



# Where there's smoke... there's *action?*

What ECHO can do to  
protect children from  
wildfire smoke

**Christine Loftus, PhD MPH MS**

ECHO Yakima Valley Site (306; PI Karr)

October 8, 2025

# OUTLINE

- Wildfire smoke: A growing public health crisis harming US children
- What can the ECHO Program do? (And, *why ECHO*?)
  - **Solution-oriented** research on wildfire smoke
  - The importance of **time sensitive** data collection
    - The Wildfire Smoke Rapid Response Protocol Pilot: Preliminary findings
- Other ways to support ECHO families
- How you can get involved
- **Discussion:** Questions, feedback, & ideas for future collaborations

# Wildfire smoke is increasingly common across all regions of the US

Historic 2023 wildfire smoke events in the Midwest and Northeast

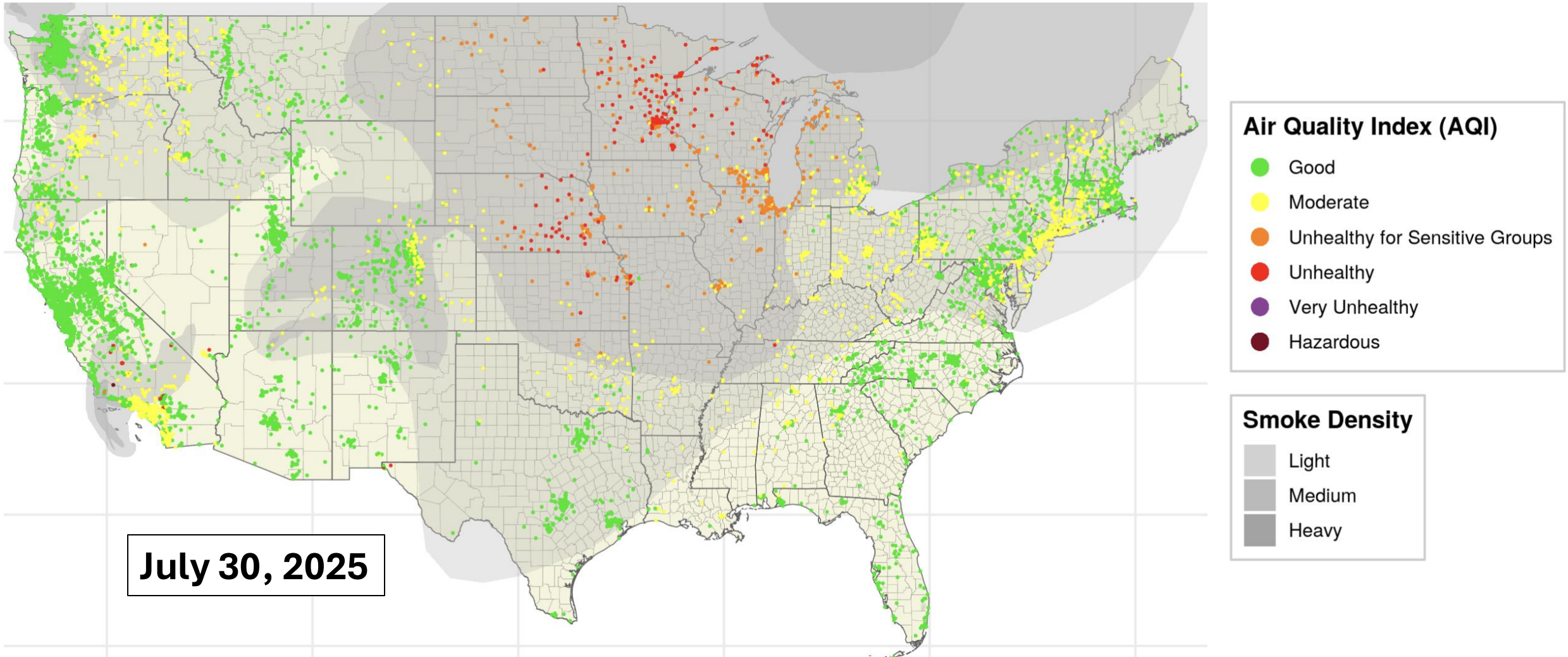


Wikimedia commons. [Smoke from the 2023 Alberta wildfires blown over to the northeastern United States](#)

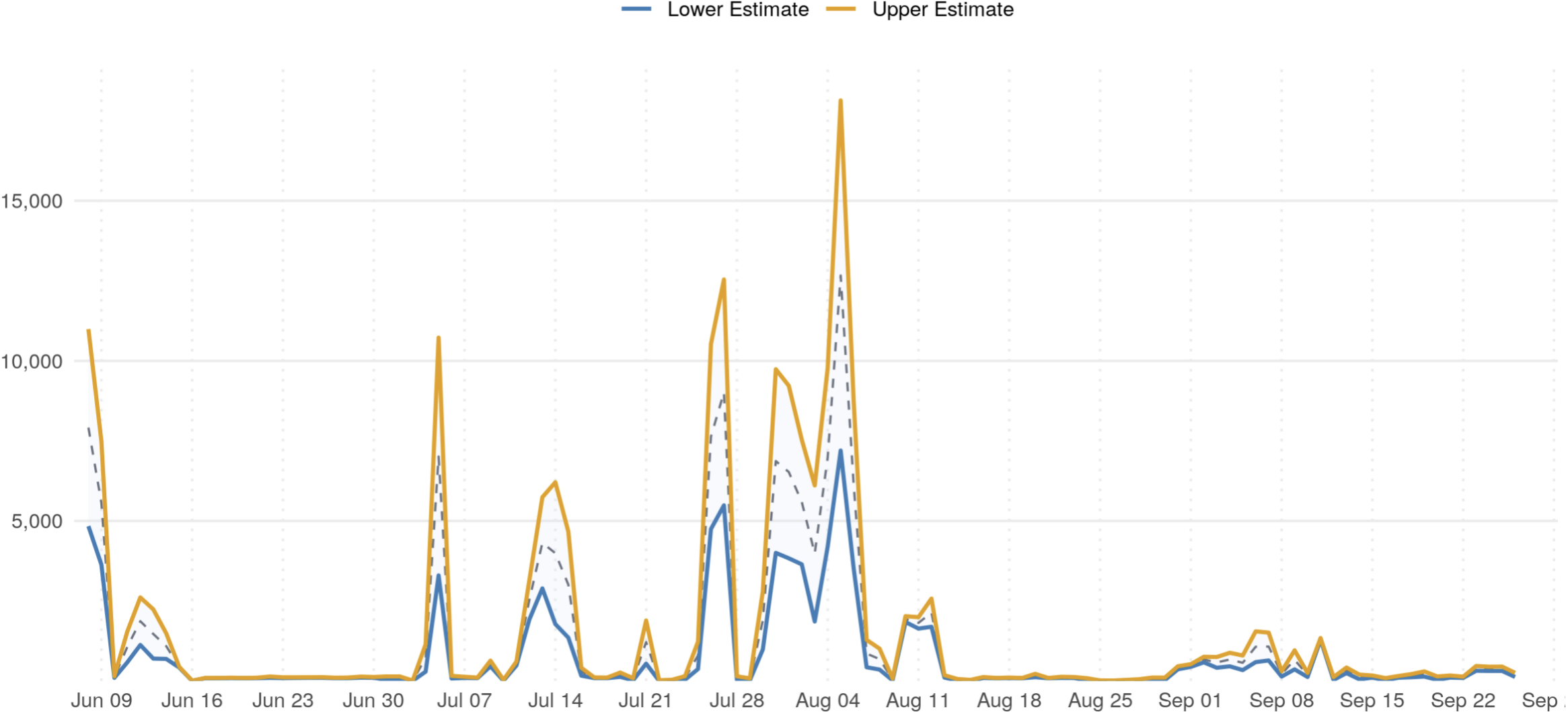


Wikimedia commons. [Quebec Canada Wildfire Smoke Consumes New Jersey and New York City June 7 2023](#)

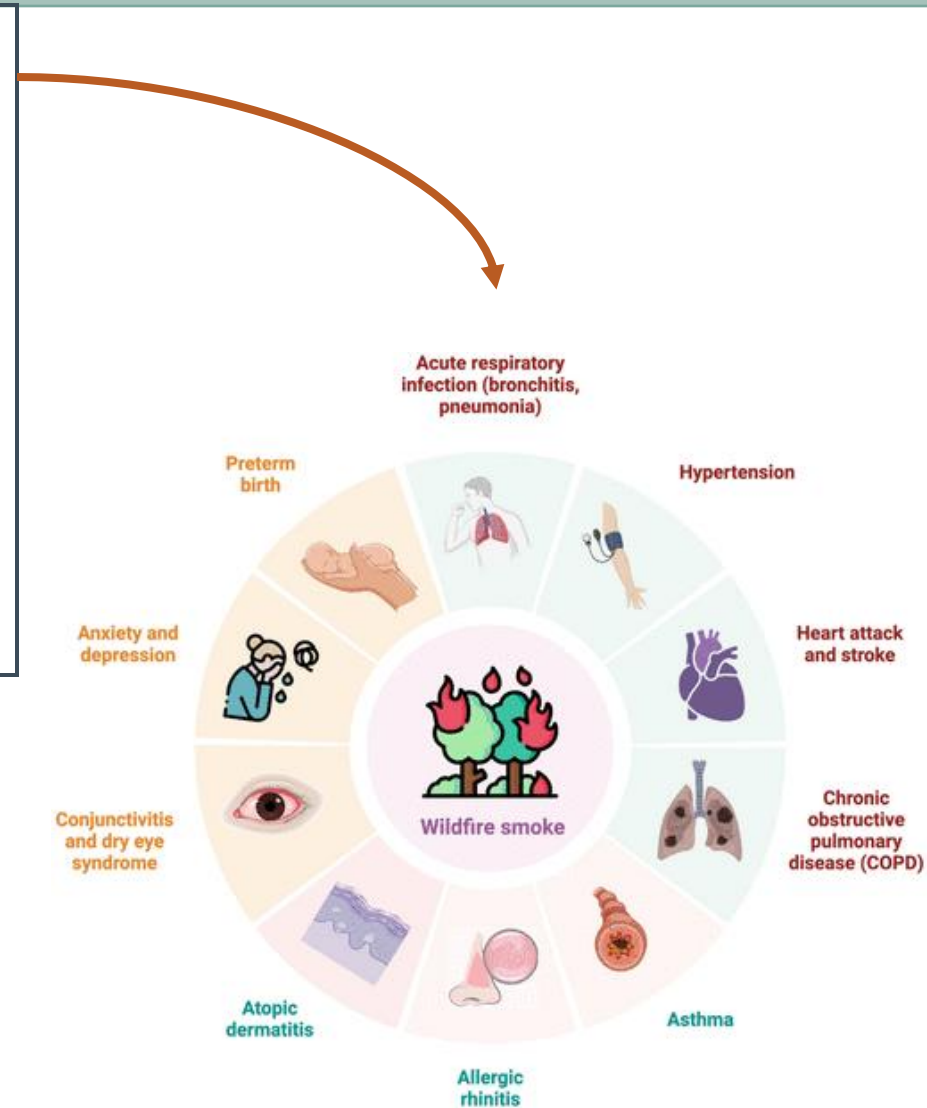
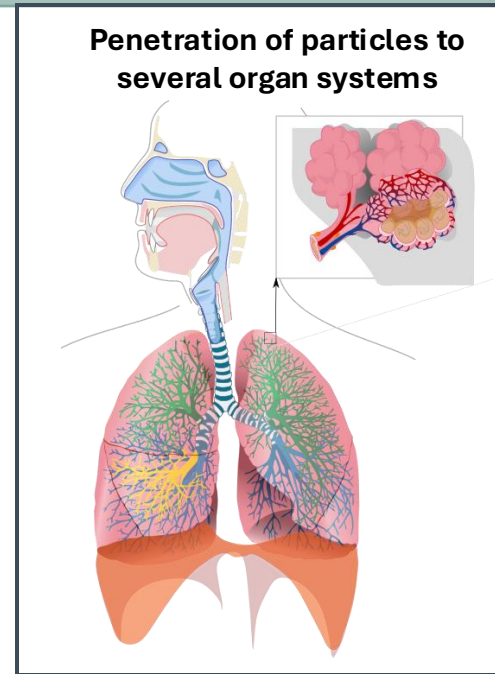
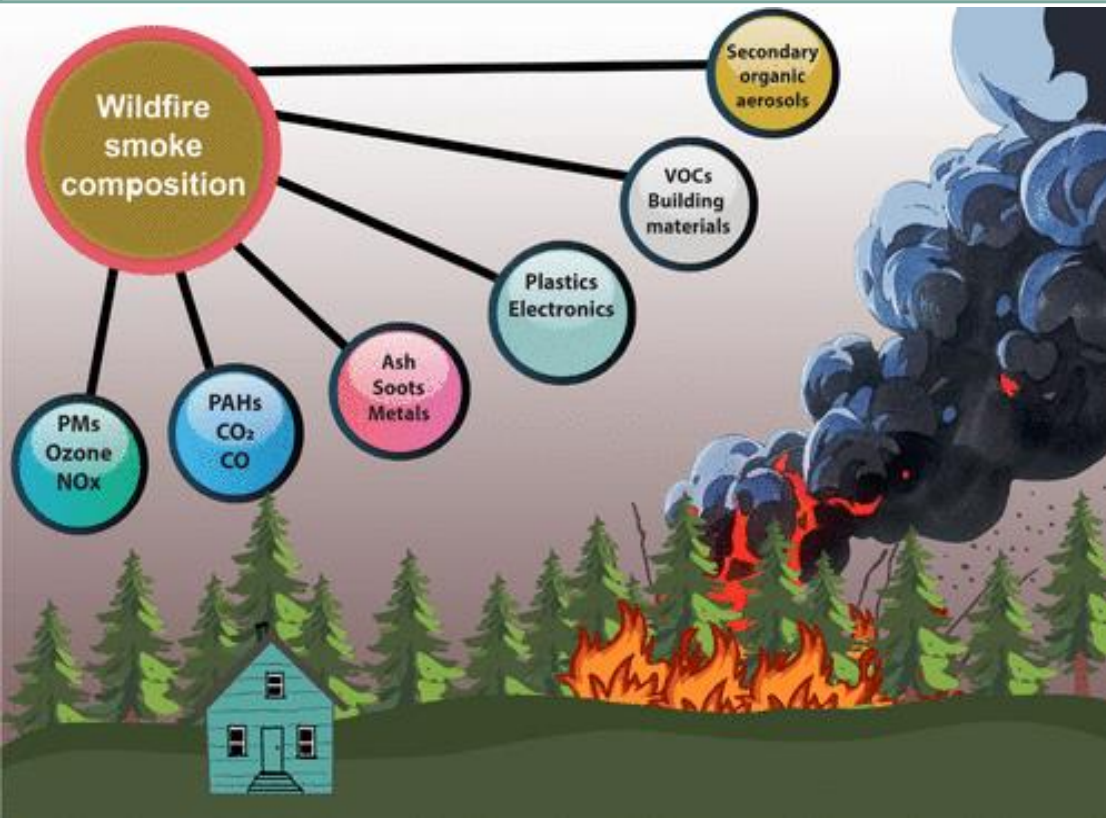
# Several serious smoke events across the US in 2025



# An estimated 14,000-33,000 ECHO participants experienced at least 1 “smoke day” in 2025, already



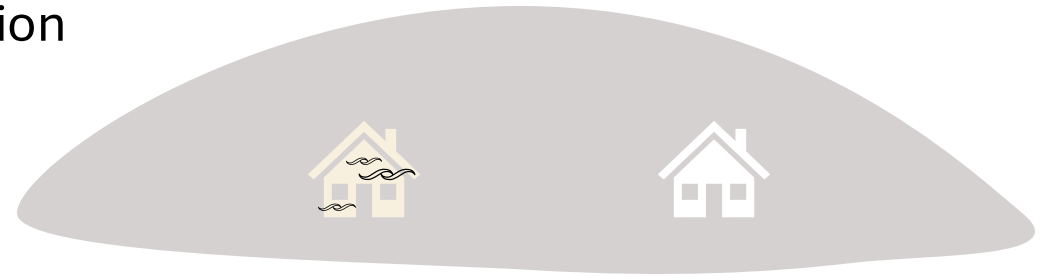
# Chemicals and small size of particles in smoke lead to developmental toxicity



# Wildfire smoke harms some families more

**Underserved, low-resource communities & households →  
higher personal exposure + lower capacity to recover from health impacts**

- Difficult to find or afford supplies for exposure reduction
- Limited availability of information
- Lower quality building construction
- Less likely to have HVAC or AC
- Barriers to health care
- *All these factors → rural-urban disparities*



**Some are more susceptible to toxic effects of wildfire smoke exposure**

- Prenatal and early-life exposure timing
- Existing asthma and other chronic diseases
- Co-exposure to other chemical & nonchemical stressors → *amplified effects of wildfire smoke*

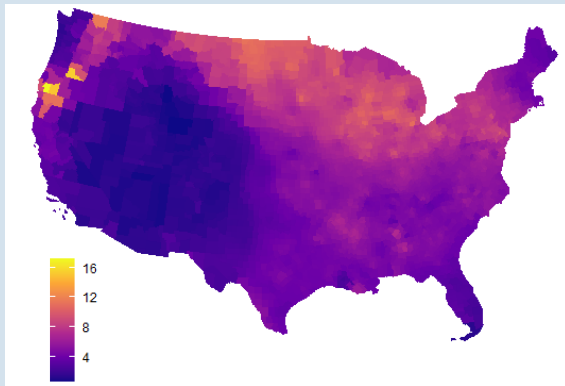
# The ECHO Program and Wildfire Smoke: What can we do?

1. Better understand health impacts of wildfire smoke on children
2. Conduct research that might help inform interventions, especially for the most vulnerable families
3. Directly support our participants

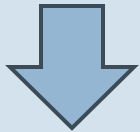
# ECHO Research on Prenatal & Early-Life Wildfire Smoke

## Estimates of PM<sub>2.5</sub> from wildfires

Daily resolution  
10 km grid, census tract, zip code  
2006-2024



*WF-ozone and additional PM models pending*



Supporting several analyses of maternal and child health outcomes

Studies of several health outcomes in progress

Adverse birth outcomes\*

Pregnancy complications

Infant growth

Respiratory health (asthma, infections)

Neurodevelopment

Atopic dermatitis (eczema)

### Do associations vary by...

- Family SES, neighborhood, breastfeeding, child sex?
- Chemical composition of the smoke?
- Timing of exposure
  - Critical windows in pregnancy or childhood?
  - Many days of low smoke vs. fewer, more extreme episodes?

**\*First paper on wildfire smoke in press at Lancet Plant. Health (Sherris/Padula)**

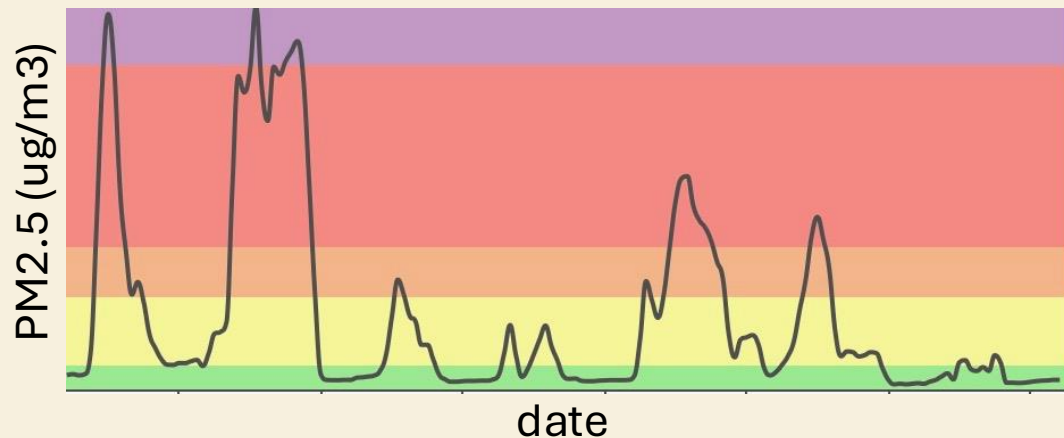
# The ECHO Program and Wildfire Smoke: What can we do?

1. Better understand health impacts of wildfire smoke on children
2. Conduct ECHO research that might help inform interventions, especially for the most vulnerable families
3. Directly support our participants

# What if ECHO collects data during or after smoke events?

## Assess short term health outcomes

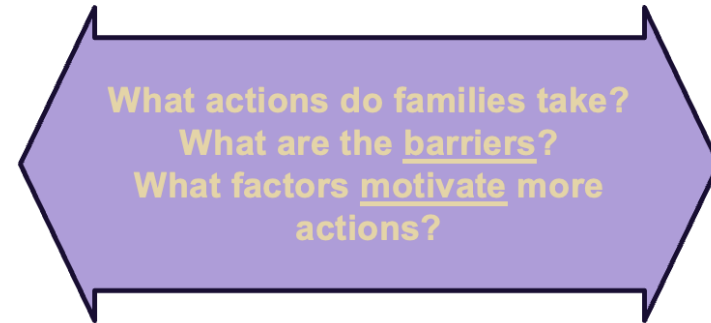
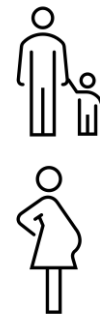
Wildfire smoke exposure is **episodic and extreme**



**Acute impacts** of smoke exposure can be very serious, even life-threatening

Example: Exacerbations of existing conditions (asthma, atopic dermatitis)

## Understand self-protective behaviors



**Little is known about what families are doing to address wildfire smoke exposure**

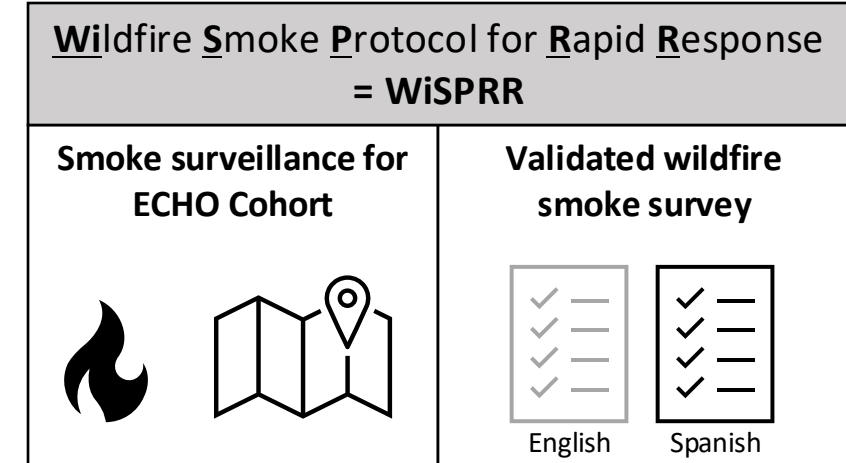
This information can identify the most vulnerable communities and inform intervention protocols. (And, also improve exposure assessment in epi.)

# Development and Evaluation of a Wildfire Smoke Protocol for “Rapid Response” (WiSPRR) in the ECHO Cohort: OIF Cycle 1

PI: Loftus; Mentor: Karr

## OBJECTIVES

1. Develop **WiSPRR**: Two components
2. Pilot **WiSPRR** at 3 ECHO sites
3. Evaluate the protocol to inform potential scale up
4. Use pilot data to learn about ECHO families’ experiences in smoke events



## POTENTIAL IMPACTS AND PRODUCTS

- Addition to the ECHO Protocol (optional/specialized?)
- Novel nationwide research on behaviors and short-term health impacts
- A model for **other** time-sensitive, *ad hoc* ECHO Protocol data collection

# 1. Developed new surveys (DCFs) for rapid response

## Priorities

1. Complement ECHO Protocol
2. Low burden (~5 min.)
3. Enable impactful, solution-oriented science



Topic	Example questions. Reference period = past two weeks
Exposure	Did you taste, smell or see wildfire smoke? Were <b>you</b> * traveling away from home?
Health impacts	Did <b>you</b> * experience any of the following? <b>Select all:</b> Shortness of breath, headache, sleep disruption, acute anxiety, hopelessness, fatigue, asthma exacerbation... + other physical/mental health problems. <b>Follow-up Qs</b> on severity (e.g., ED visit), medications, and others
Protective behaviors	Did you do any of the following to protect <b>yourself</b> * during recent smoke days? <b>Select all:</b> Stay indoors, wear a mask, use indoor air cleaner, talk to a health care provider, increase medication use, visit a “clean air” shelter, leave the region, etc. <b>Follow-up Qs</b> about frequency, details of action (e.g., type of mask), and barriers to actions not taken.
Community resources	Did you receive support from any people, organizations or programs in your community? ...your child’s school? What resources could have helped you better <b>protect yourself</b> *?

\*Survey for parents of ECHO children will refer to child

**Complete:** 1) Drafted in English, 2) Translated to Spanish; 3) Pilot tested N>15 team members

**PENDING:** Validation, using focus groups w/ English/Spanish speakers → (first validated survey of its kind)

## 2. Establish Wildfire Smoke Surveillance in ECHO

### IDEAL FEATURES

- ✓ US-wide
- ✓ Low-burden
- ✓ Rapid\*
- ✓ Accurate\*\*

\* Identify events w/in 1-2 days

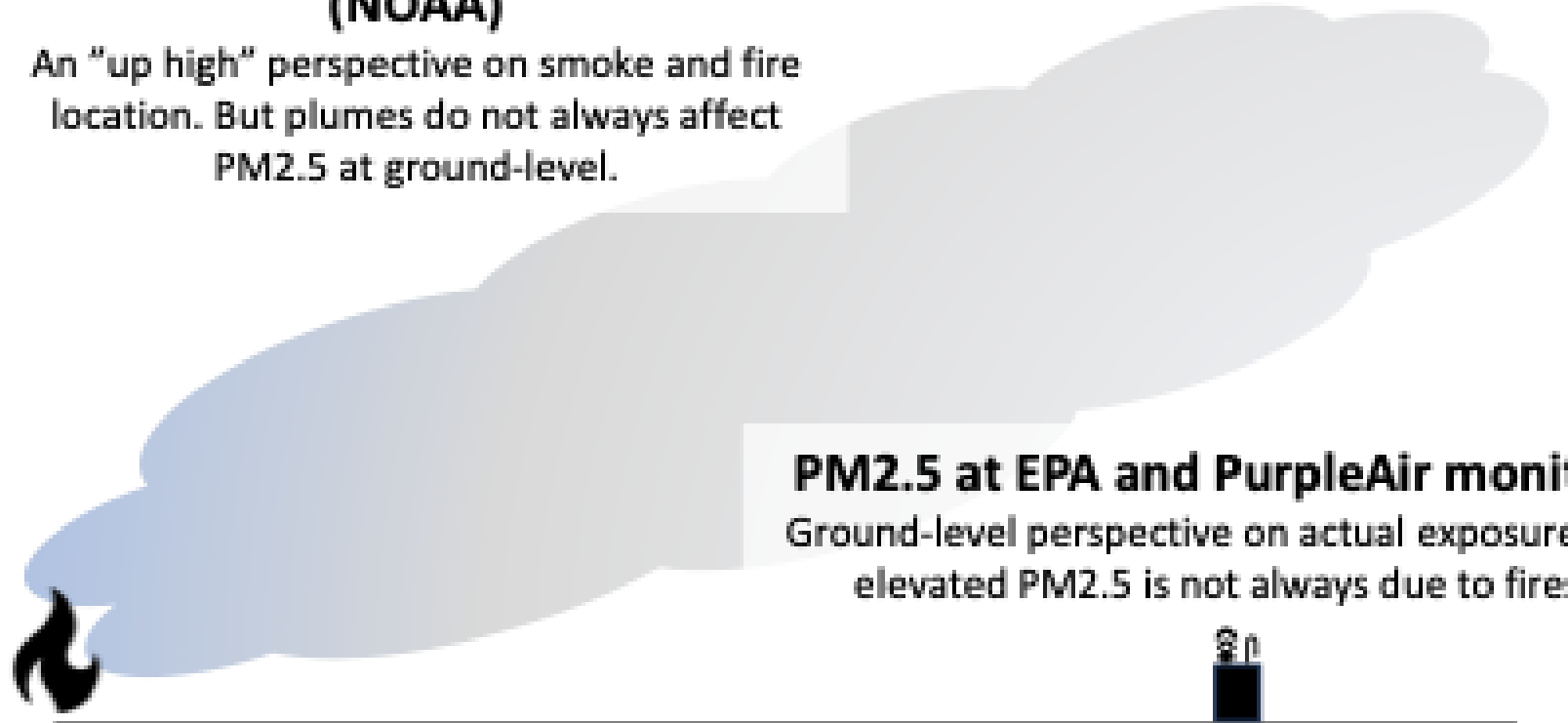
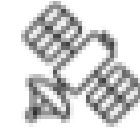
\*\* *Fairly* accurate is good enough. Will use models for health effects studies.

#### OIF Surveillance team!

Dustin Burnham, Elizabeth Spalt,  
Adam Szpiro, Stuart Ilson, Dan  
Jaffe

### Satellite images of smoke plumes (NOAA)

An "up high" perspective on smoke and fire location. But plumes do not always affect PM2.5 at ground-level.



### PM2.5 at EPA and PurpleAir monitors

Ground-level perspective on actual exposure. But elevated PM2.5 is not always due to fires.

# Aren't there existing resources that ECHO can leverage?

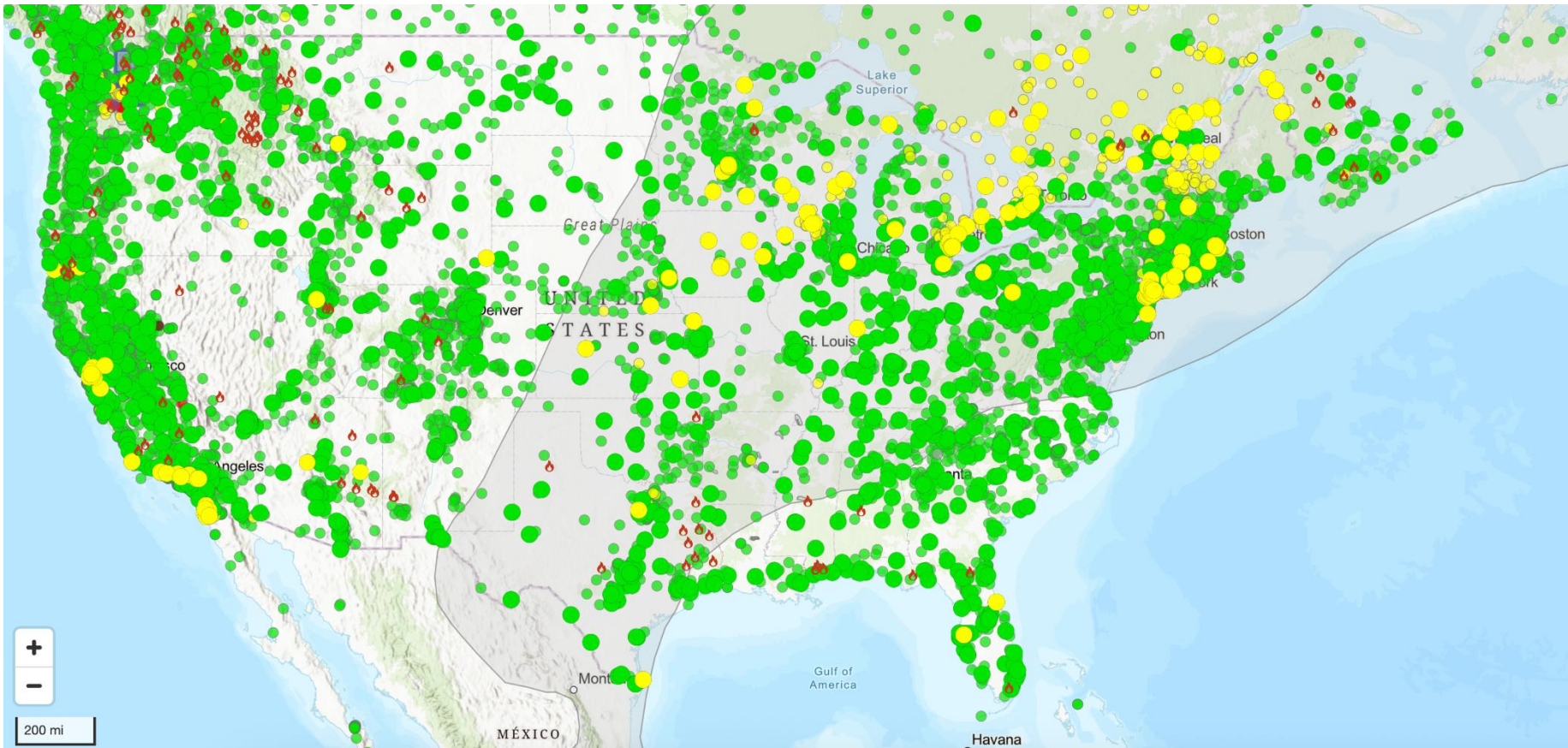
→ US EPA Fire & Smoke Map?

→ Advanced modeling approaches?

→ Local knowledge (staff observations, news reports, etc)?

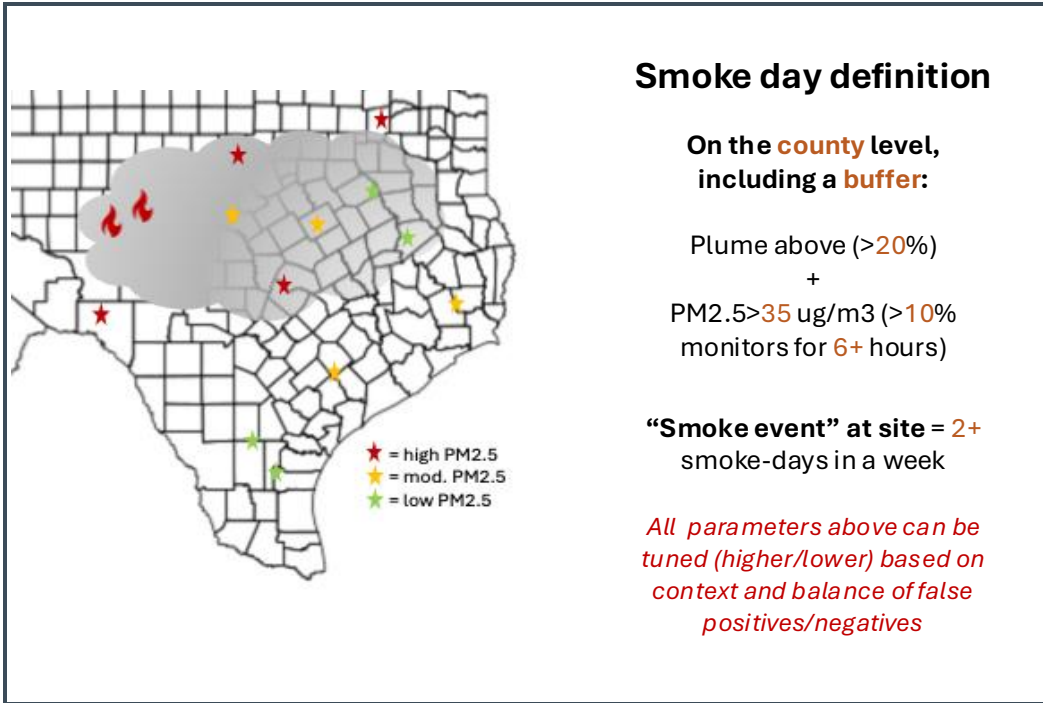


*Impossible to automate, too slow, problematic in rural regions, and/or too subjective*



# Draft surveillance protocol – Went “live” on Jun 8, 2025

Automated data downloads (NOAA HMS, AQS, PurpleAir), QA, and processing



Thursday, September 25th

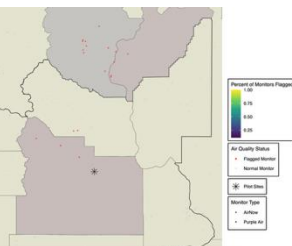


OIF Wildfire Update APP 7:01 PM

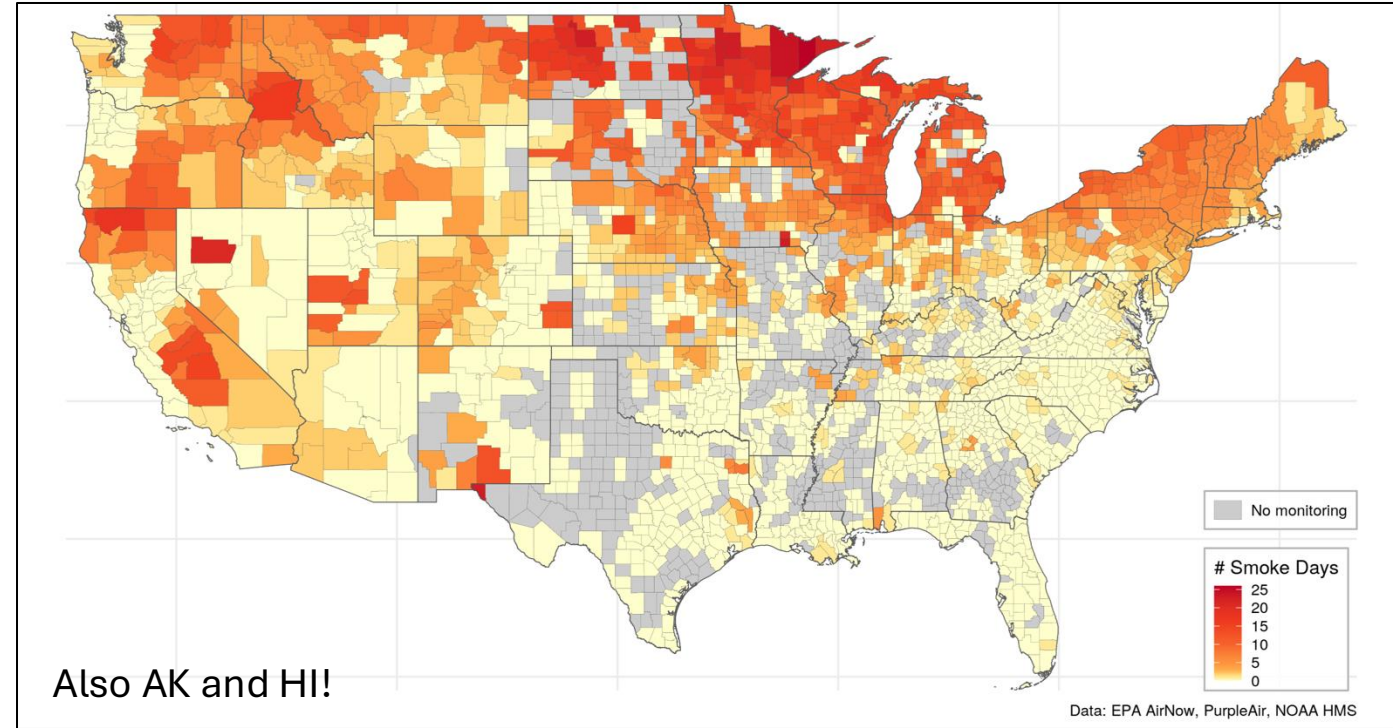
Pilot areas impacted by wildfire smoke. Check data/results/pilot\_summary/daily/20250923. Areas impacted: Yakima



1	state	county	GEOID	site	date	pct_total fla	population_k	population_u	monitors_air	flagged_moni	pct_ainow_f	monitors_pa	flagged_moni	pct_pa_flagged
1117	Utah	Sevier Count	49041	Other	7/2/25	0.33	0	0	0	0	0	3	1	0.33
1118	Wyoming	Sheridan Co.	56033	Other	7/2/25	0.2	1	4	1	0	0	4	1	0.25
1119	Alabama	Mobile Count	01097	Other	7/3/25	0.12	1	4	3	0	0	5	1	0.2
1120	California	Kern County	06029	Other	7/3/25	0.12	1	4	7	1	0.14	49	6	0.12
1121	Iowa	Davis County	19051	Other	7/3/25	0.25	0	0	1	0	0	3	1	0.33
1122	Iowa	Wapello Cou	19179	Other	7/3/25	1	0	0	0	0	0	1	1	1
1123	Michigan	Marquette C.	26103	Other	7/3/25	0.29	1	4	1	0	0	6	2	0.33
1124	Minnesota	Lake County	27075	Other	7/3/25	0.25	0	0	1	1	1	3	0	0
1125	Nebraska	Custer Count	31041	Other	7/3/25	0.33	0	0	0	0	0	3	1	0.33
1126	Alabama	Mobile Count	01097	Other	7/4/25	0.12	1	4	3	0	0	5	1	0.2
1127	Alaska	Denali Borou	02068	Other	7/4/25	0.33	0	0	0	0	0	6	2	0.33
1128	Alaska	Fairbanks No	02090	Other	7/4/25	0.96	1	4	3	3	1	82	79	0.96
1129	Alaska	Southeast Fa	02240	Other	7/4/25	0.5	0	0	0	0	0	4	2	0.5
1130	Alaska	Yukon-Koyuk	02290	Other	7/4/25	0.29	0	0	0	0	0	7	2	0.29
1131	California	Kern County	06029	Other	7/4/25	0.14	1	4	7	1	0.14	49	7	0.14
1132	California	Tulare Count	06107	Other	7/4/25	0.11	4	16	8	0	0	47	6	0.13

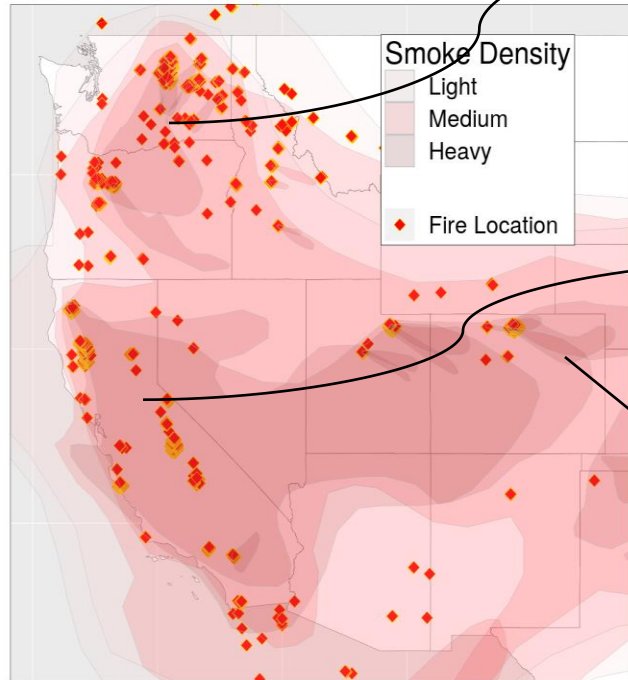


## Count of smoke days by county (2025, to date)



# Three WiSPPR Pilot Sites: On alert for smoke since June 2025

West Coast Wildfires  
September 7, 2020

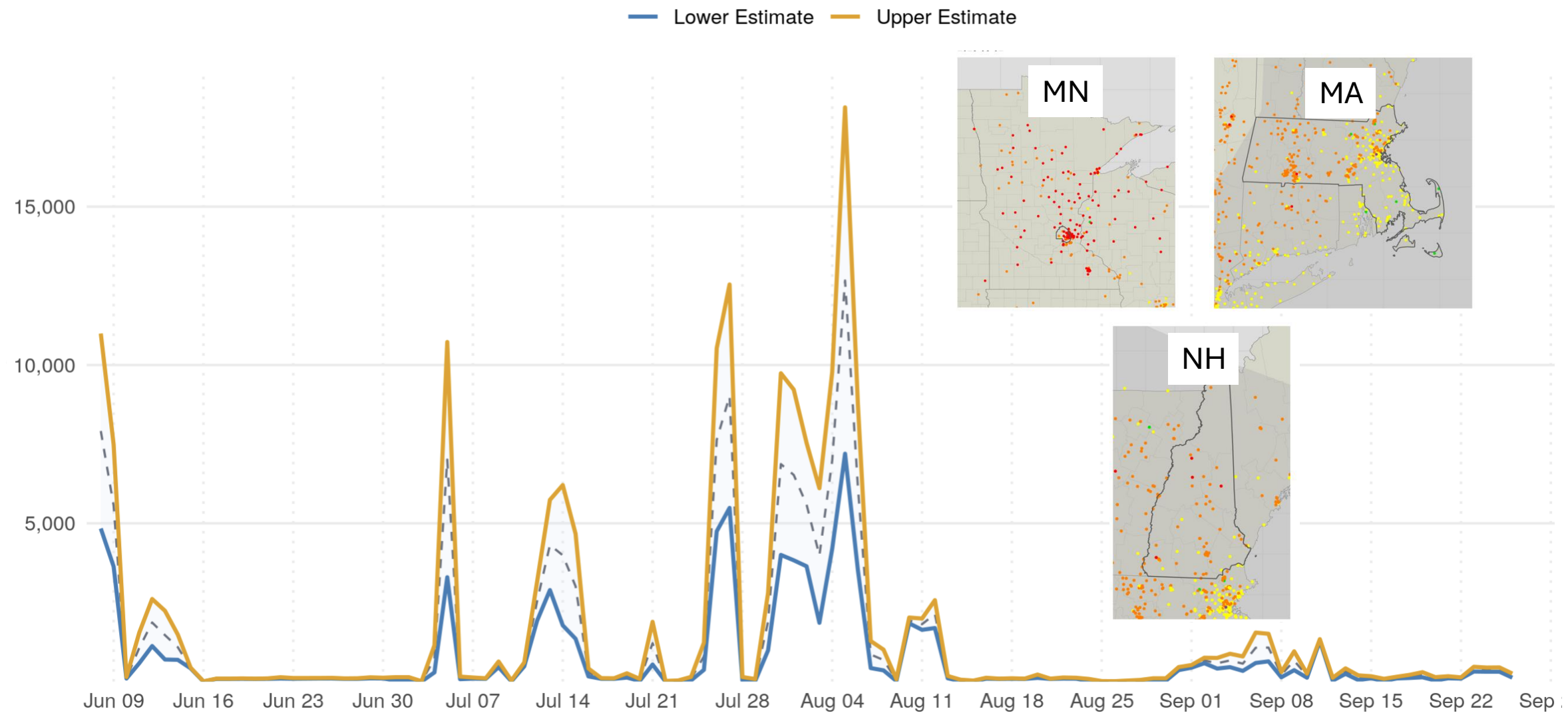


**Site 306** (PI: Karr. *ECHO AWARE*). Yakima, WA  
*new pregnancy cohort*

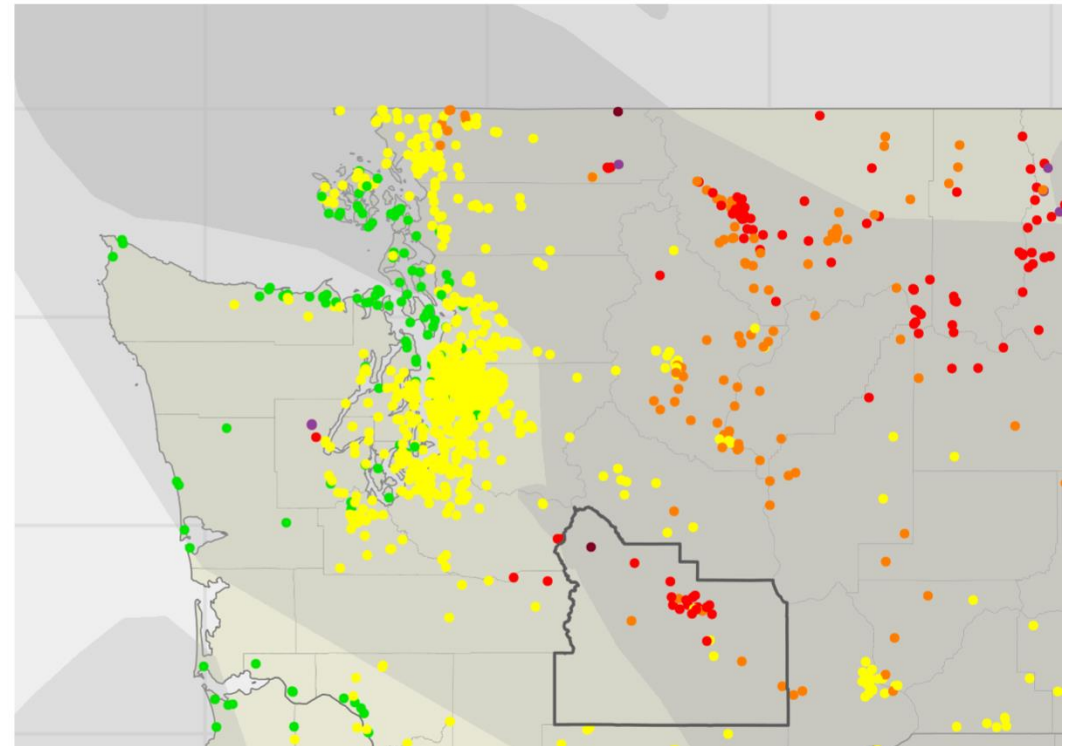
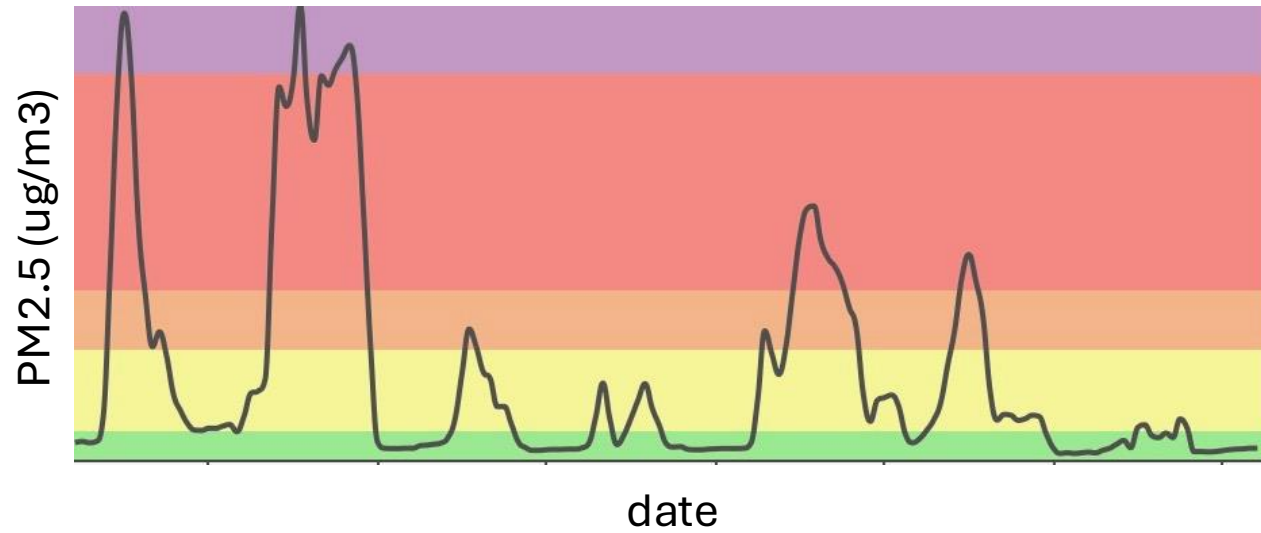
**Site 311** (PI: Schmidt. *PEACH*). Sacramento, CA  
*new pregnancy cohort*

**Site 105** (PI: Dabelea. *Healthy Start*). Denver, CO  
*continuing child cohort*

# Most 2025 smoke events have been in Midwest and Northeast (!)



# First smoke event! Yakima, Sept 3-8

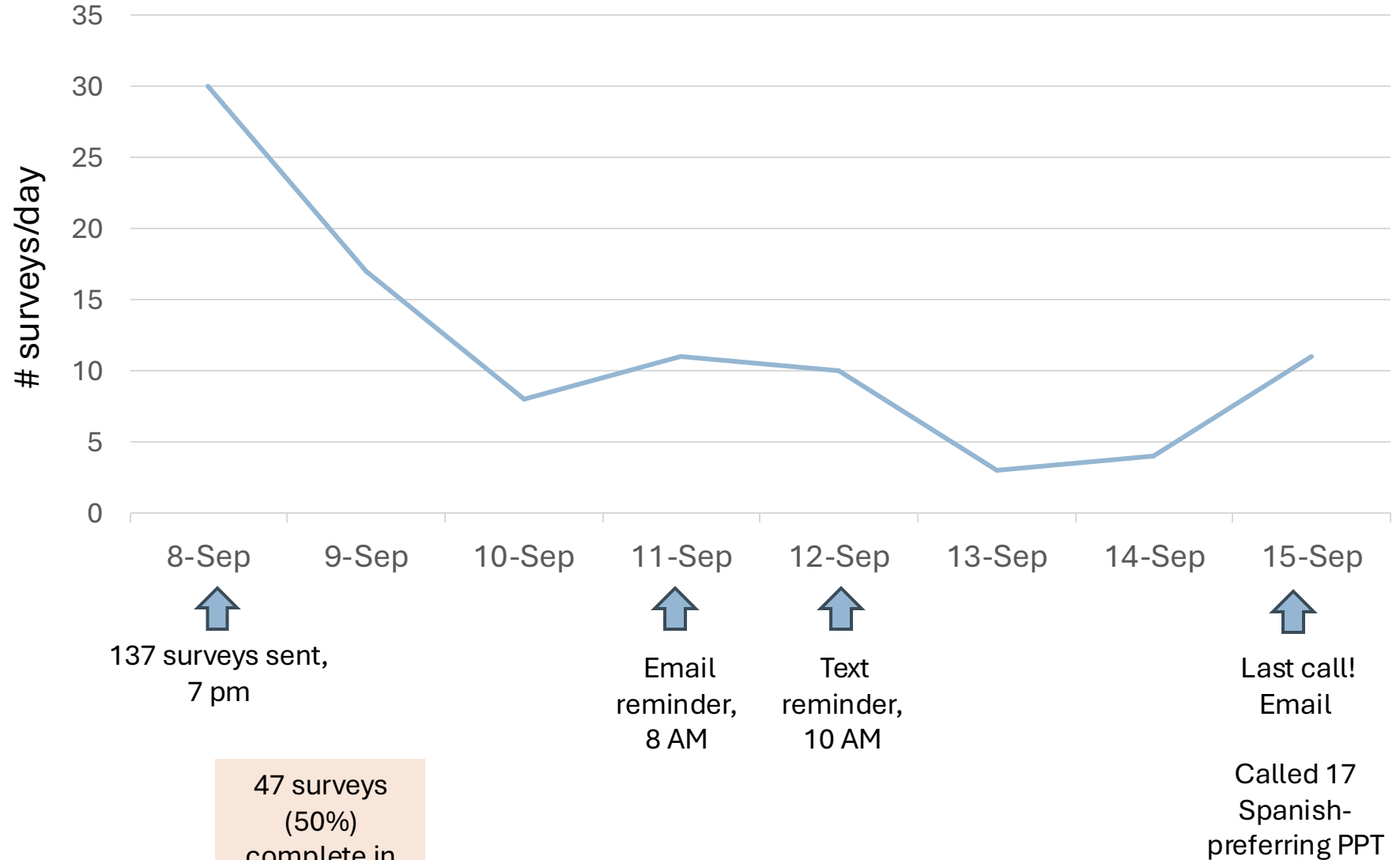


Sent surveys to 137 participants

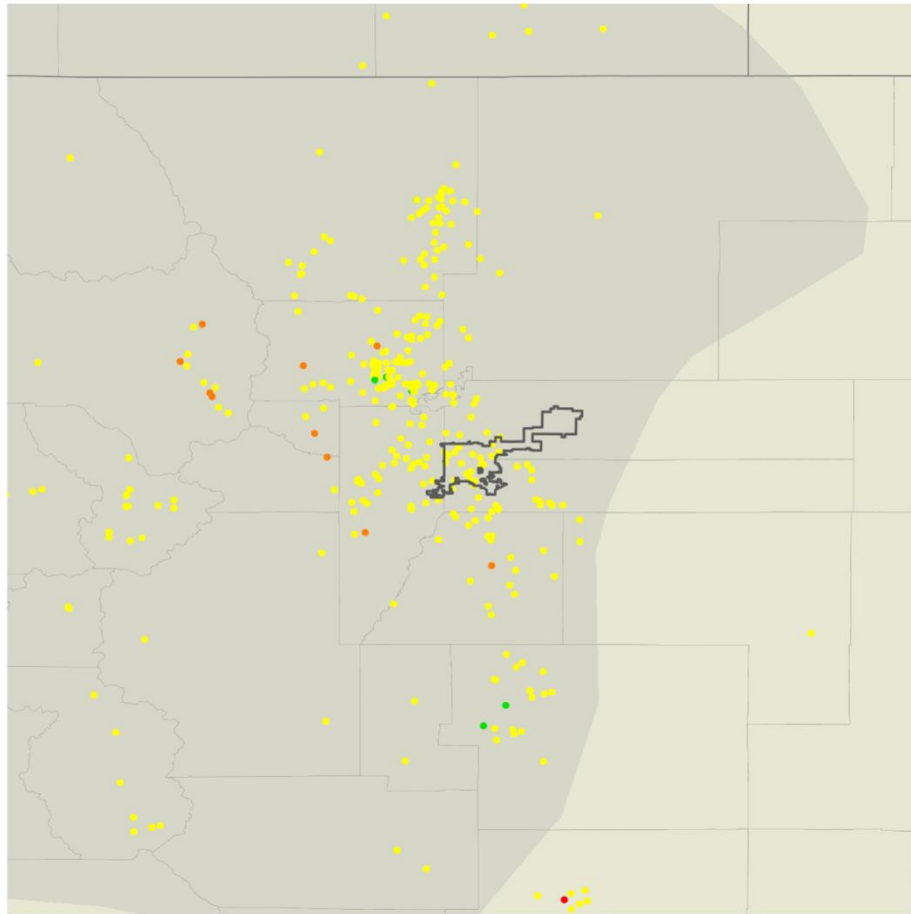
94 (69%) responded within 7 days

# Yakima survey returns

## Seven day response window



# Second smoke event! Denver, Sept 6-7



Data: EPA AirNow, PurpleAir, NOAA HMS

**Sent surveys to N=185  
parents of school-age  
children**

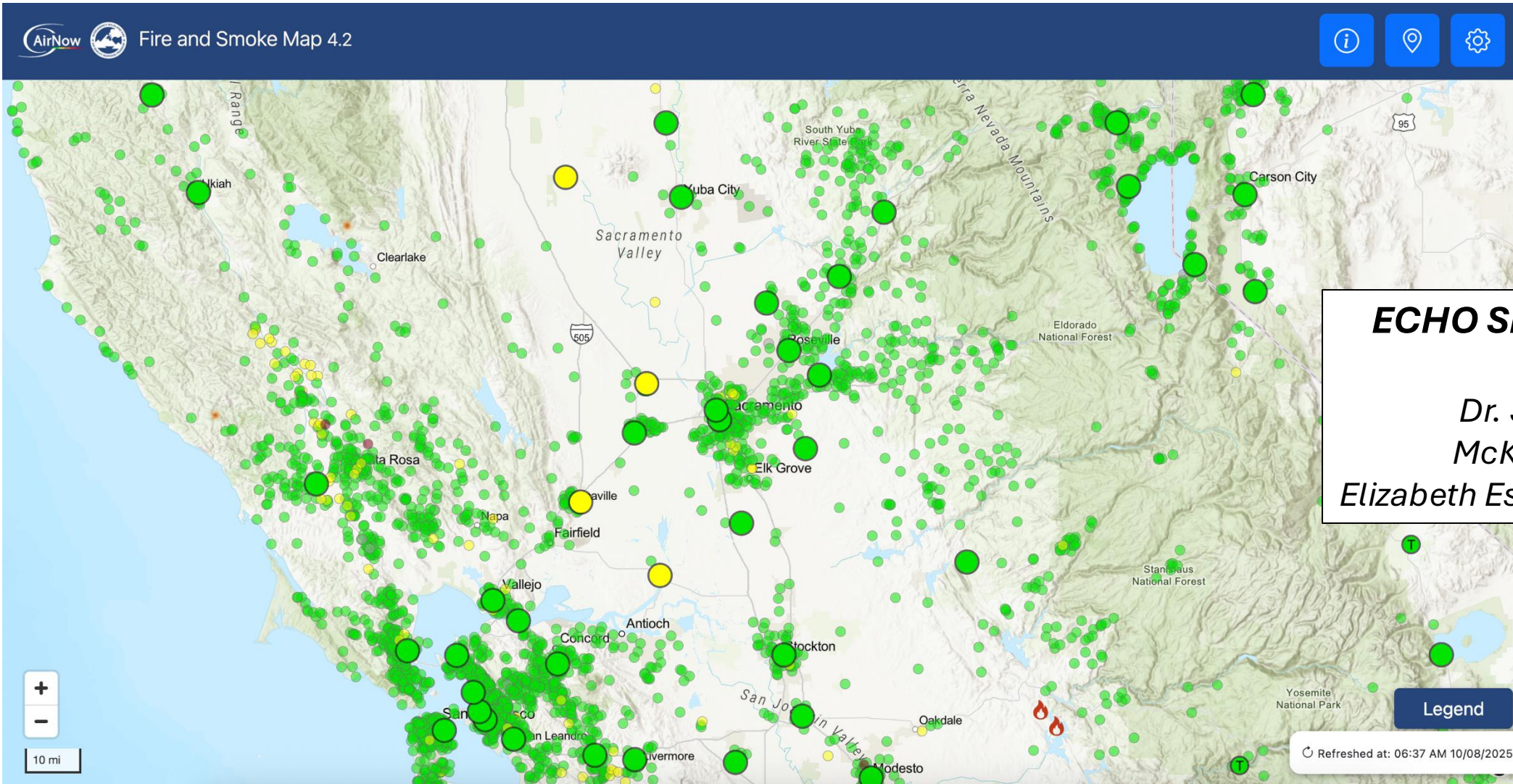
***Healthy Start ECHO Site***

*Dr. Dabelea (PI)*

*Caylor Schuldt (Manager)*

**N=95 responded within 7  
days (50%)**

# Third smoke event? Sacramento is still on alert



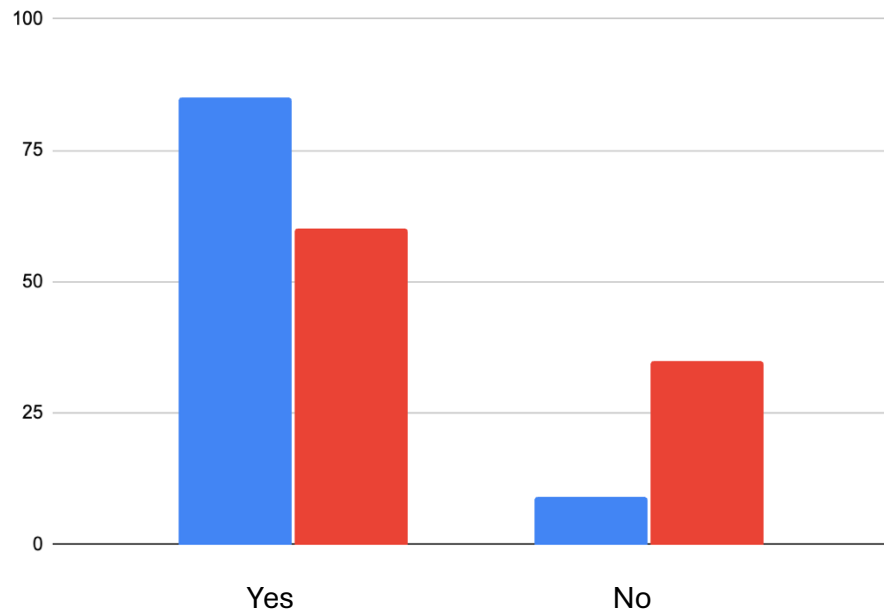
***ECHO Site 311 (PEACH)***

*Dr. Schmidt (PI)*  
*McKenzie Oliver*  
*Elizabeth Esther Guerrero Angel*

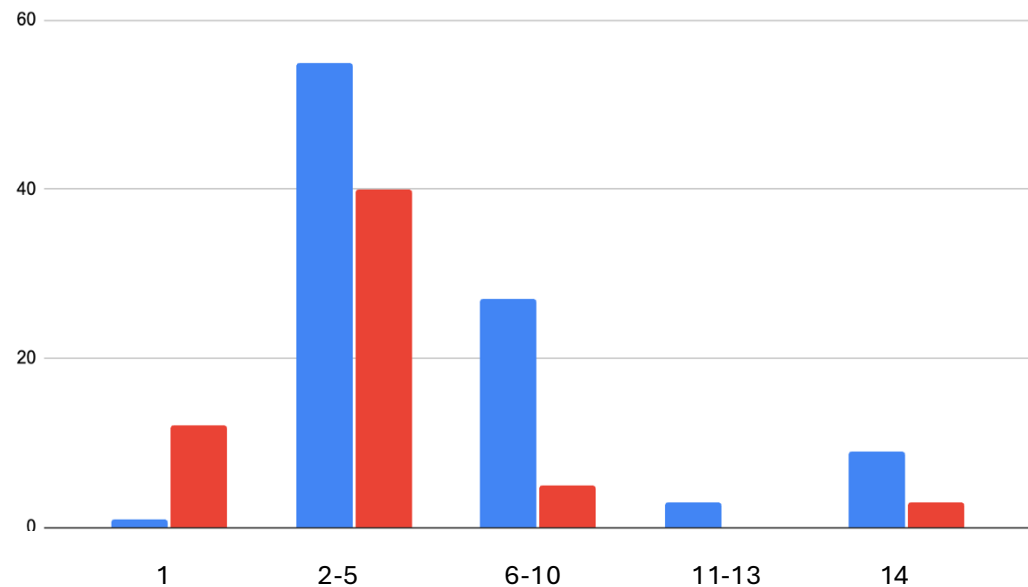
# Perceived smoke in neighborhood

■ Yakima, WA ■ Denver, CO

Did you notice a lot of smoke\*... in the past two weeks?



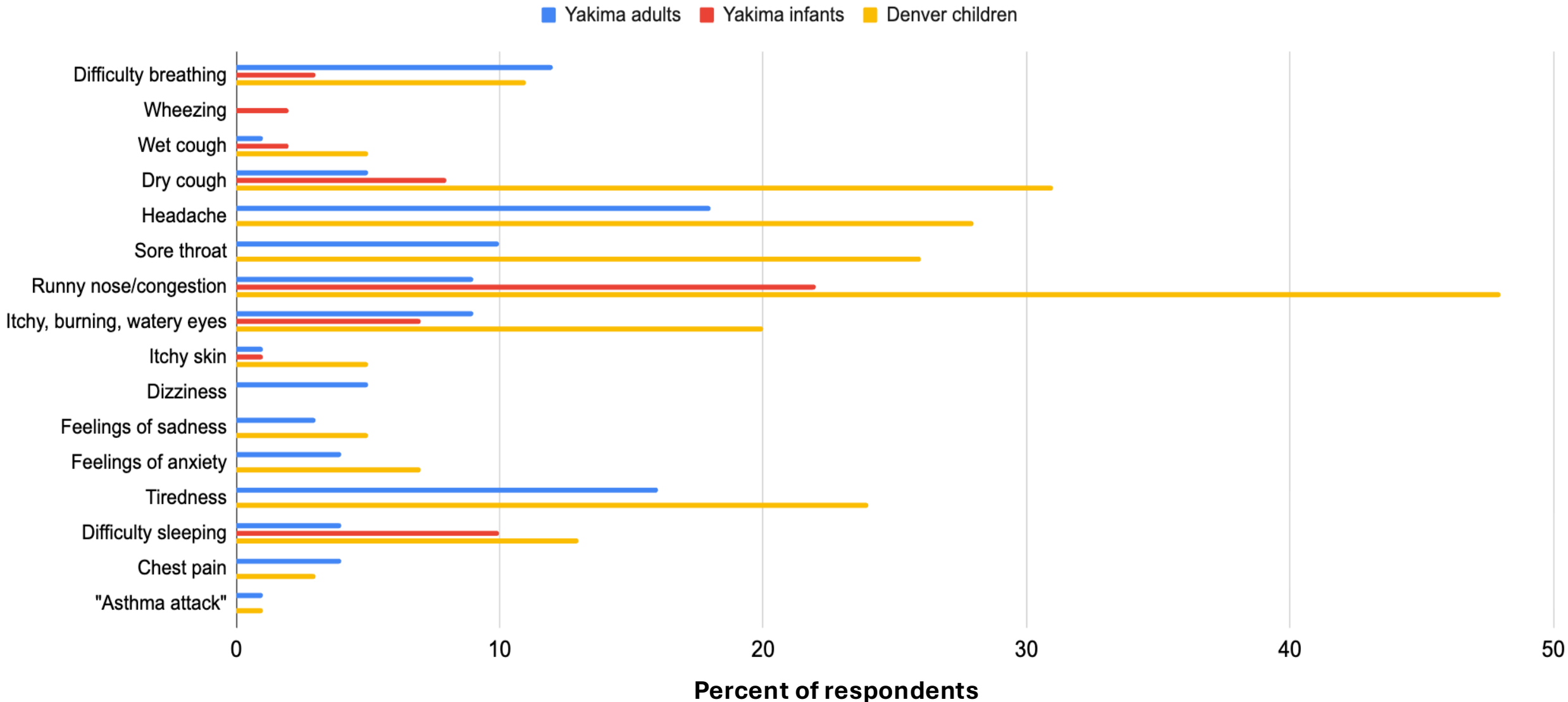
On how many days was the outdoor air smoky\*?



*\*In full text of survey, these terms were defined in concrete terms*

# Reported health symptoms in prior two weeks

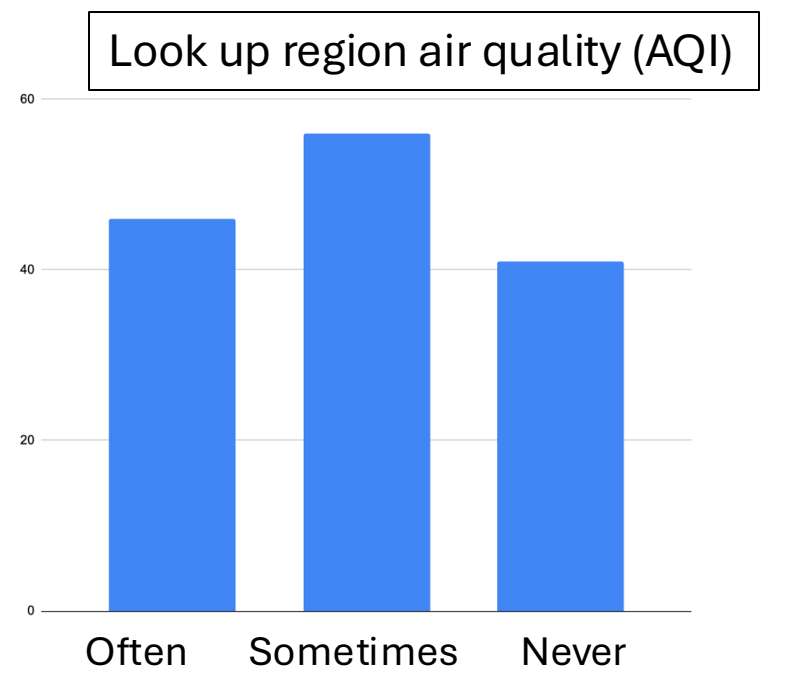
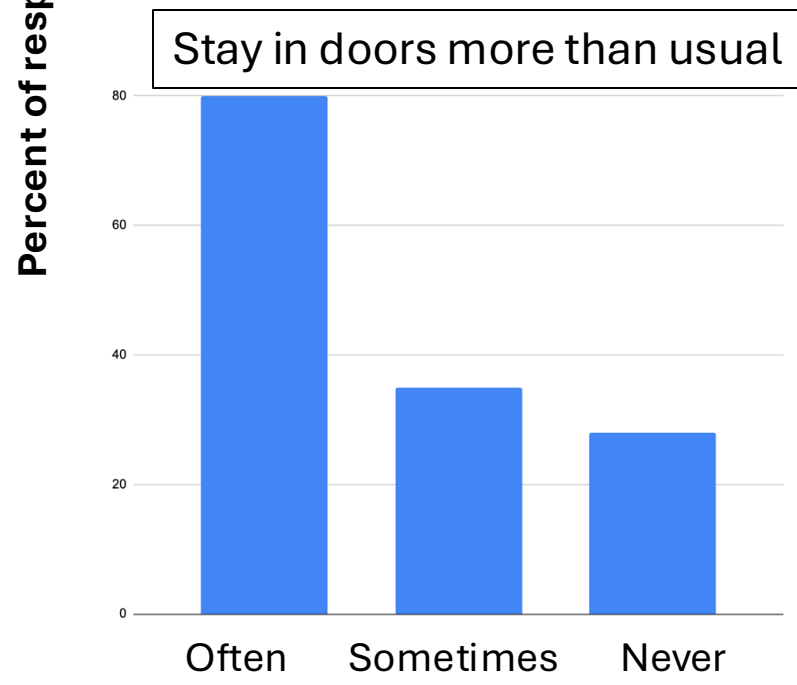
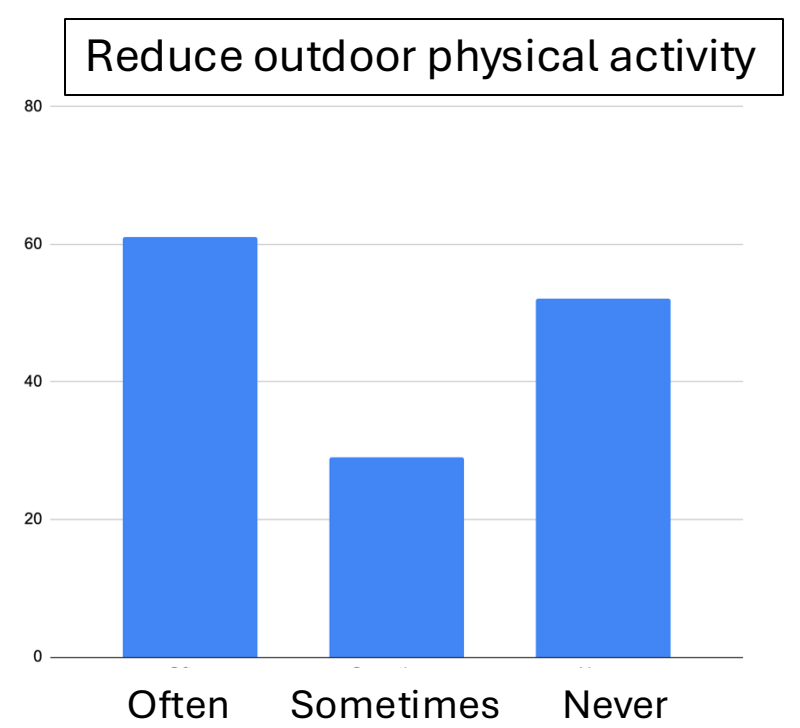
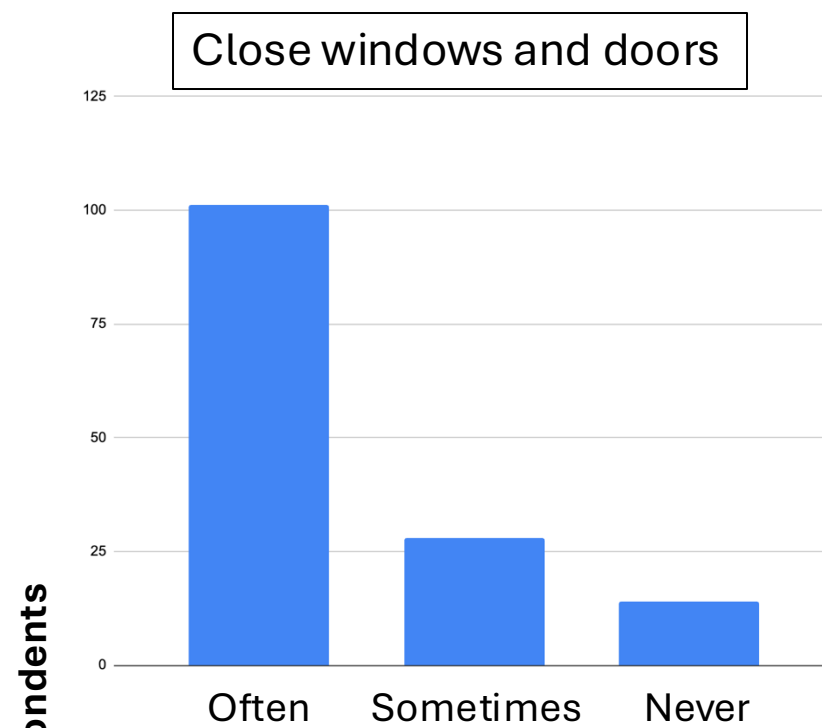
## select all



# Protective actions taken

*When the air was smoky in the past two weeks, how often did you...?*

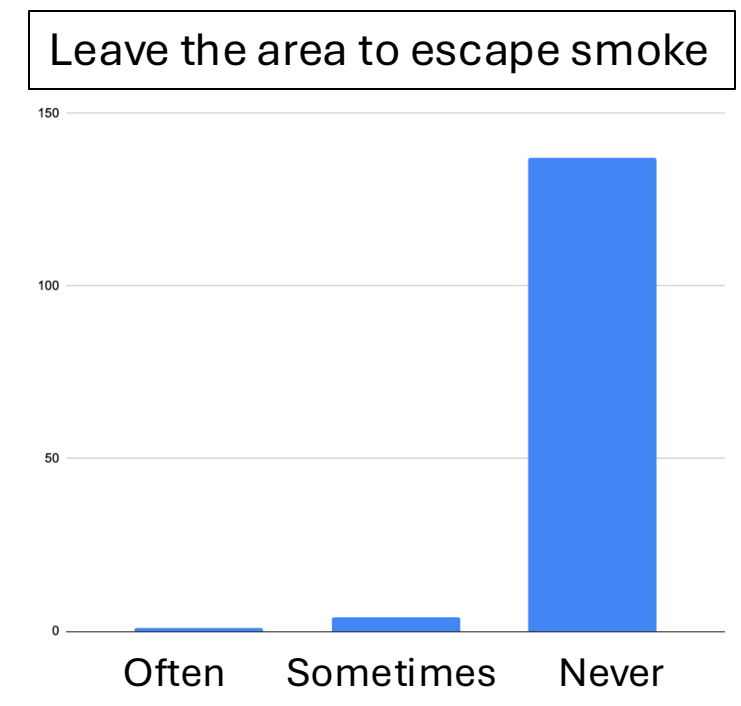
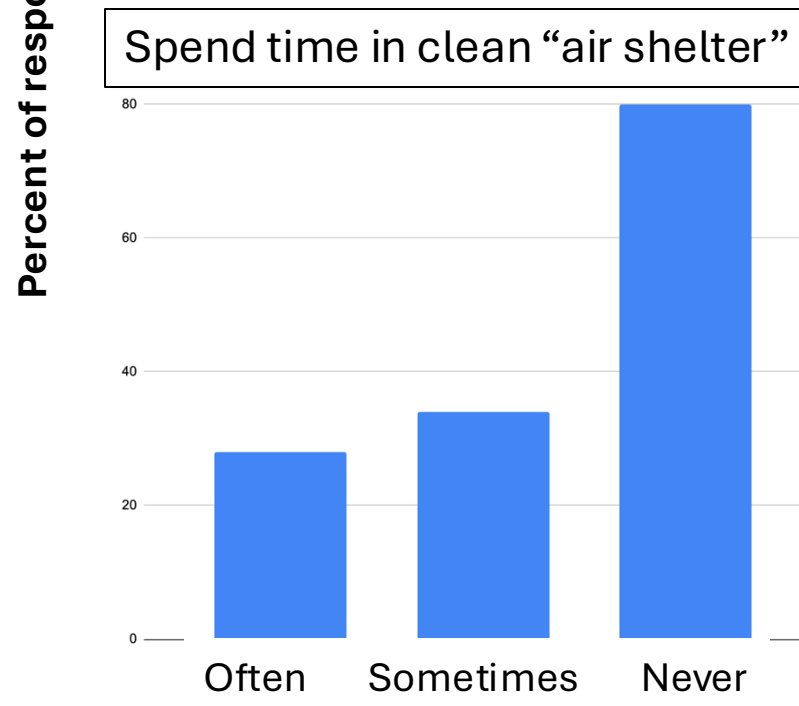
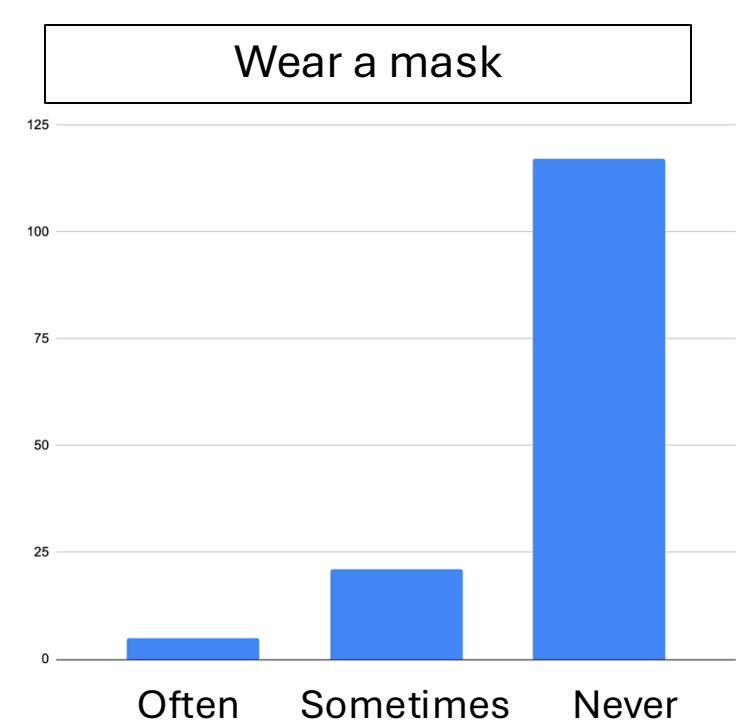
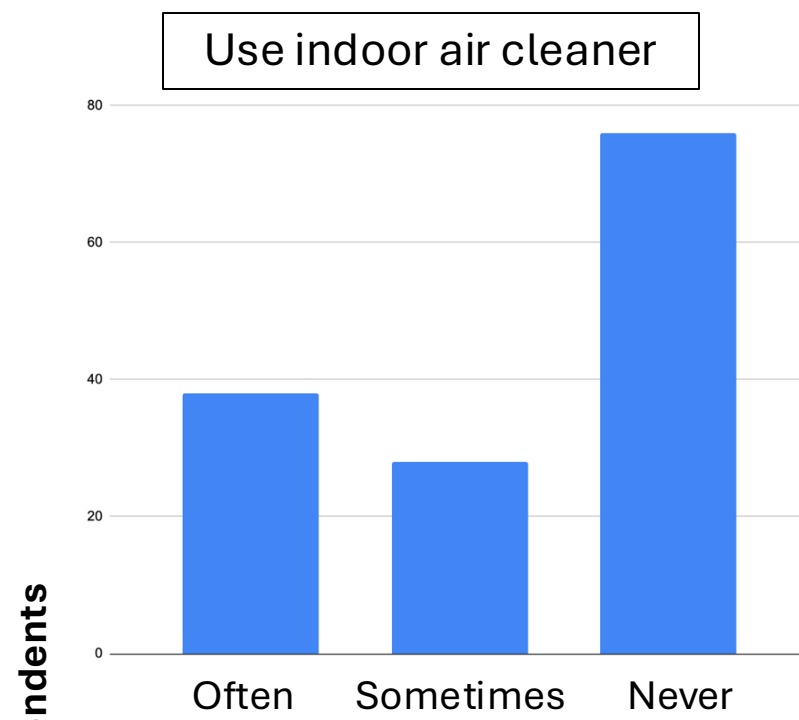
Both sites pooled



# Protective actions taken

*When the air was smoky in the past two weeks, how often did you...?*

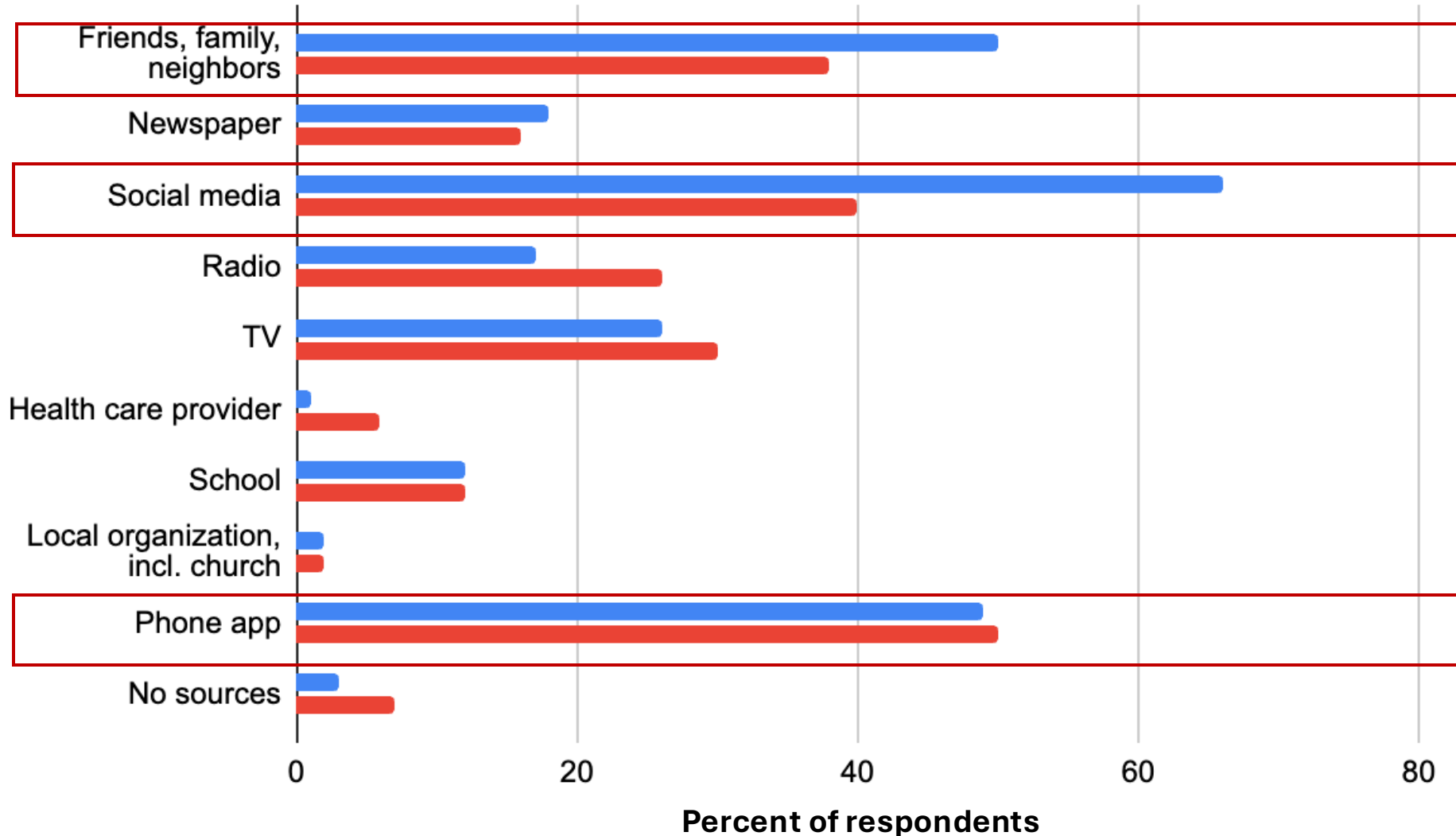
Both sites pooled



# What are your sources of info. about wildfire smoke?

select all

■ Yakima, WA ■ Denver, CO



# Interests in future community resources

**Percent of participants reporting they'd be “likely” or “highly likely” to utilize the following in the future:**

	<b>Yakima WA</b>	<b>Denver CO</b>
<b>Assistance with purchasing and using portable indoor air cleaners</b>	<b>78.7%</b>	<b>70.5%</b>
<b>Text alerts at time of smoke events, with guidance</b>	<b>76.6%</b>	<b>62.1%</b>
Free N95 masks, with assistance in proper fitting	52.1%	23.2%
Informational sessions about smoke risks and exposure reduction	50.0%	28.4%
More time with your health care provider to talk about smoke	36.2%	22.1%
Clean air shelter in your region	48.9%	17.9%

# Interest in future wildfire smoke research

Almost all participants volunteered to join future focus groups, to talk more about wildfire smoke

Most expressed interest in participating in additional data/specimen collection in the future, during/after smoke events:

- Set up an indoor air sensor in home to monitor pollution
- Collect surface “wipe” in home
- Collect adult/child specimens for mail or in-office delivery:
  - Urine
  - Hair
  - Nail clippings
  - Nasal swab
  - Saliva

# Next Steps: Evaluation of the Rapid Response Protocol

To inform potential future adoption by ECHO sites, we'll assess:

- Burden on participants
- Burden on staff
- Best practices for rapid deployment and collection (7 days response time)

## Automated smoke surveillance protocol

- Code + manual for the DAC in prep.
- Evaluation of performance (false negatives/positives) and parameter tuning is pending, using external data:
  - Google search data
  - US EPA Smoke Sense app → >3K reports of perceived outdoor smoke
  - Regional ED visits for respiratory conditions, with “wildfire smoke” in dx code or notes

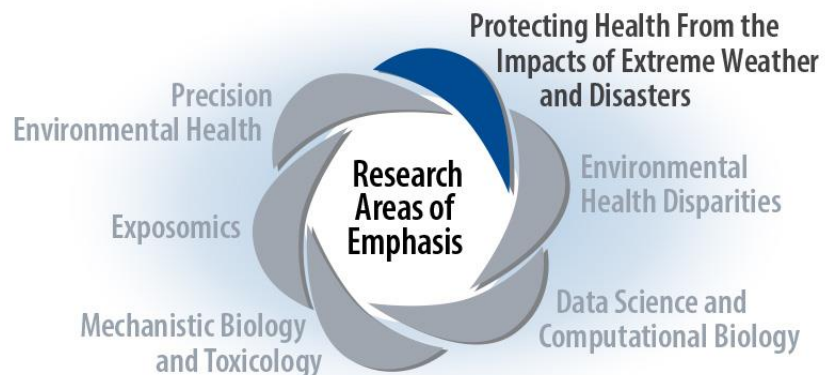


# Beyond wildfire smoke: Rapid response to other acute events?

The Wildfire Smoke Rapid Response protocol can serve as a model for time-sensitive ECHO data collection following **other acute events**

- Extreme weather (heat and cold)
- Natural disasters (hurricanes, earthquakes, floods, power outages, etc.)

**Aligns well with the 2025-2029 Strategic Plan of the National Institute of Environmental Health Science (NIEHS)**



”**Catalyze research and translation** of extreme weather effects\* on human health to reduce related health threats and impacts, **especially among those most at-risk**, and build health resilience among individuals and communities.”

\*and wildfires

# How can ECHO Cohort observational research inform interventions?

The ECHO Cohort can be harnessed for groundbreaking research on wildfire smoke and health effects as well as **behaviors and barriers to self-protection**

→ For Rapid Response OIF, we will conduct focus groups to learn more about barriers to self-protection (beyond survey data)

Work with clinicians and interventionists to design ECHO Cohort research to inform future intervention research (trials and implementation) on wildfire smoke

→ Bridge the gap between ECHO Cohort and IDEA States Pediatric Clinical Trials Network (ISPCTN)?

# ECHO and Wildfire Smoke: What can we do?

1. Better understand health impacts of wildfire smoke on children
2. **Conduct ECHO research that might help inform interventions, especially for the most vulnerable families**
3. Support our participants!

# ECHO Participant Engagement and Outreach

## Community events



Credit: Dr. Corbin Schuster (OSU)

## Printed and web-based multi-media materials for participants

### WILDFIRE SMOKE & YOUR FAMILY'S HEALTH

#### How can I learn about the air quality in my area?

The Air Quality Index (AQI) informs you about your outdoor air quality and health risk. The higher the AQI value the greater the level of air pollution and the greater the health concern. You can look up your local AQI or download the AirNow app at [AirNow.gov](https://www.airnow.gov)

Wildfire smoke can harm everyone. Some are more at risk, such as:

- people with asthma
- kids
- pregnant women
- older adults

When the AQI is > 100 or in the unhealthy range (**ORANGE** level or higher), you can take actions to protect yourself and your family

AQI Range	Category
0-50	Good
51-100	Moderate
101-150	Unhealthy for sensitive groups
151-200	Unhealthy
201-300	Very unhealthy
301-500	Hazardous

Adapted by A. Andrade-Torres from OSU CTEHR P30 Center materials

# Interested in collaborating? Please reach out

Learn more about the rapid response protocol and provide feedback on the potential for ECHO Cohort implementation

Join papers related to this project (several ECHO Concepts in prep.)

Learn more about resources for conducting ECHO Cohort research on wildfire smoke

- Join the Air Pollution and Wildfire Smoke Interest Group!

Interest in contributing to materials to support ECHO Cohort families with wildfire smoke exposure?

Contact Christine: [cloftus@uw.edu](mailto:cloftus@uw.edu) – or connect at the F2F meeting next week

# Acknowledgements

## **OIF Investigators**

Catherine Karr (UW, PI Site 306)

Rebecca Schmidt (UC Davis, PI  
Site 311)

Dana Dabelea (UC Denver, PI Site  
105)

## **OIF Pilot Sites**

Caylor Schuldt (U of C),  
McKenzie Oliver (UC Davis)  
Elizabeth Esther Guerrero Angel  
(UC Davis)

Clare McCarthy (UW)

Lisa Younglove (UW)

Adriana Perez (UW)

Aileen Andrade-Torres (UW)

Ashley Scott (GAPPS)

Berenize Canchola (UW)

Ciara Benson (GAPPS)

Courtney Baruch Gravett (GAPPS)

Eric Gabino (UW)

Vanessa Vidrios (GAPPS)

Yocelin Geerrero-Mandujano  
(GAPPS)

## **OIF Smoke Surveillance team UW**

Dustin Burnham, Elizabeth Spalt,  
Adam Szpiro, Stuart Ilson, Dan  
Jaffe

## **FUNDING**

**ECHO Cohort Site (Yakima  
Valley)**

**OIF Award (Loftus, Cycle 1)**