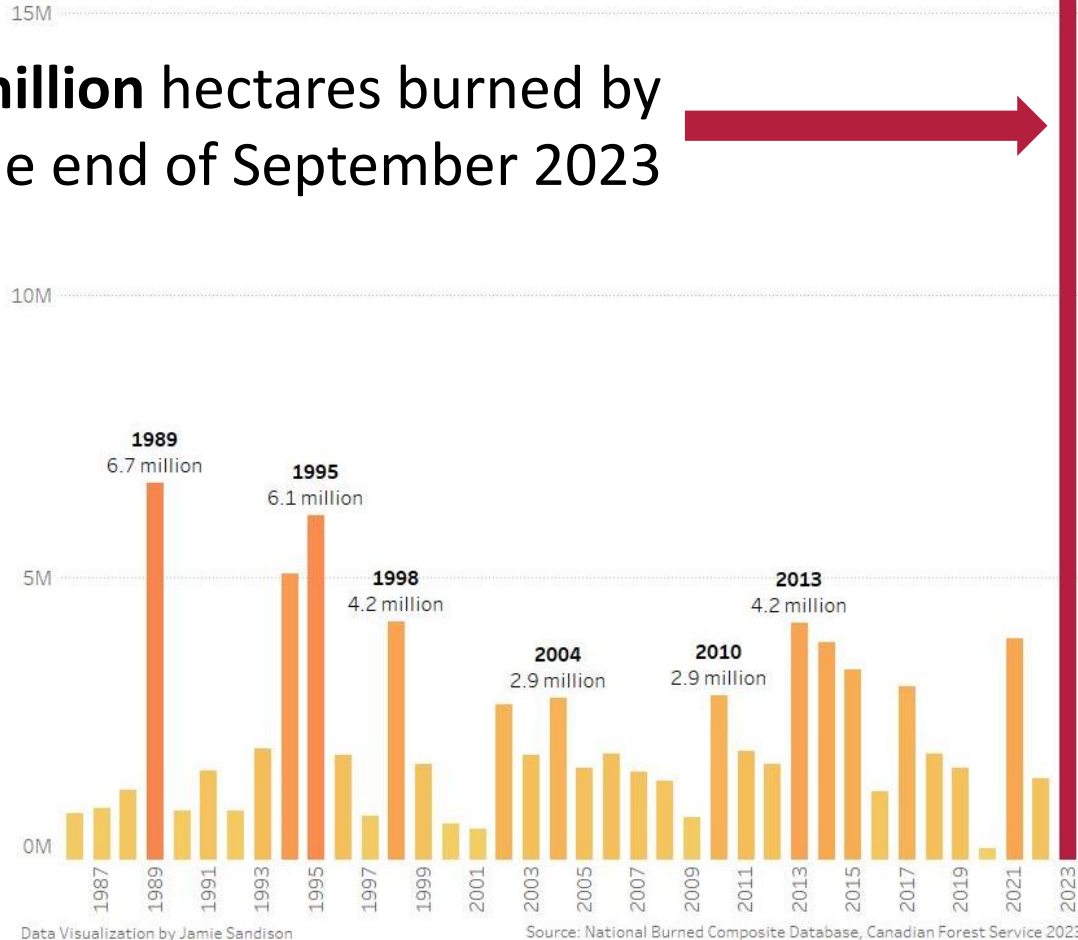
The 2023 wildfire season was the most severe in recorded Canadian history. Do you believe there will be an even more severe season in the next ten years?

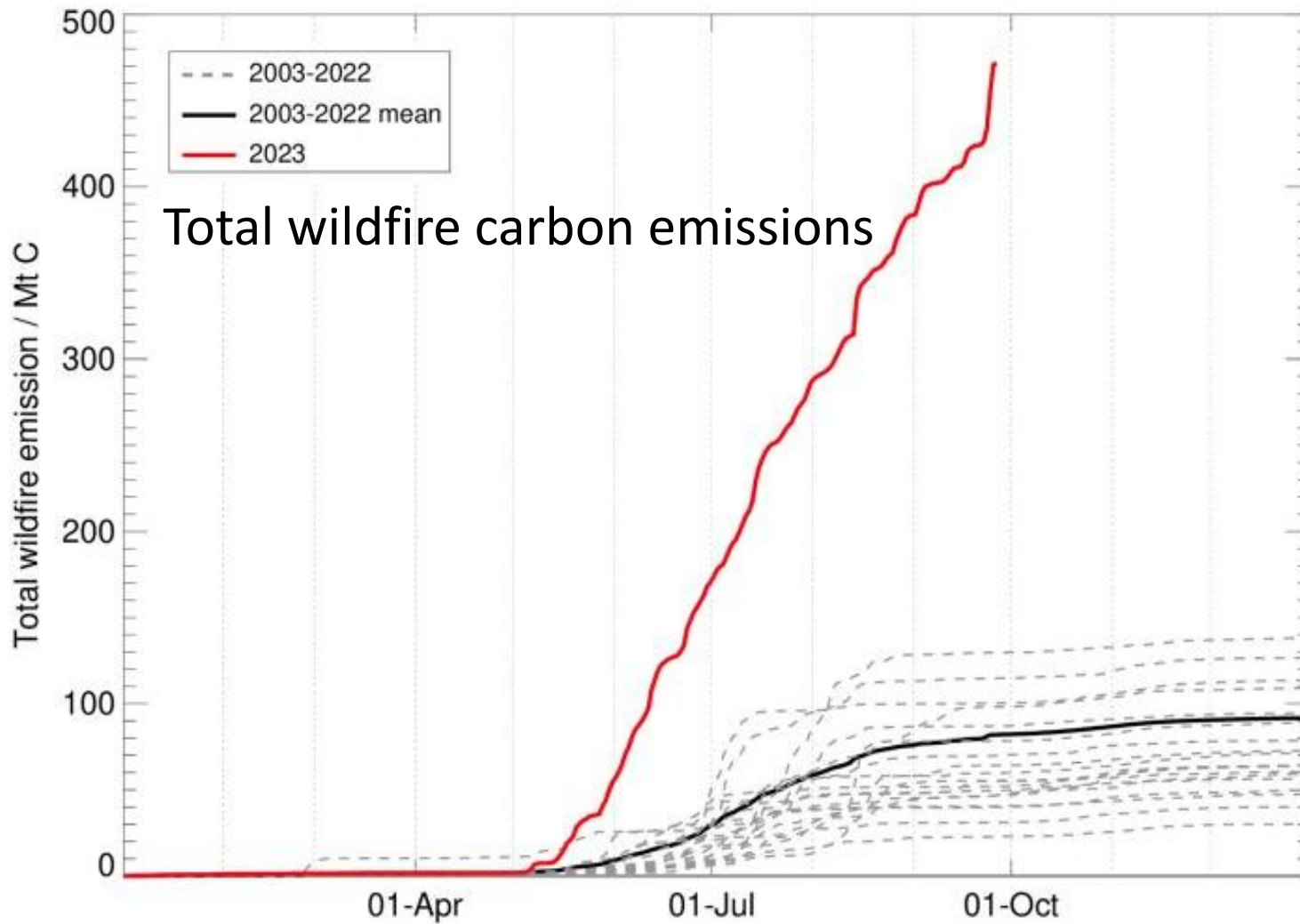
A. Yes

B. No

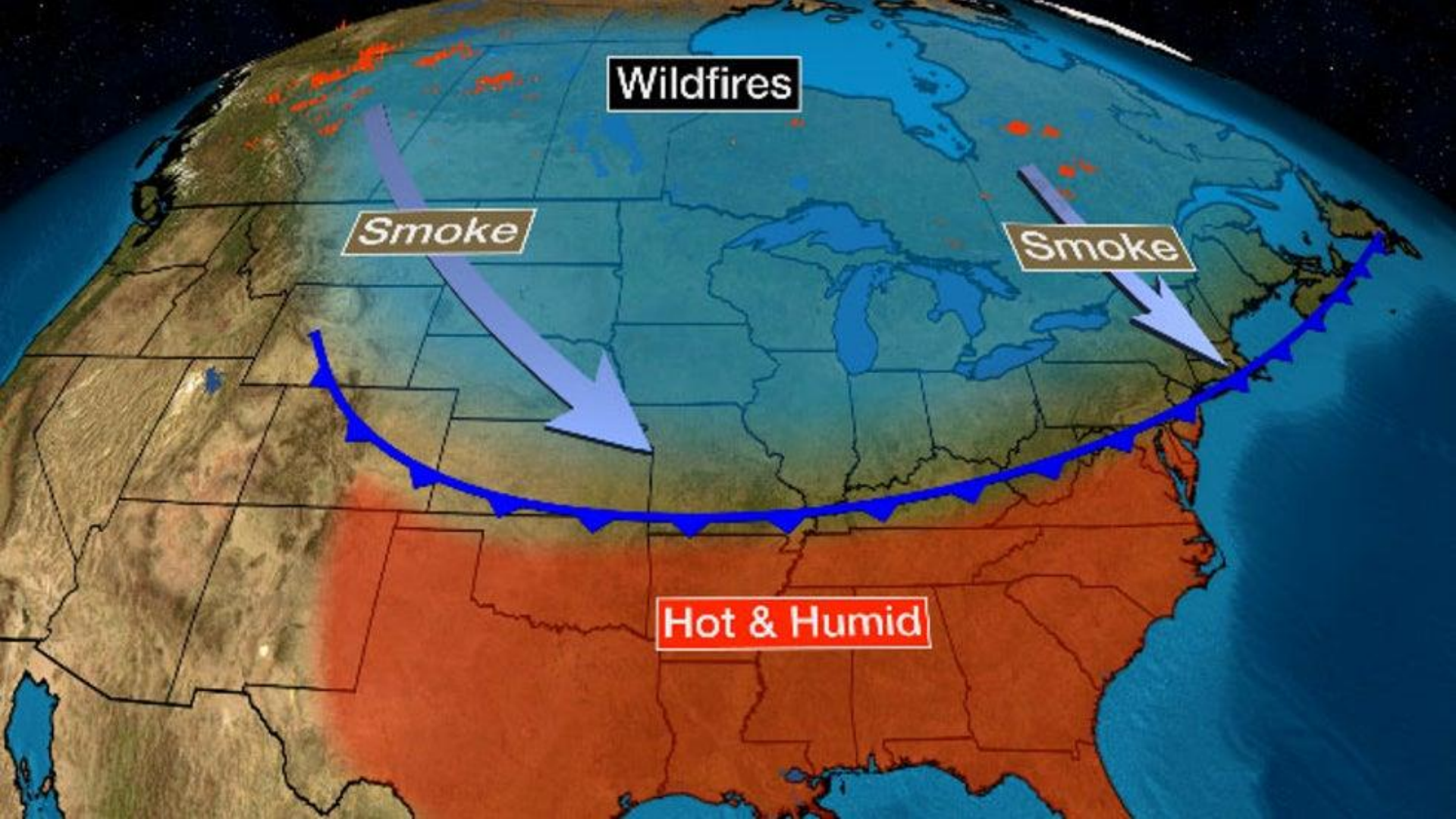
C. Maybe

17 million hectares burned by
the end of September 2023









Wildfires

Smoke

Smoke

Hot & Humid

SURFACE SMOKE FORECAST

THU 11:00 AM

LOW



VERY HIGH



Sault Ste. Marie

Val-d'Or

Québec

Fred

Montréal

Ottawa

Kingston

Toronto

MI

Windsor

NY

NH

ME

Boston

CT

New York

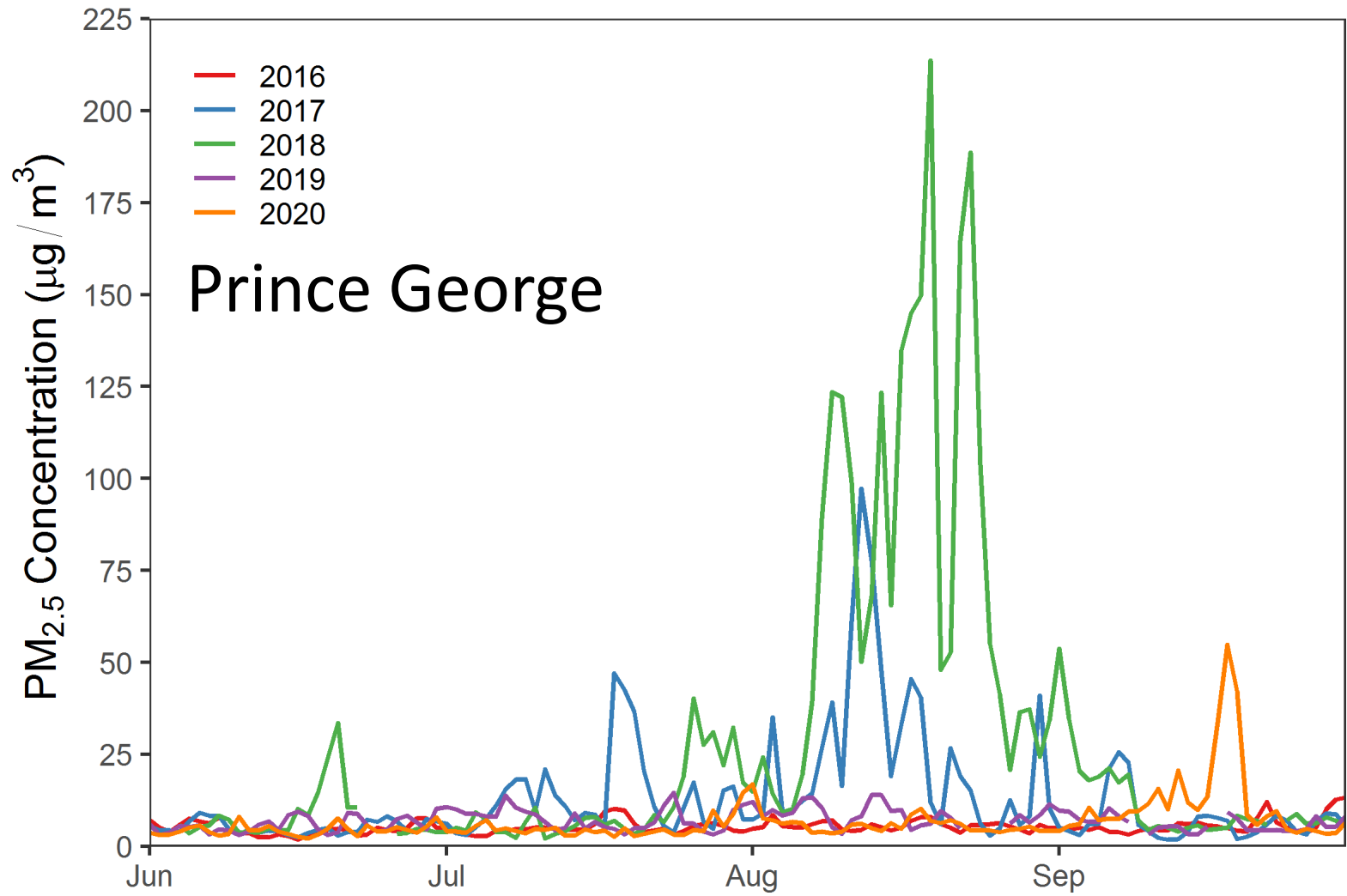


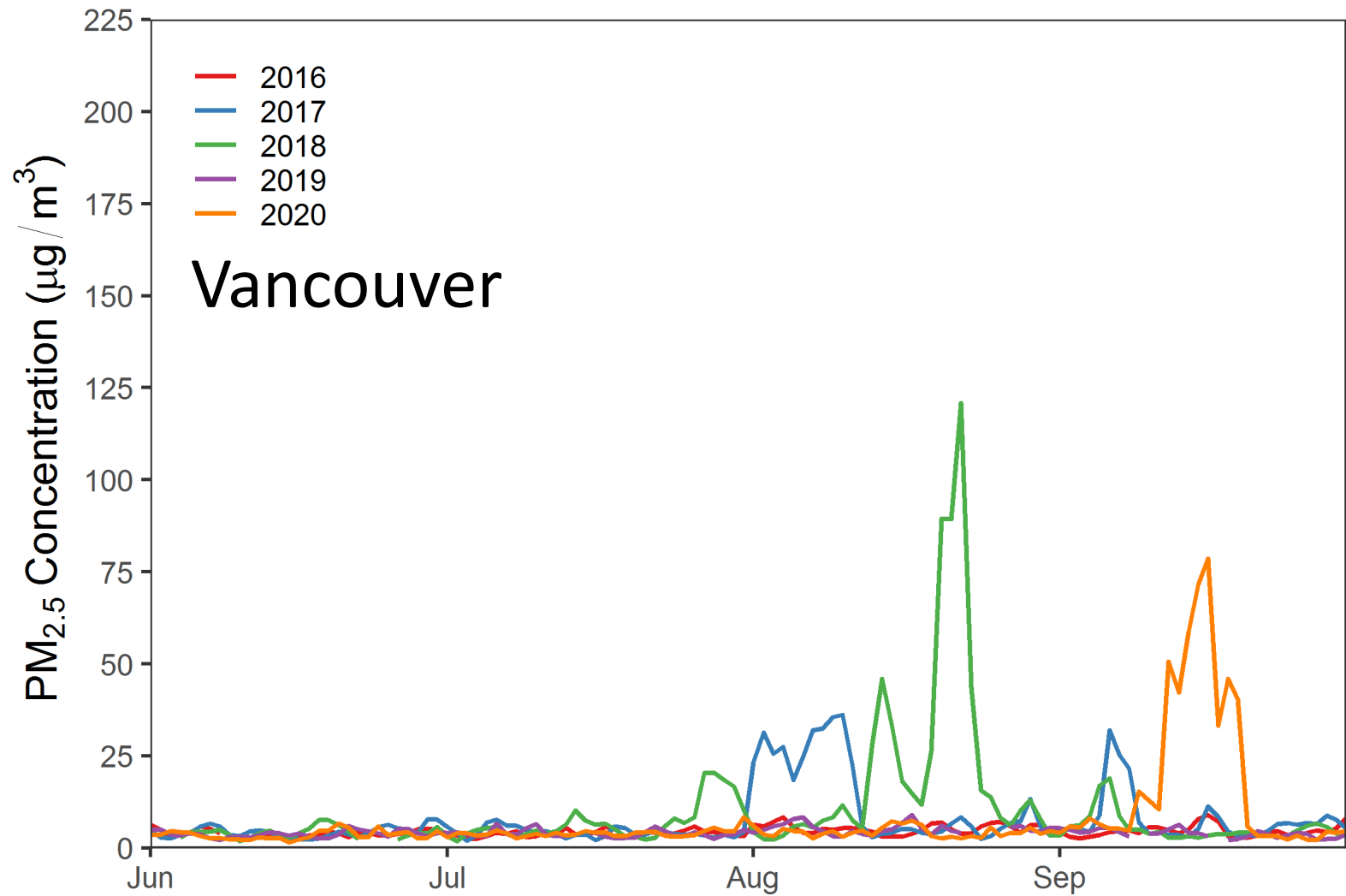
How is exposure to wildfire smoke most different from exposure to other types of air pollution (e.g., vehicle exhaust or industrial emissions)?

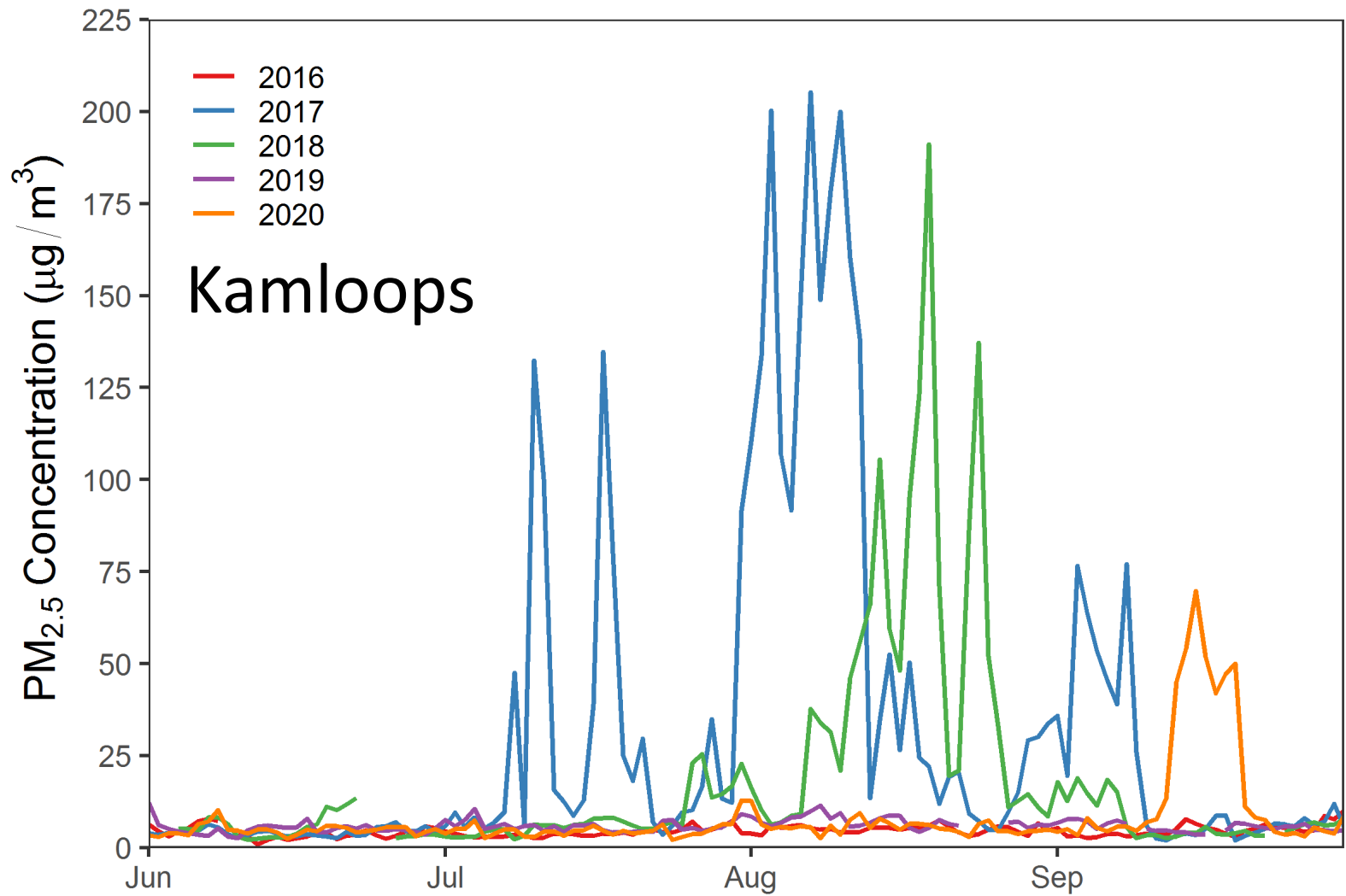
- A. It is more spatially unpredictable
- B. It is more temporally unpredictable
- C. The air quality impacts are higher in magnitude
- D. A and B
- E. All of A, B, and C

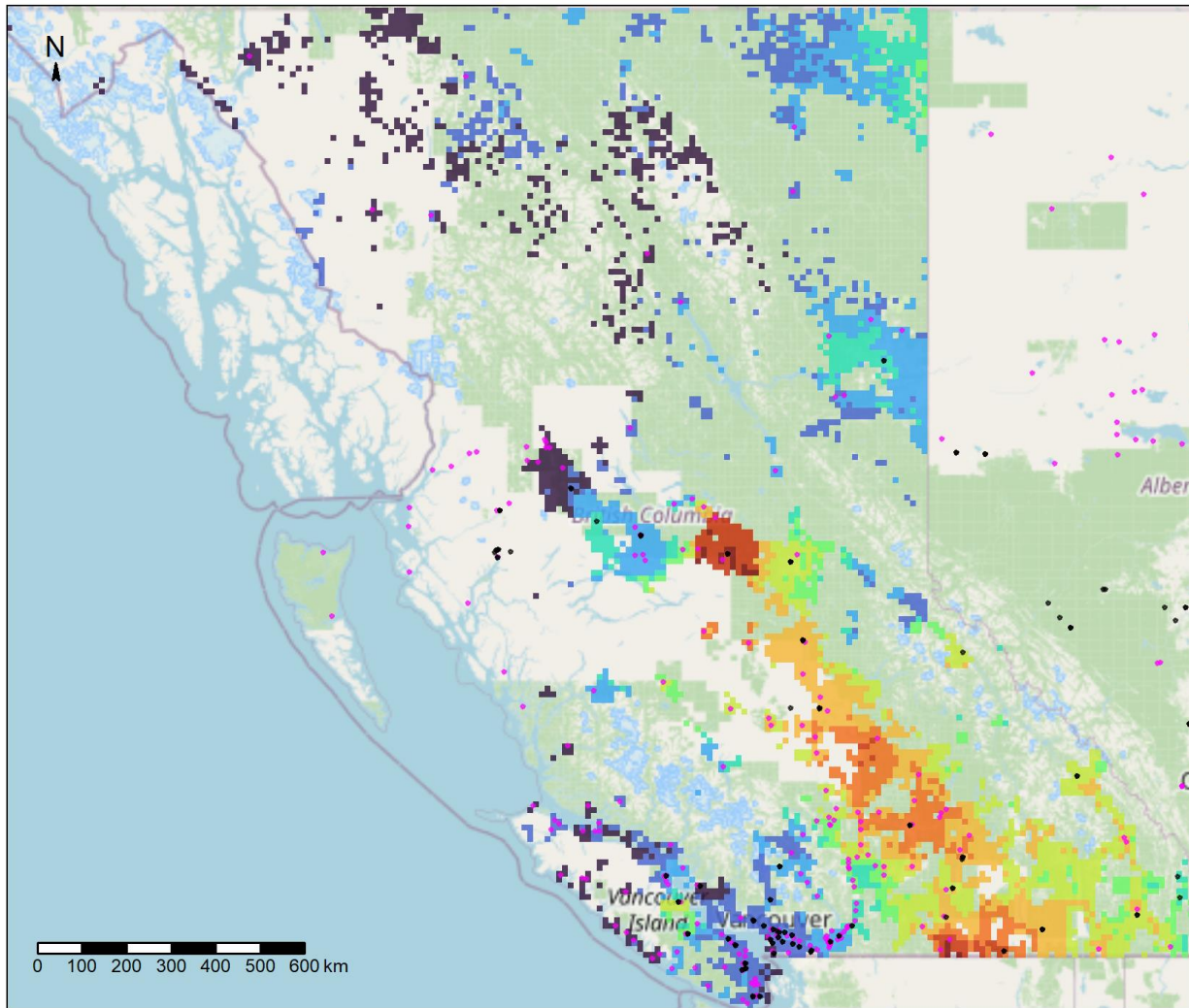
Decades of research
show that air
pollution adversely
affects human
health



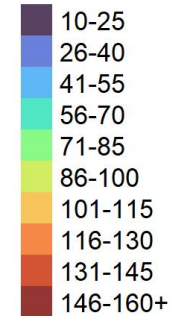








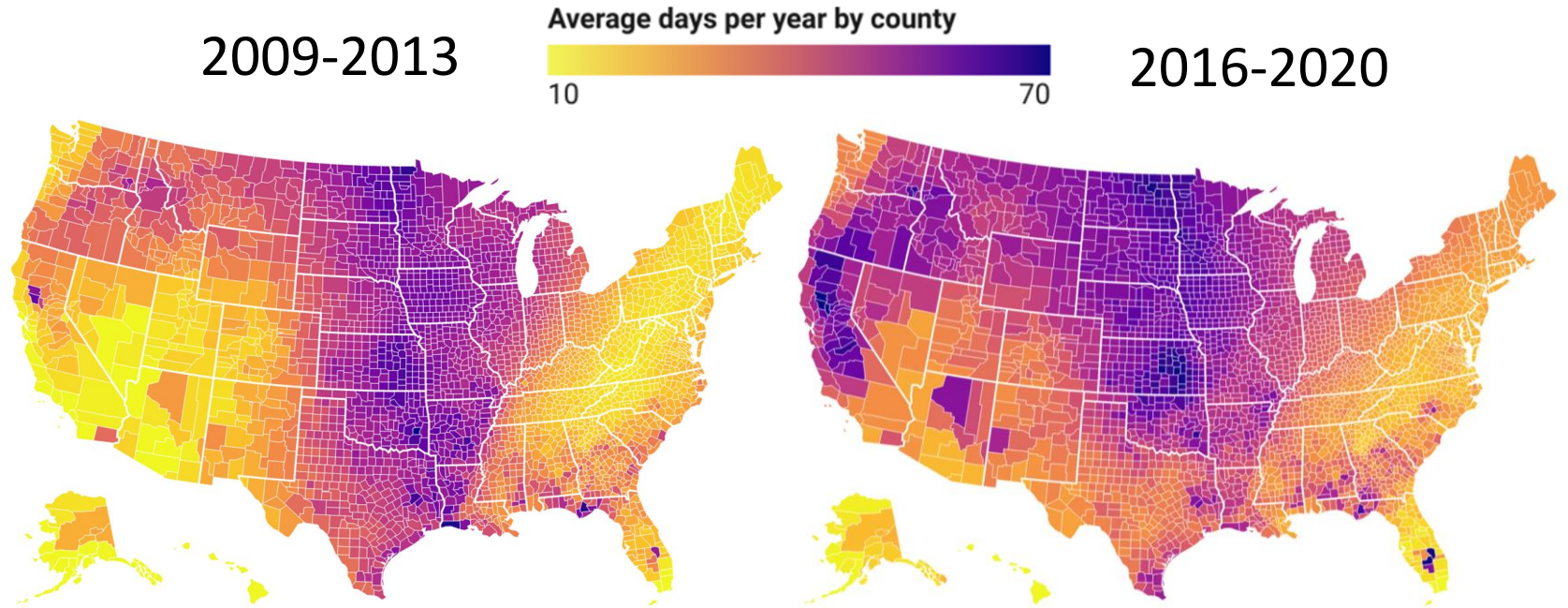
Number of days
in 2010-2022 with
high biomass
smoke exposure



Indigenous community

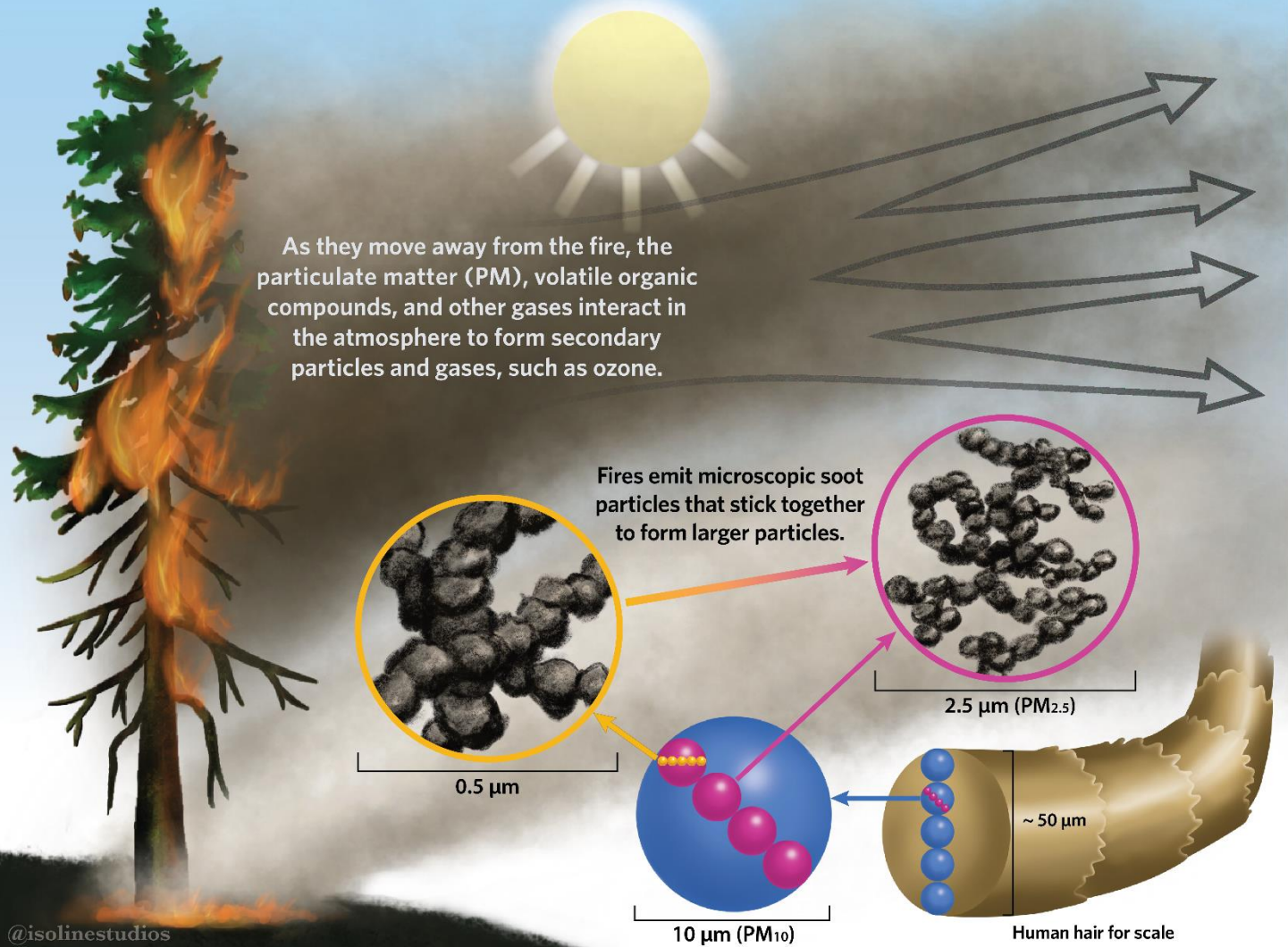
NAPS station

Wildfire smoke is starting to dominate lifetime PM_{2.5} exposure



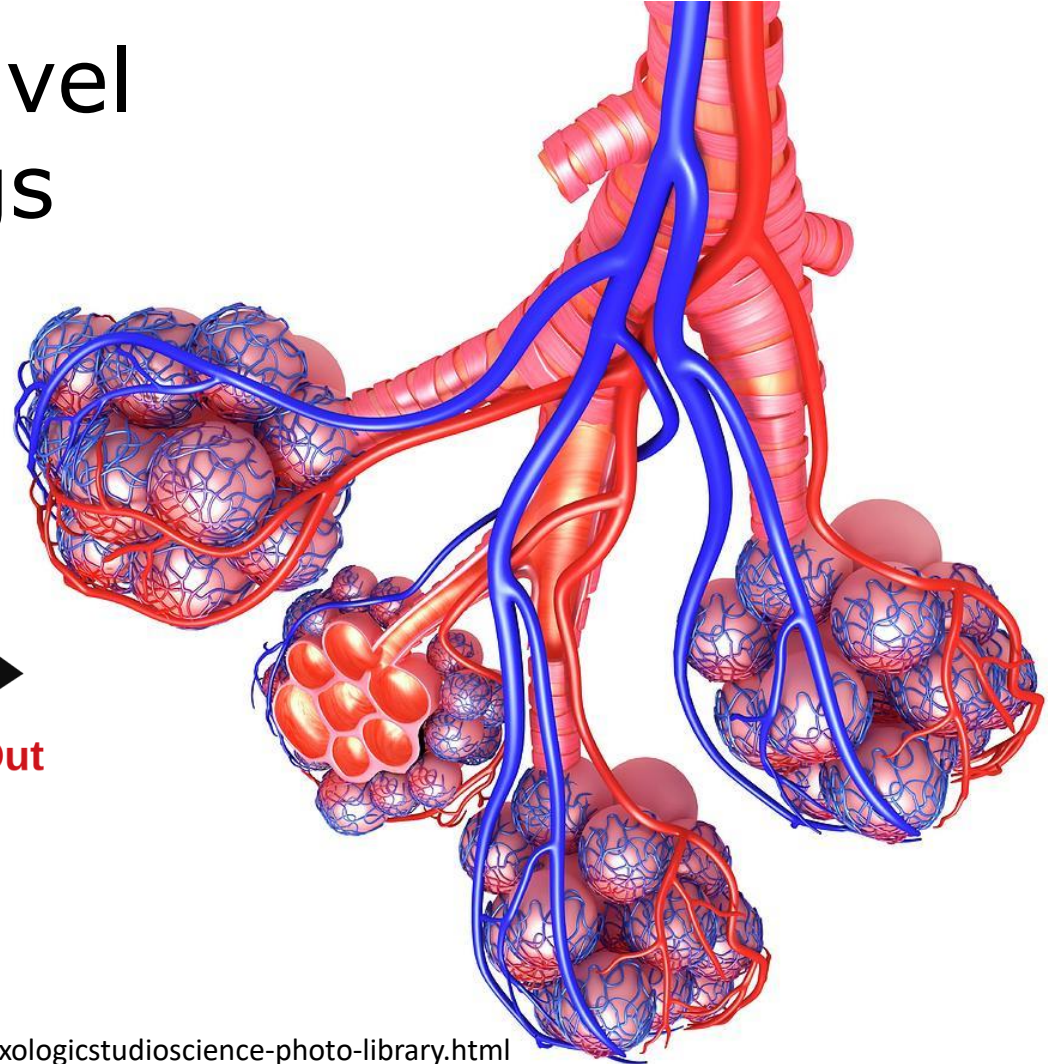
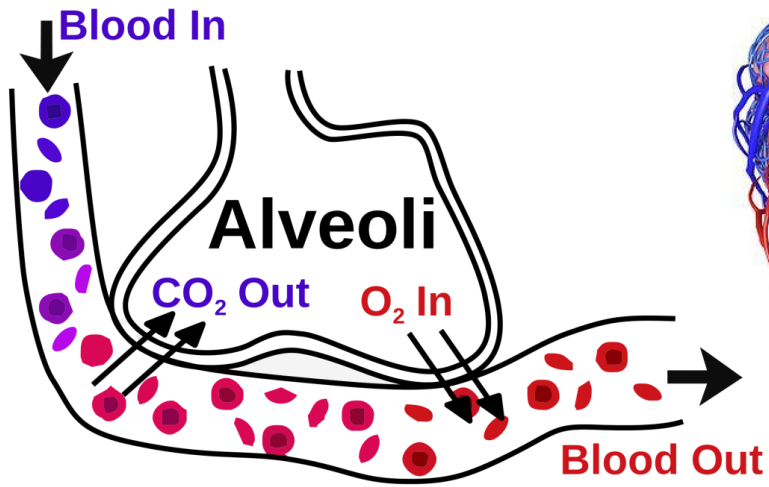
Wildfire smoke is a complex mixture of organic and inorganic gases and fine particles with a complex composition. Which component of wildfire smoke is most relevant to human health?

- A. Inorganic gases (e.g., CO, NO_x, O₃)
- B. Organic gases (e.g., PAH, VOC)
- C. Fine particulate matter
- D. We don't really know



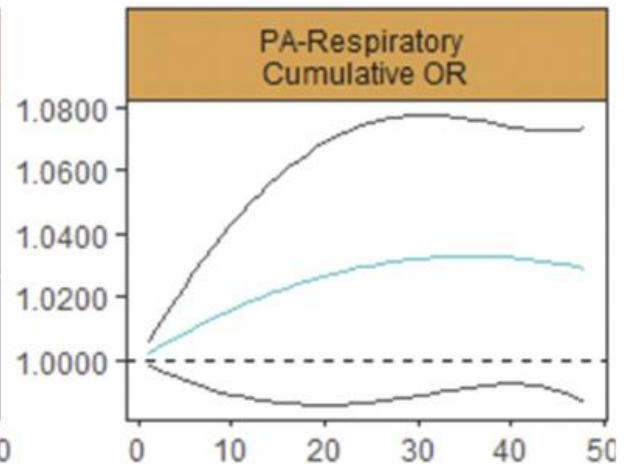
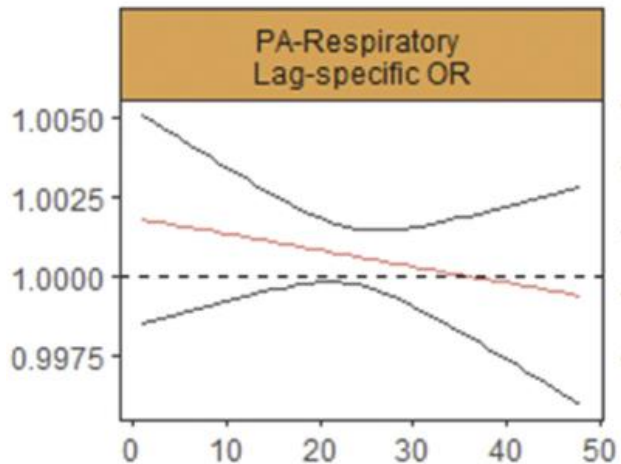
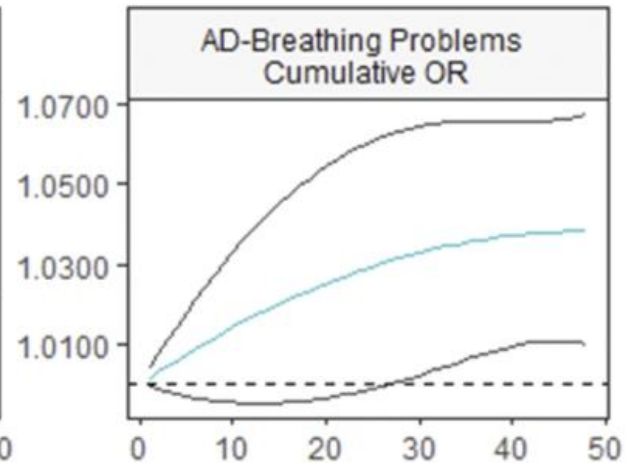
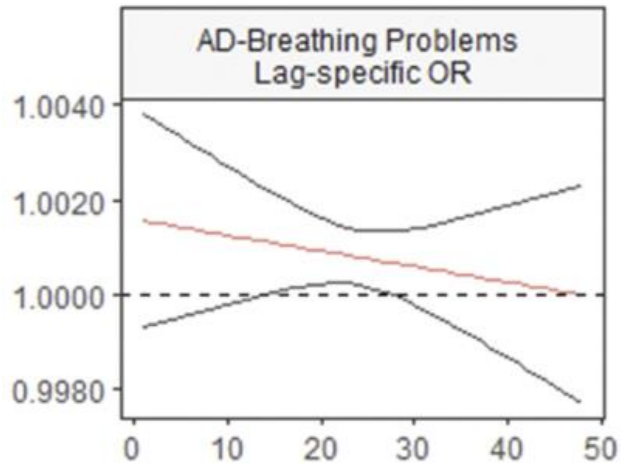


Small particles travel deep into the lungs

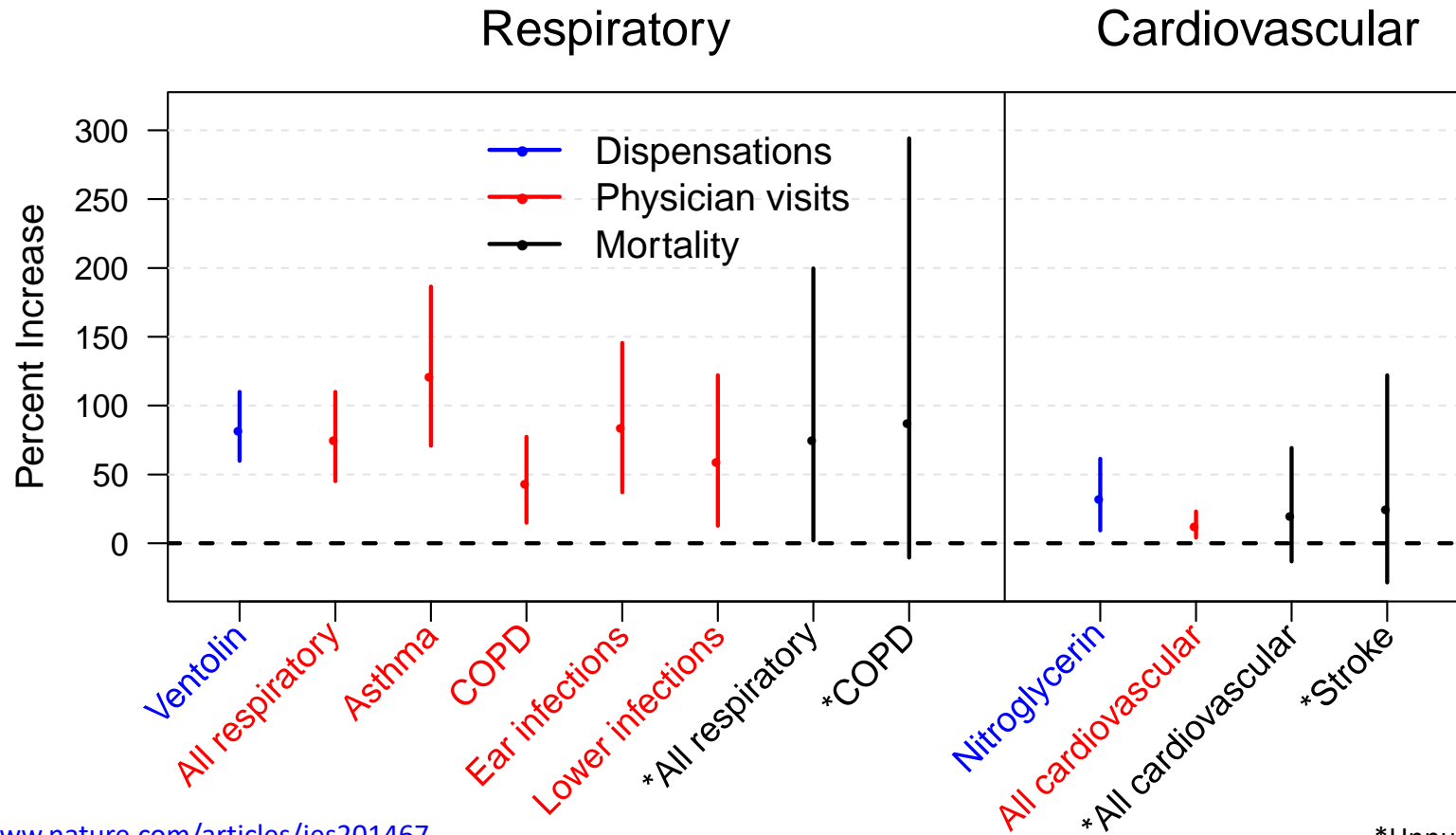


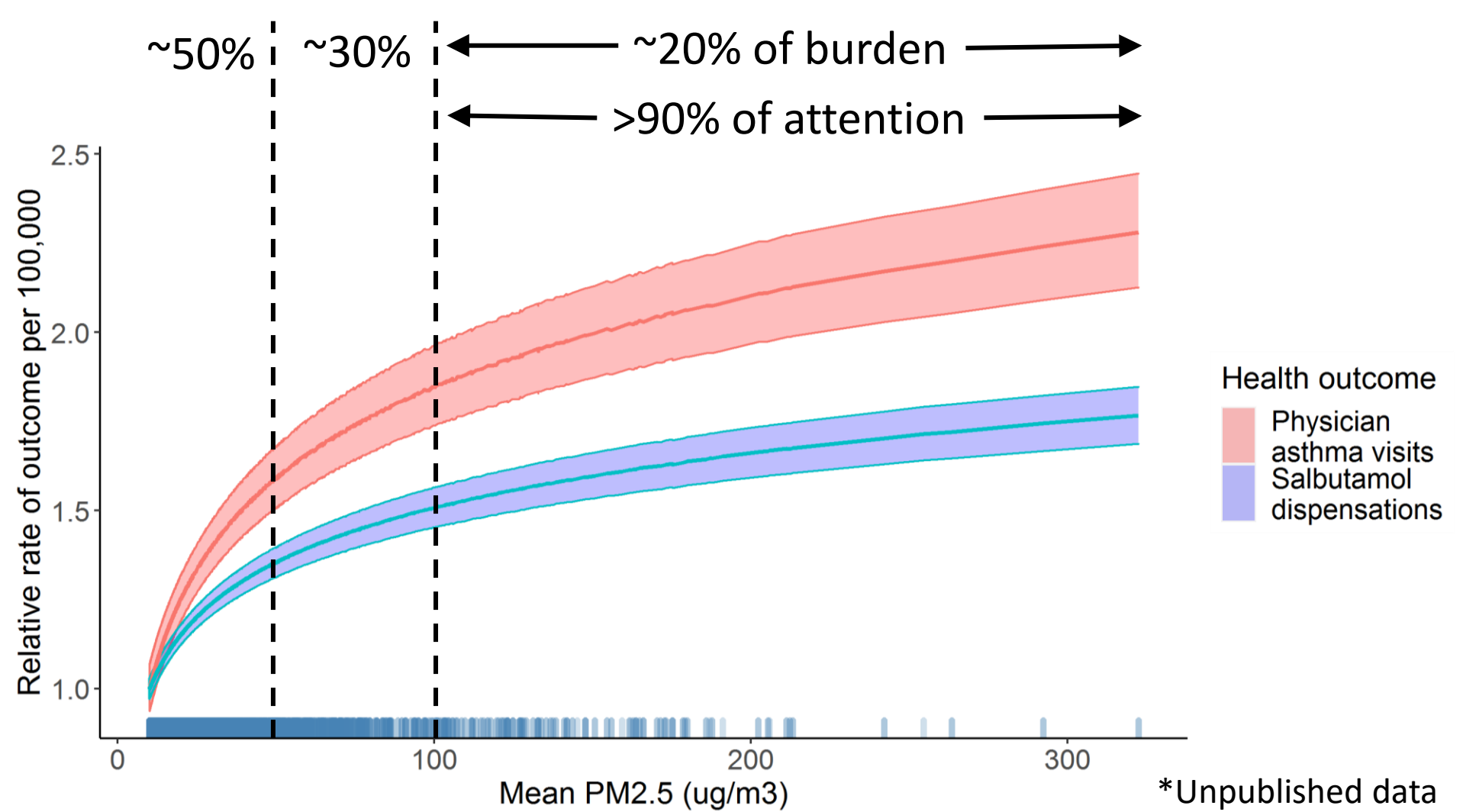
- Inflammation
- Oxidative stress

Effects
start within
hours



Acute effects on a smoky day (100 $\mu\text{g}/\text{m}^3$ $\text{PM}_{2.5}$)



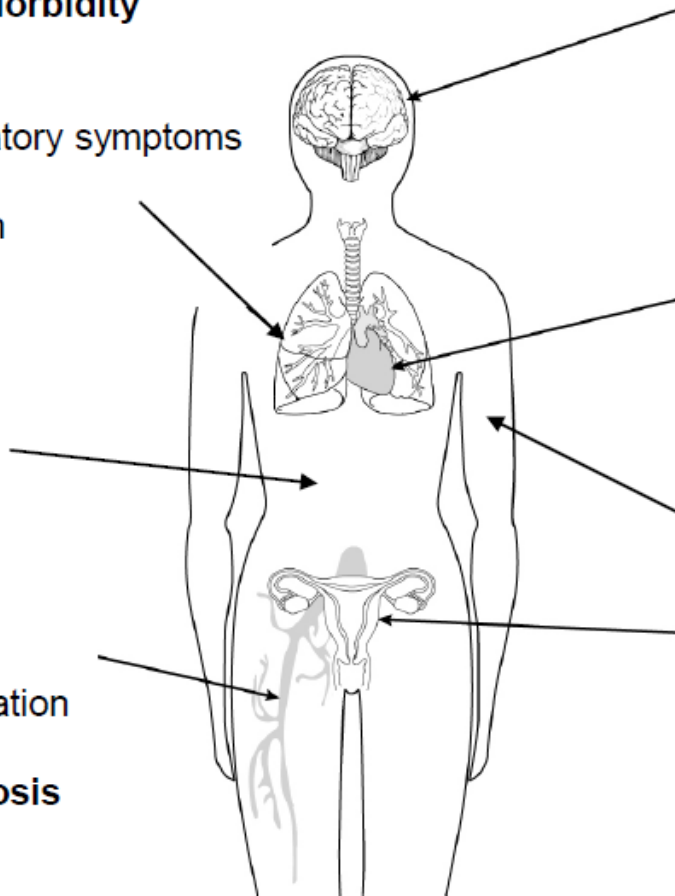


- **Respiratory Disease Mortality**
- **Respiratory Disease Morbidity**
- **Lung Cancer**
- **Pneumonia**

- Upper and lower respiratory symptoms
- Airway inflammation
- Decreased lung function
- Decreased lung growth

- Insulin Resistance
- **Type 2 diabetes**
- **Type 1 diabetes**
- Bone metabolism

- **High blood pressure**
- Endothelial dysfunction
- Increased blood coagulation
- Systemic inflammation
- **Deep Venous Thrombosis**





- **Stroke**
- Neurological development
- Mental Health
- **Neurodegenerative diseases**

- **Cardiovascular Disease Mortality**
- **Cardiovascular Disease Morbidity**
- **Myocardial Infarction**
- **Arrhythmia**
- **Congestive Heart Failure**
- Changes in Heart Rate Variability
- ST-Segment Depression

- Skin Aging

- **Premature Birth**
- **Decreased Birth Weight**
- Decreased foetal growth
- In uterine growth retardation
- Decreased sperm quality
- Preclampsia

Rapid summary of acute wildfire smoke effects

Same	Different
<p>How is wildfire smoke the same as other types of air pollution?</p>	<p>How is wildfire smoke different from other types of air pollution?</p>
<ul style="list-style-type: none">• Seems to affect every organ system in the body• Magnitude of effect is similar for most health outcomes 	<ul style="list-style-type: none">• Much stronger acute respiratory effects, especially for those with chronic conditions such as asthma 

Does wildfire smoke affect our health even after the air has cleared?

A. Yes

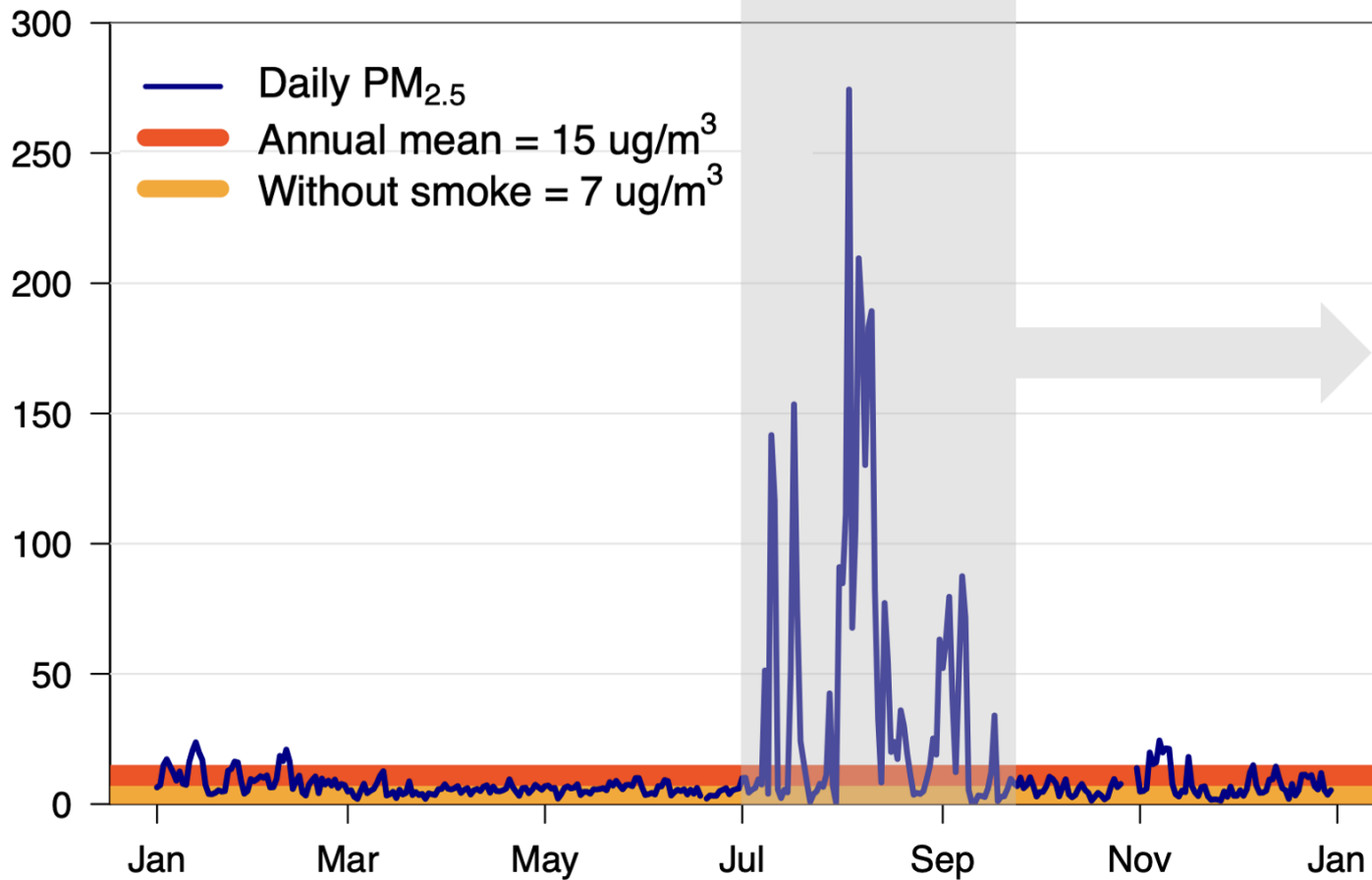
B. No

C. Probably

PM_{2.5} focus

Acute
phase

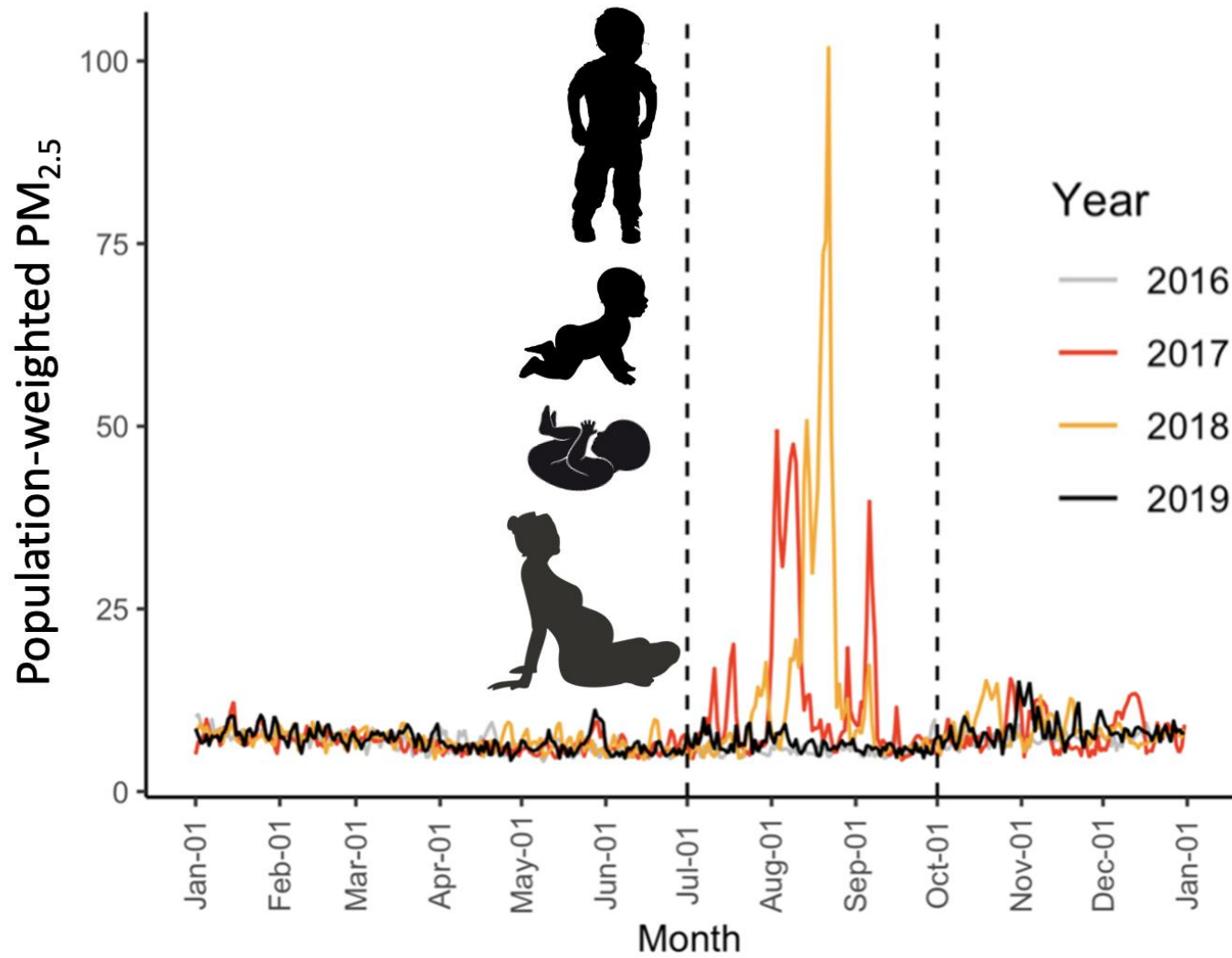
Chronic
phase



Chronic effects so far...

- Persistent reductions in lung function
- Increased cardiovascular disease (wildland firefighters)
- Higher healthcare use
- Subsequent severe acute events (e.g., MI)
- Mood and developmental disorders (e.g., PTSD)
- Lung, brain cancers

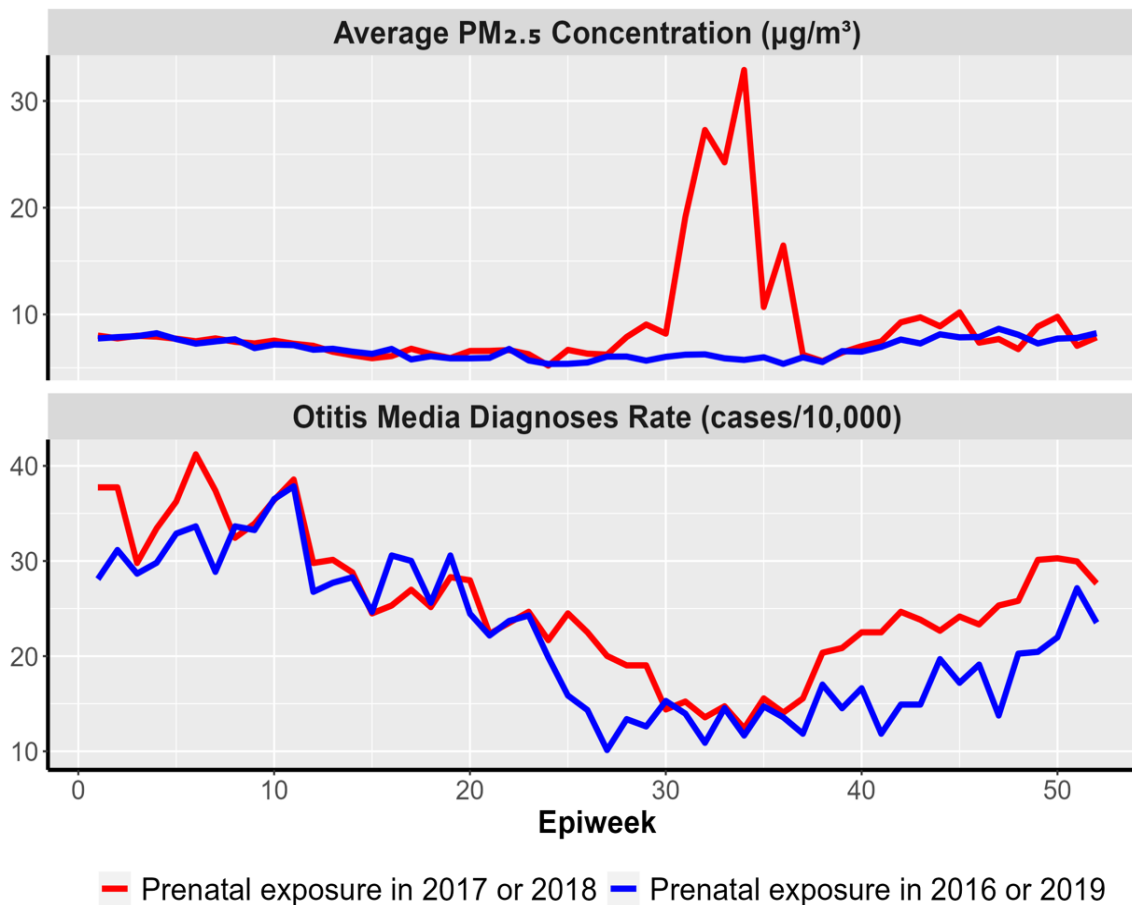
In the absence of more specific evidence, there is **NO REASON** to believe that exposure to wildfire carries less risk than other types of air pollution.



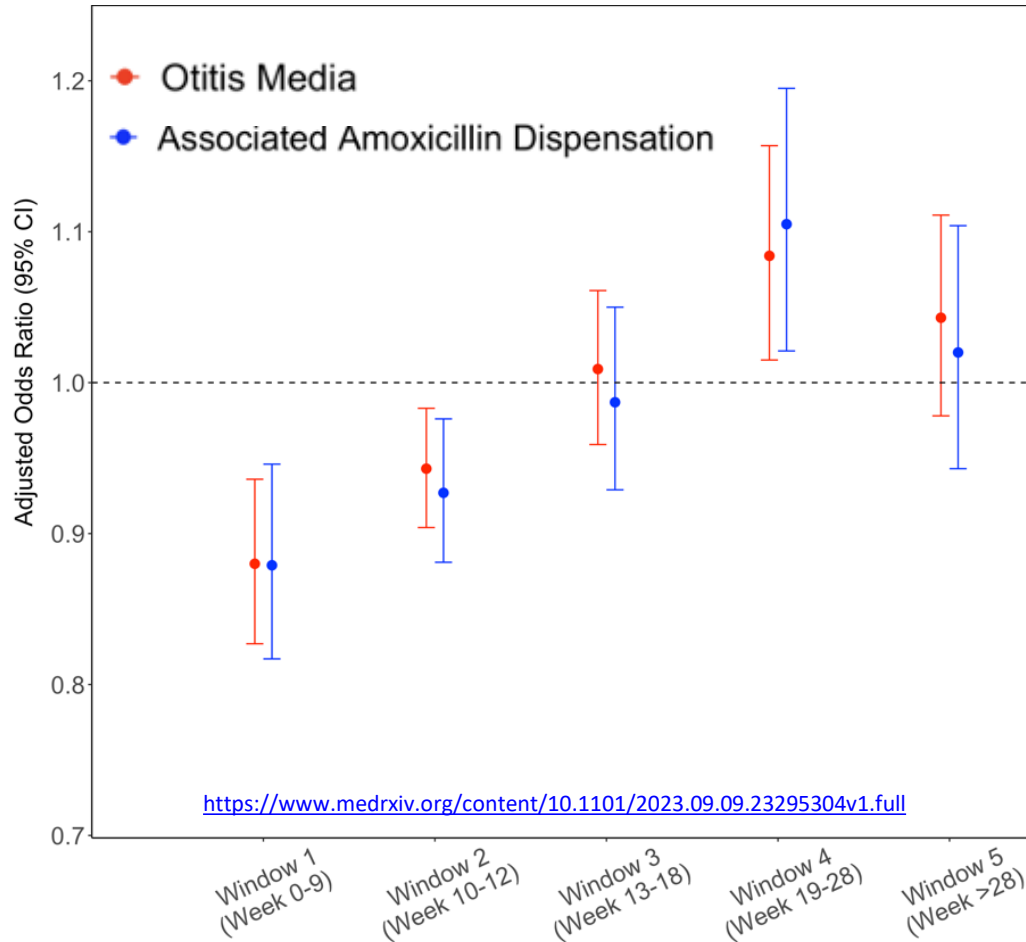
What factors make children more susceptible than adults to the effects of air pollution?

- A. Higher respiratory rate
- B. Higher activity levels
- C. More time outdoors
- D. Rapid lung development
- E. A and D
- F. B and C
- G. All of A, B, C and D

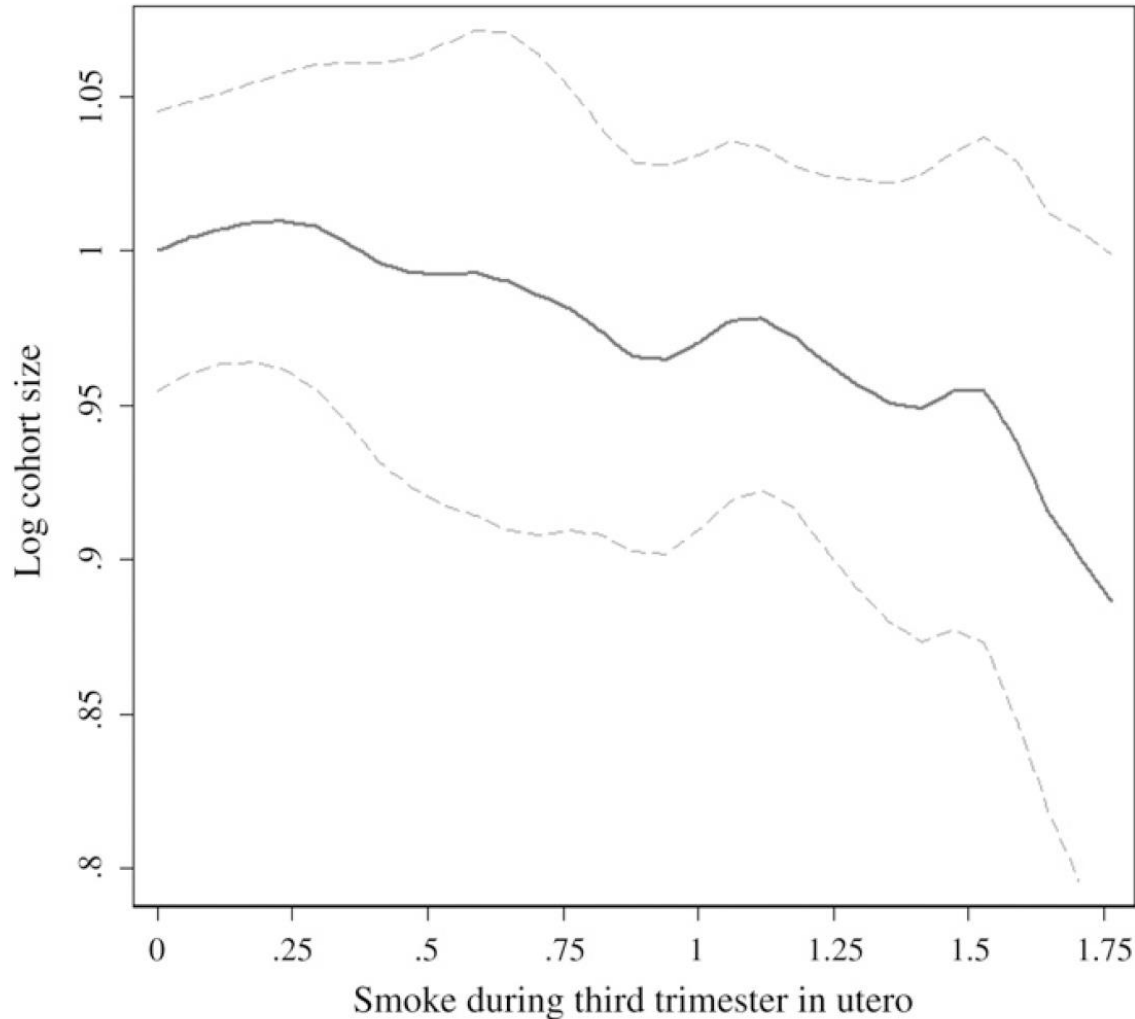
Eyeball epidemiology



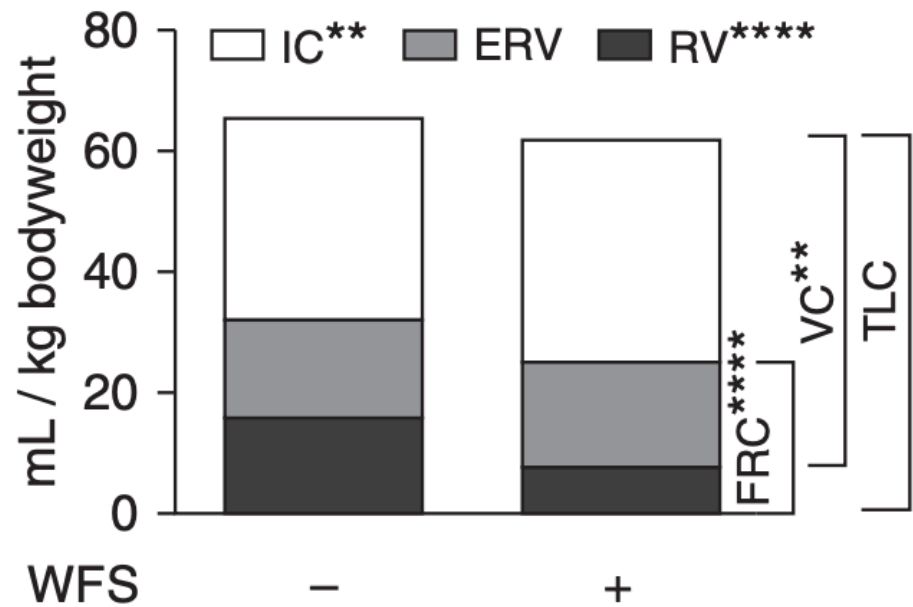
Real epidemiology



1997-1998 haze in Indonesia



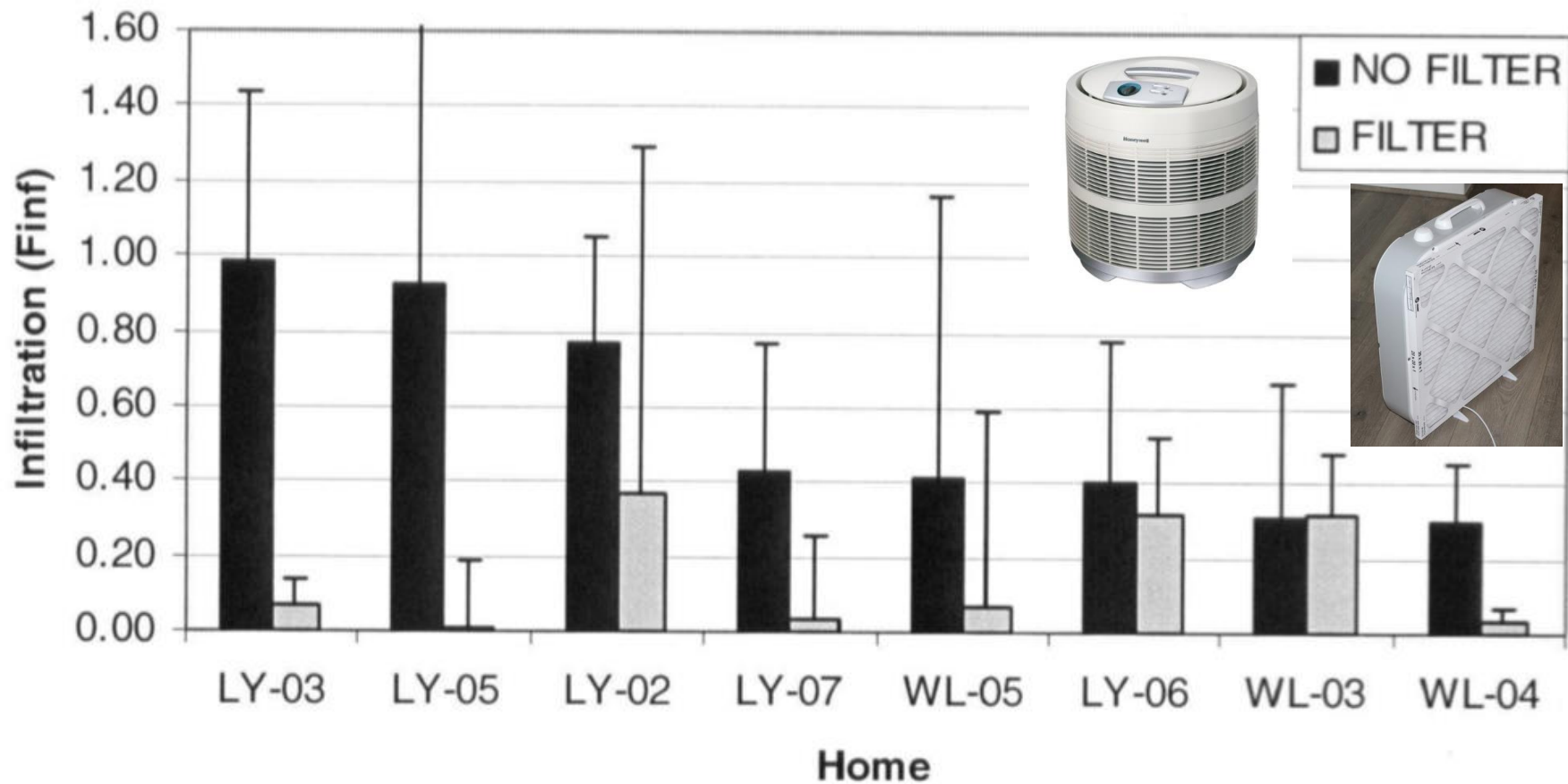
- Strong El Nino cycle
- Exposed infants were >3 cm shorter than non-exposed infants as adults

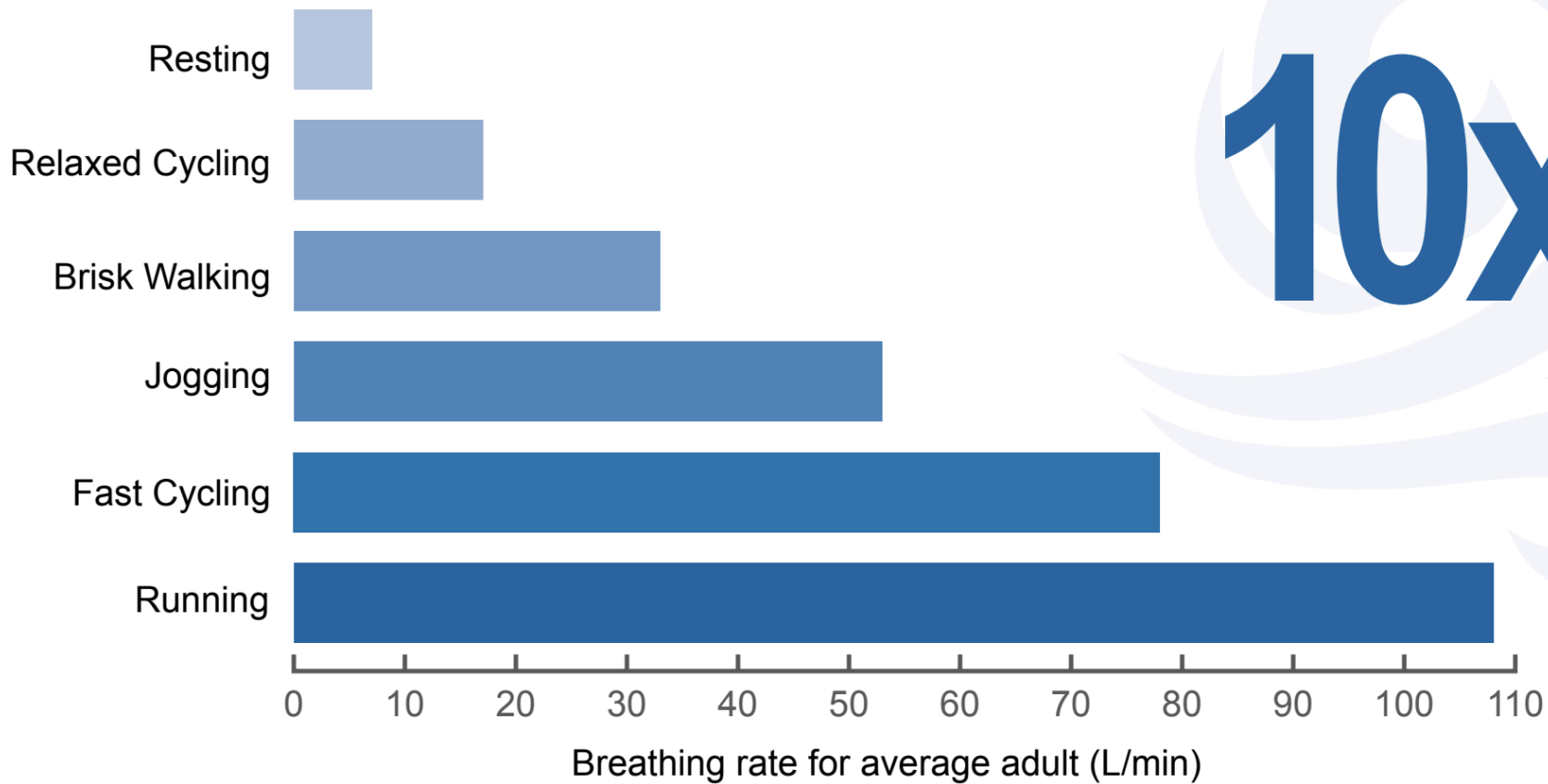


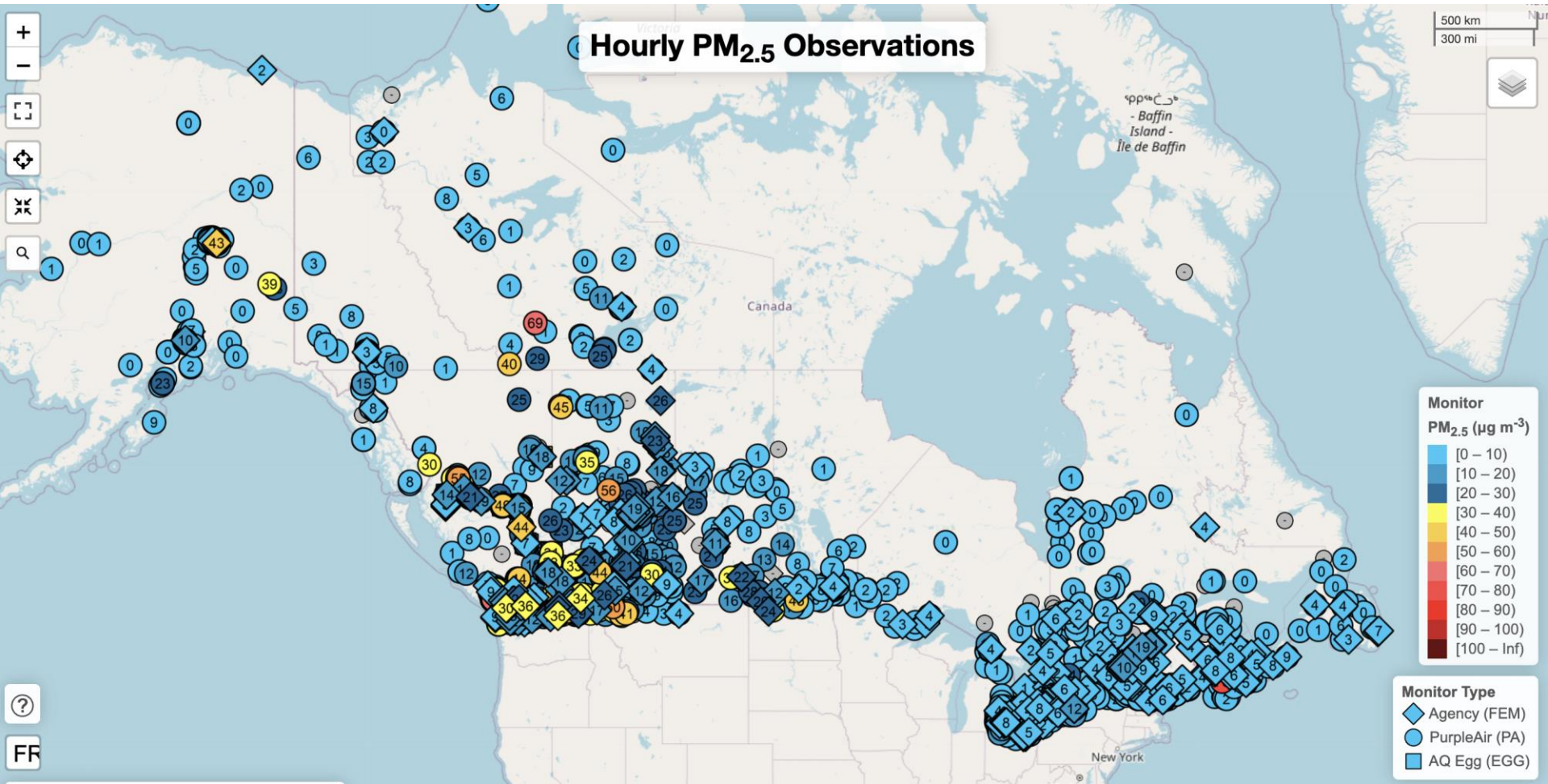
WFS = Wildfire Smoke
IC = Inspiratory Capacity
ERV = Expiratory Reserve Volume
RV = Reserve Volume
FRC = Functional Residual Capacity
VC = Vital Capacity**
TLC = Total Lung Capacity

What is the best way to protect adults and children (including those in the womb) from the effects of wildfire smoke?

- A. Staying indoors
- B. Using indoor air cleaning strategies
- C. Wearing masks
- D. Reducing activity levels outdoors
- E. Monitoring air quality at home









“It’s natural!”

“It’s unsafe.”

“It’s a form of air pollution that can affect your health. The more you reduce your exposure, the more you reduce the risks.”

The 2023 wildfire season was the most severe in recorded Canadian history. Do you believe there will be an even more severe season in the next ten years?

A. Yes

B. No

C. Maybe

Thank you!

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