

Smoke Sense

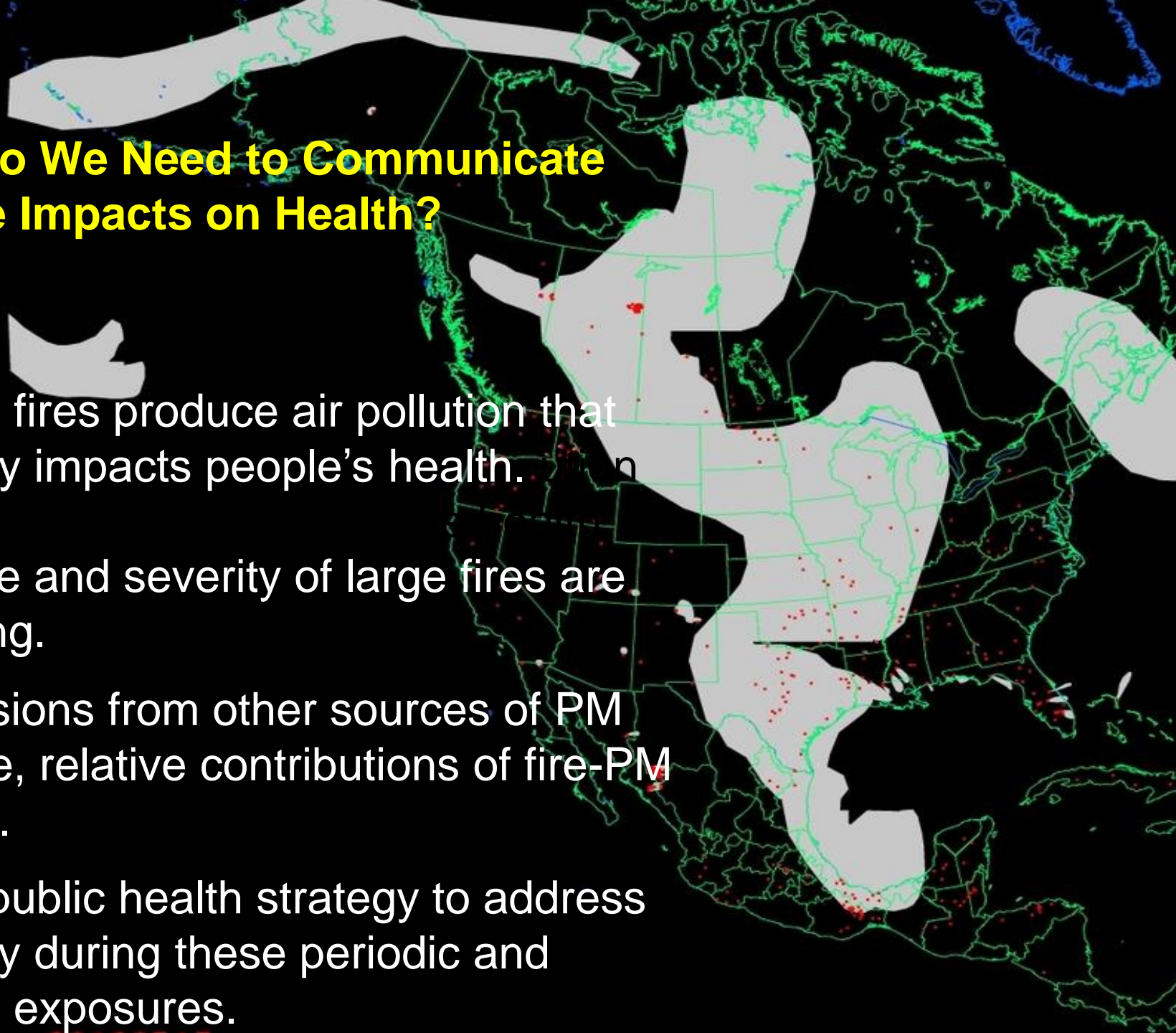
Citizen Science Study
on Health Risk and
Health Risk
Communication
during Wildfire
Smoke Episodes

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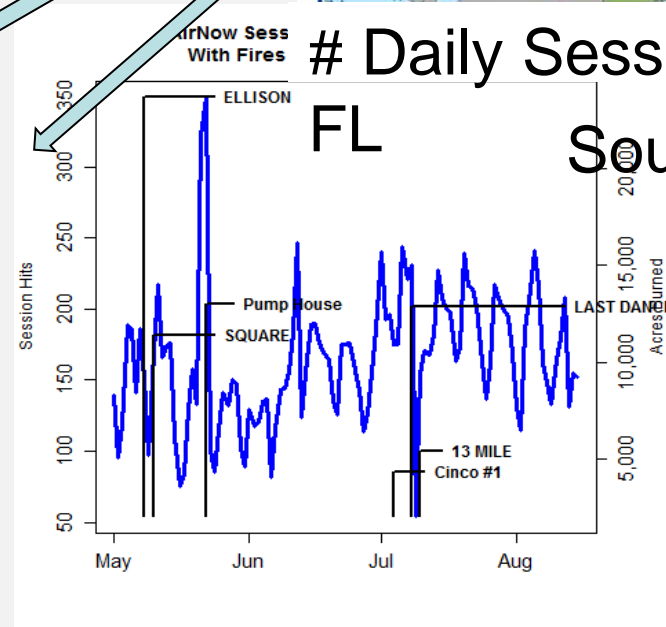
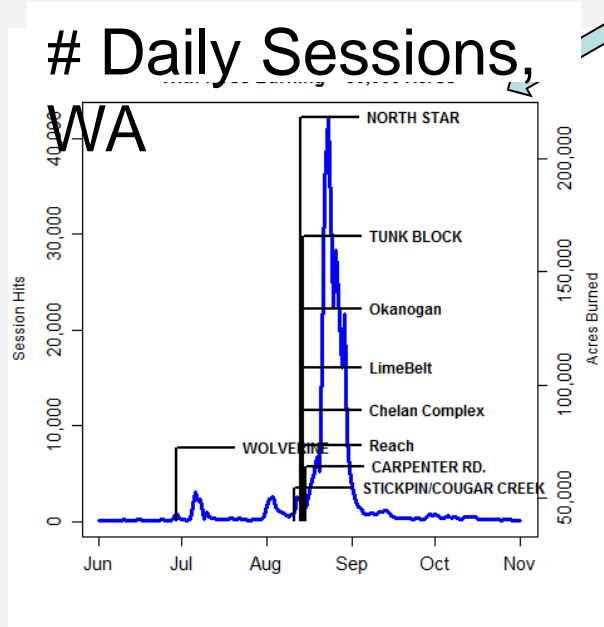
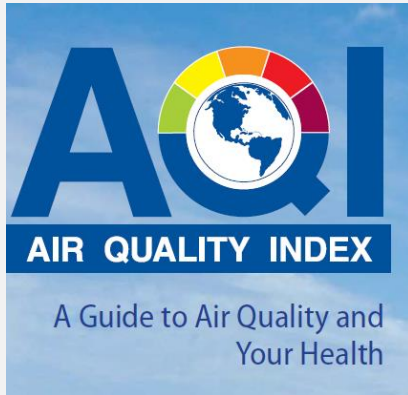


Why Do We Need to Communicate Smoke Impacts on Health?

- Wildland fires produce air pollution that adversely impacts people's health.
- Incidence and severity of large fires are increasing.
- As emissions from other sources of PM decrease, relative contributions of fire-PM increase.
- Need a public health strategy to address air quality during these periodic and transient exposures.



AirNow.gov



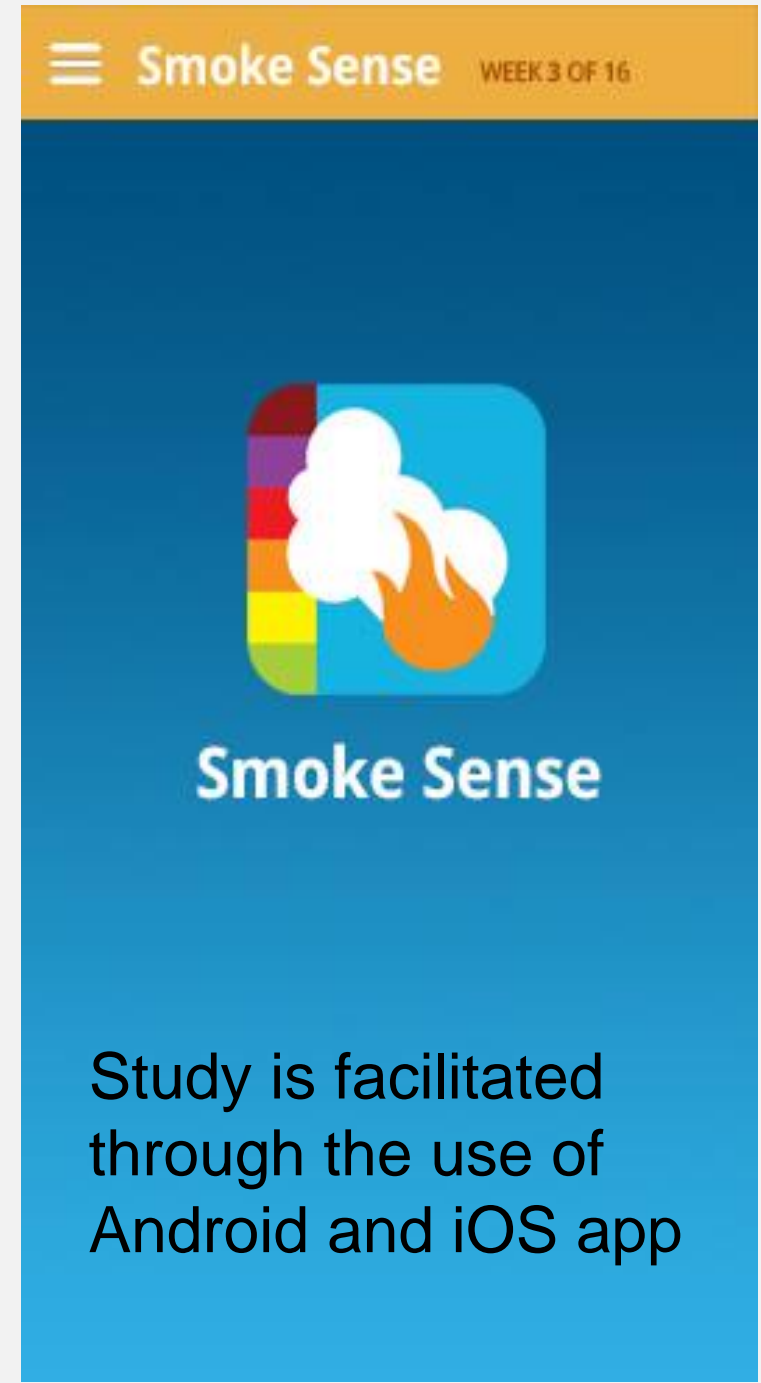
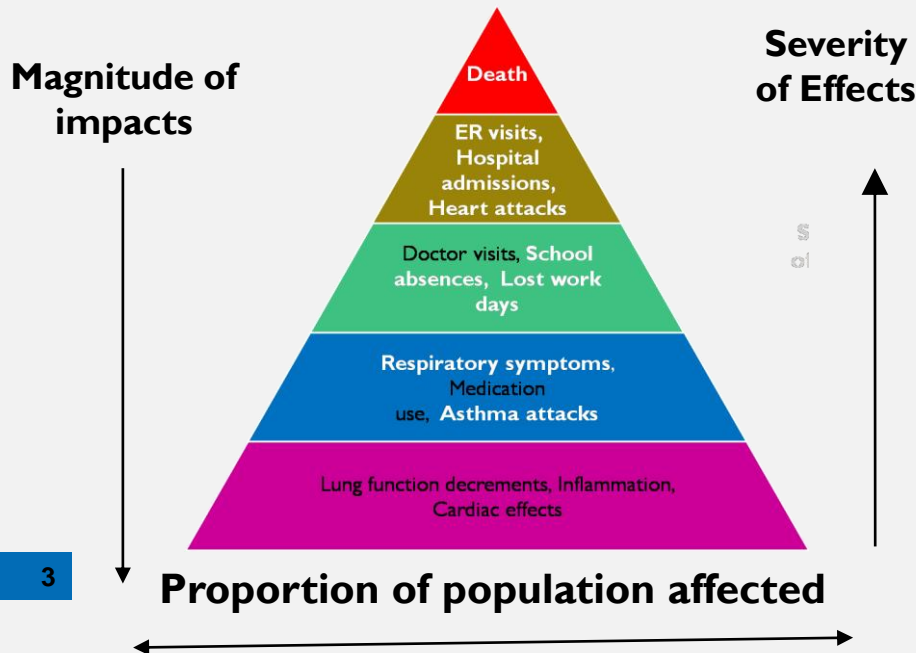
Source: AirNow

But it doesn't tell us about the likelihood of the impact, how long it will last, and how will it impact me!

Smoke Sense

A citizen science study with goals to:

- 1) determine the extent to which exposure to wildland fire smoke affects health and productivity
- 2) develop health risk communication strategies that protect public health during smoke days





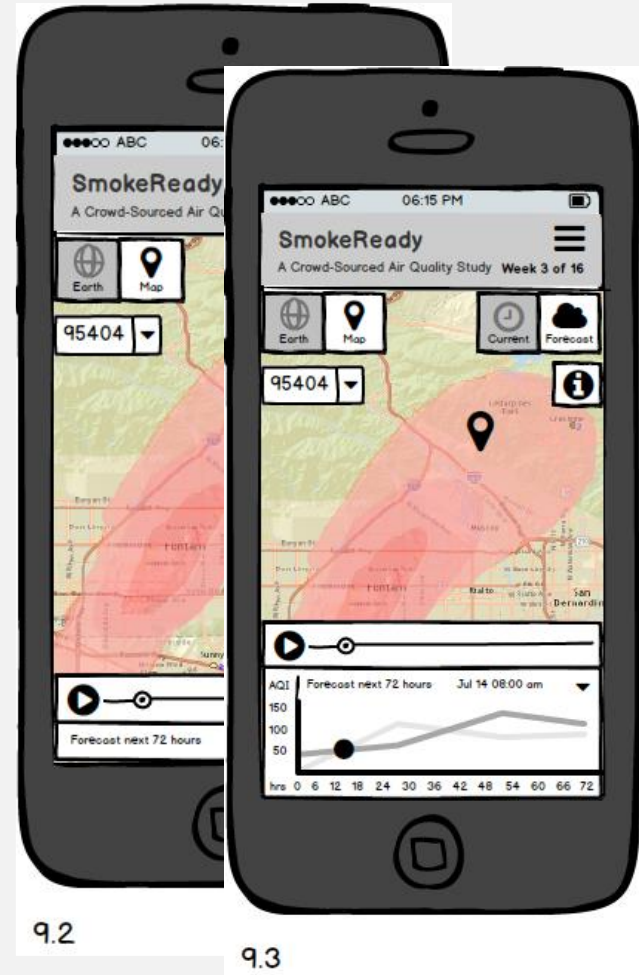
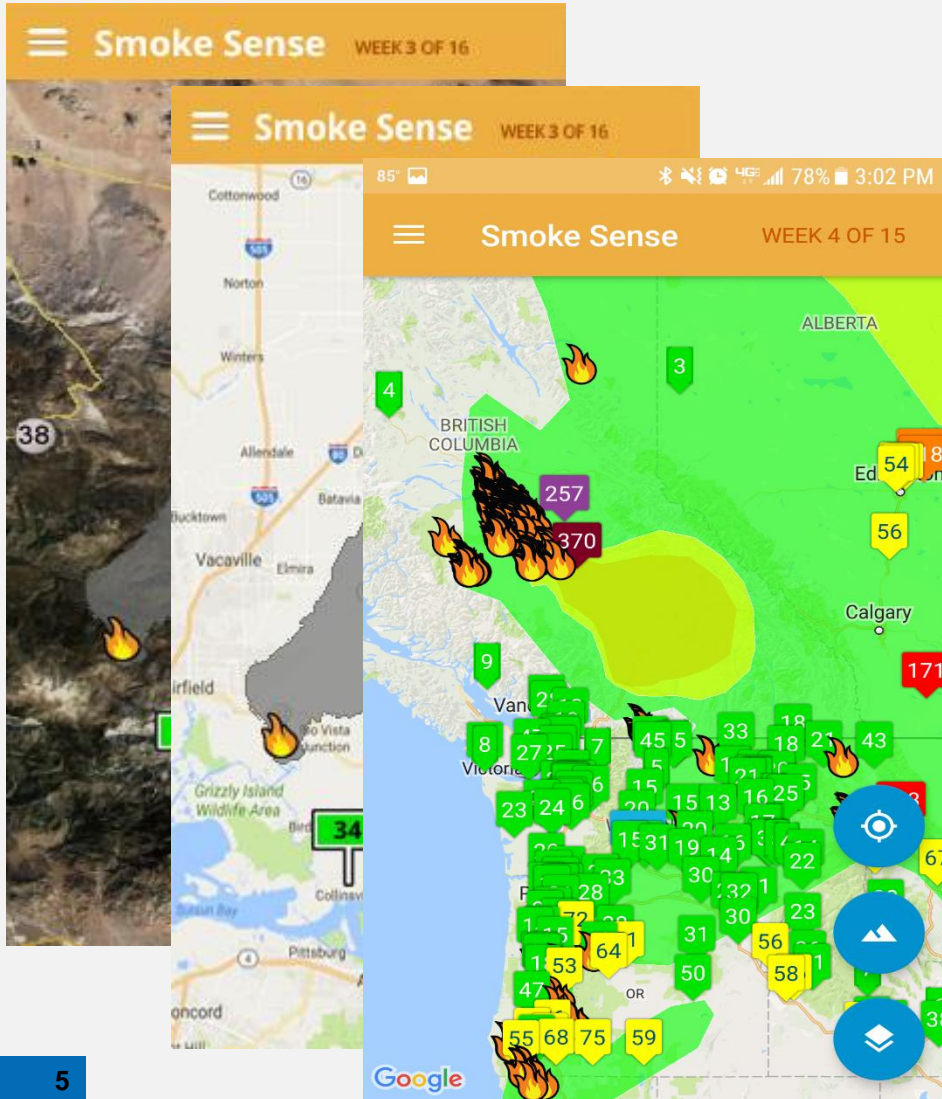
For participants:

- Current and forecast air quality.
- Satellite imagery of smoke.
- Public health risk messaging.
- Air Quality 101 module.
- Gamification to promote desired behaviors.

For investigators:

- Demographic profile of users.
- Symptom and medication usage survey.
- Behavioral survey.
- App usage statistics.
- Score card on Gamification compliance behavior.

Satellite images of smoke plumes hourly smoke forecasts,

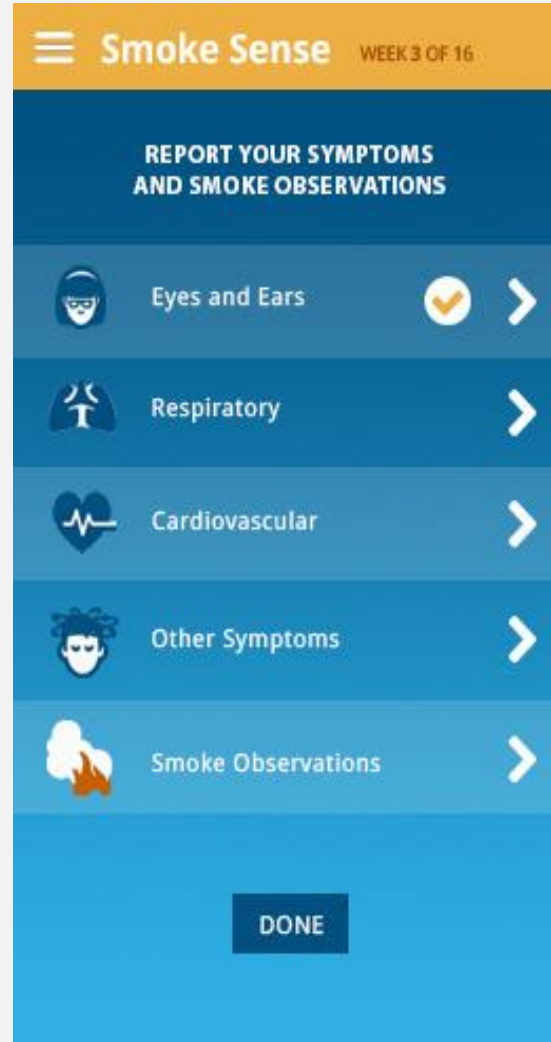


Surveys

Profile Survey - demographic information and baseline levels of health symptoms, baseline activity level and perceptions about health risks of air pollution.

Symptoms Survey –on Monday mornings participants will receive a notification on their device inviting them to complete the weekly survey on health symptoms (Yes/No).

Smoke Observation Surveys – questions about smoke exposure during the previous week including their actions (did you miss days from work) and perceived or actual exposures (did you smell smoke inside your home) during the past week.



Smoke Sense WEEK 3 OF 16

REPORT YOUR SYMPTOMS AND SMOKE OBSERVATIONS

- Eyes and Ears
- Respiratory
- Cardiovascular
- Other Symptoms
- Smoke Observations

DONE



Smoke Sense WEEK 3 OF 16

EYES AND EARS SYMPTOMS

DID YOU EXPERIENCE THE FOLLOWING SYMPTOMS IN THE PAST WEEK: WATERY EYES, STINGING EYES OR EAR INFECTION?

MON	TUE	WED	THU	FRI	SAT	SUN
6	7	8	9	10	11	30

WERE YOU TREATED BY A PHYSICIAN FOR THESE SYMPTOMS?

No

Yes (Outpatient or Clinic)

Yes (Inpatient Hospitalization)

DID YOU USE MEDICATION TO TREAT YOUR SYMPTOMS?

No

Yes (Prescription)

Yes (Over the Counter)

WERE YOU TRAVELING MORE THAN 50 MILES FROM HOME WHEN YOU EXPERIENCED THESE SYMPTOMS?

No

Yes

SAVE

Gamification - Participation Component

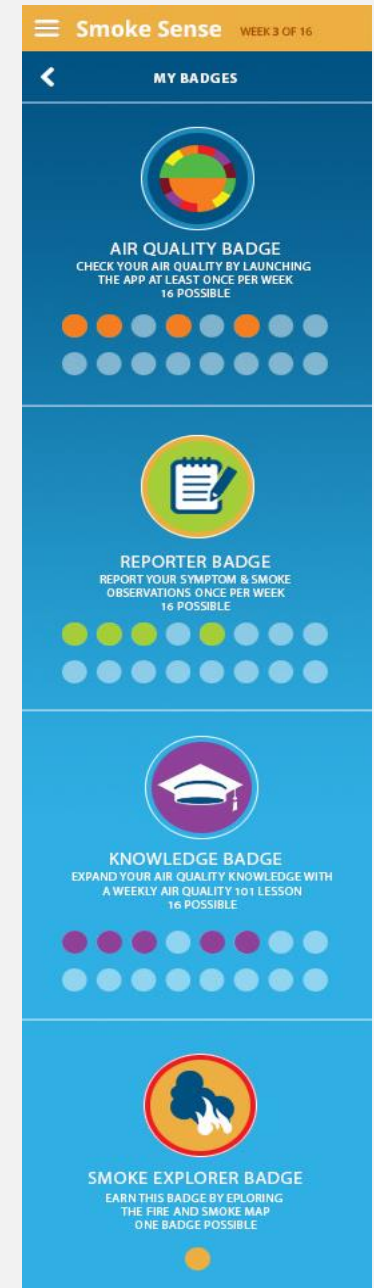
Badge Reward System facilitates and **measures** engagement.

Air Quality Badge - for participating and launching the app at least once per week.

Science Science/ Reporter Badge - for reporting symptoms and smoke observations once per week.

Knowledge Badge – for expanding air quality knowledge with a weekly air quality 101 lesson.

Smoke Explorer Badge – for exploring fire and smoke maps.

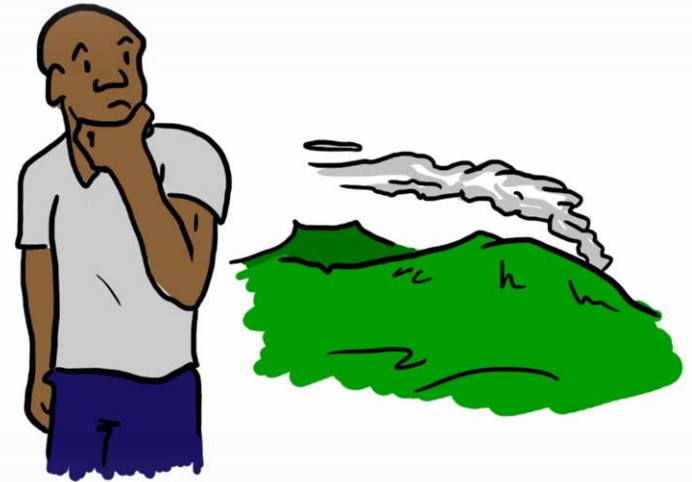


Gamification - Education component

Weekly Air Quality 101 module:

Week #8 Question:

*“Kai is healthy and young.
Can he assume that the smoke from
the wildfire won’t affect him?”*



Answer:

NO. High concentrations of smoke can trigger a range of symptoms even in healthy individuals. Common symptoms include burning eyes, a runny nose, cough, phlegm, wheezing and difficulty breathing. Smoke may also reduce your lungs’ ability to protect against inhaled substances such as pollen, bacteria or viruses. If you have heart or lung disease, smoke may make your symptoms worse. Learn about the health effects from smoke at

<https://go.usa.gov/xXa8c>

Feedback to the Users

Individual weekly survey results will be aggregated and reported back to the app and available to the users.

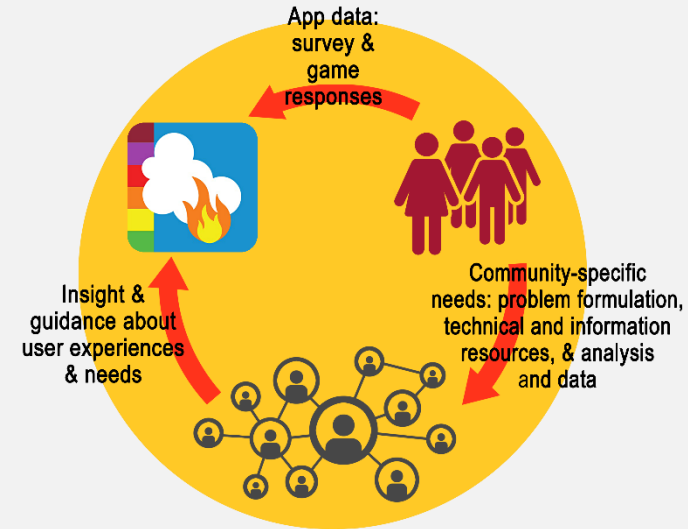
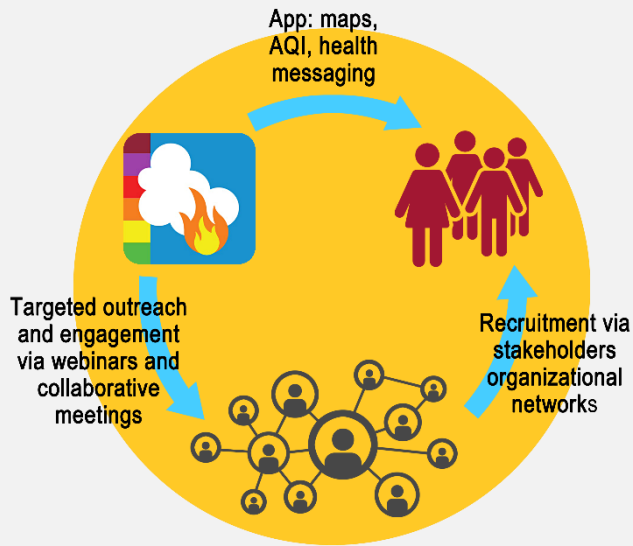


Two-Way Communication with Users

Smoke Sense is developing structures for two-way interaction and communication as part of a citizen science approach

...Phase I

... Phase II



Where we want to be...



Citizen Science

- Citizen science is defined in multiple ways, using multiple frameworks – depending on the context
 - Role-based (Bonney et al. 2009)
 - Contributory, Collaborative, Co-created
 - Research goal-based (Crowston and Wiggins, 2011)
 - Action; Conservation; Investigative; Virtual; Education



Examples of Role-based Citizen Science

- Role-based: *how* members of public engage



Examples of contributory engagement:

- Collecting physical samples or photographic evidence
- Allowing remote access to unused/idle computing power
- Remotely reviewing and coding images as part of the analysis process

Examples of collaborative and co-created:

- Community participatory research with a focus on participation across research lifecycle
 - Problem formulation; data collection; analysis; dissemination



Smoke Sense: A Citizen Science Project

A goal of the project is to provide entry points for members of the public to contribute to research and access data.

This kind of involvement is mutually beneficial – it helps EPA answer questions, and it also serves as educational/data resource that communities can leverage to address issues related to air quality and health in their communities.

This two-way interaction and communication framework is the citizen science feature in Smoke Sense.

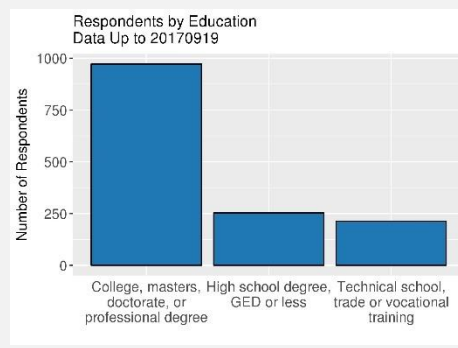
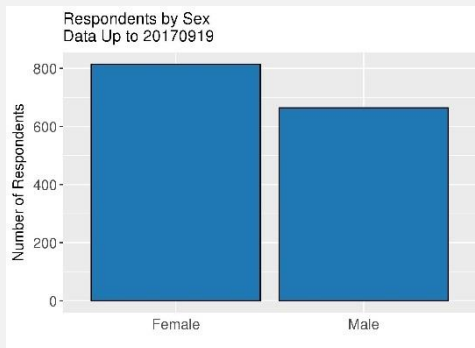
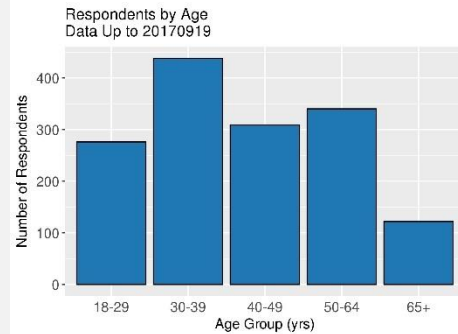
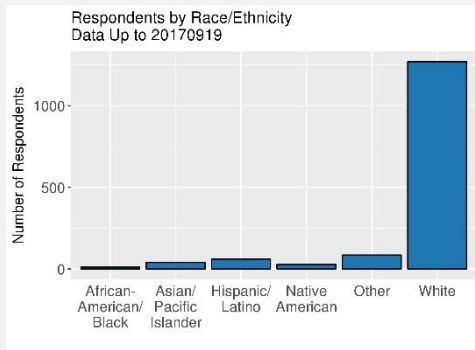
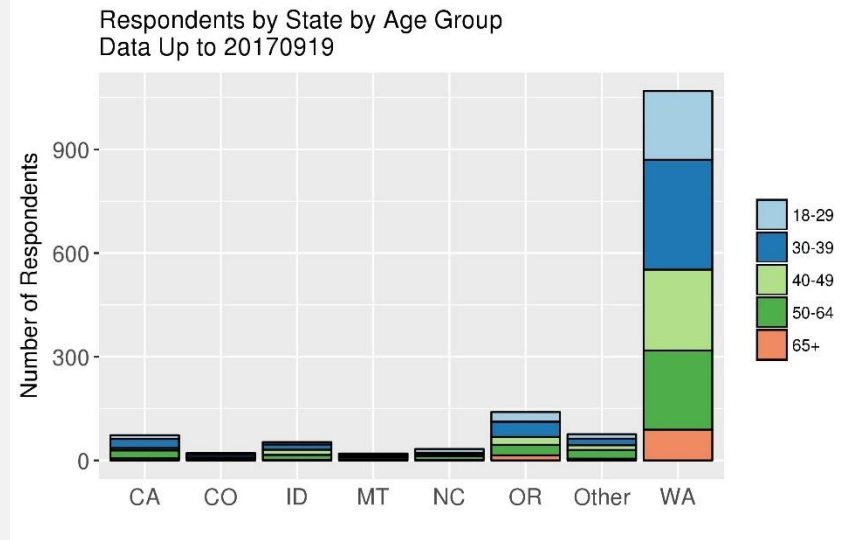


Research opportunities / methods development

- Research opportunities – exploring the motivations and experiences of pilot communities
 - What factors influenced members of the public to get involved?
 - How has involvement impacted participants, both personally and their community?
 - In what ways could the project be improved to better meet community needs?
- Methods related to preferential sampling and missing data
- Behavioral models

Results –

Large fire events –
British Columbia
affecting Washington
(WA); Oregon (OR);
California (CA)



First 5 weeks:

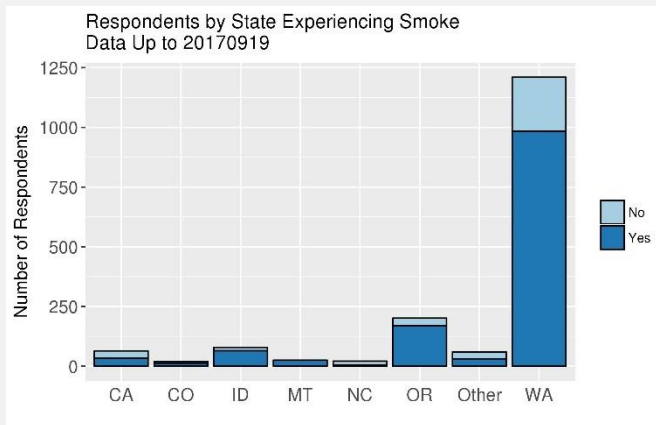
“Did you experience symptoms such as:

[Eyes&Ears] stinging, itchy, or watery eyes, ear infection, allergic symptoms, or similar?

[Respiratory] runny or stuffy nose, scratchy throat, irritated sinuses, coughing, trouble breathing normally, shortness of breath, wheezing, asthma attack, allergic symptoms, or similar?

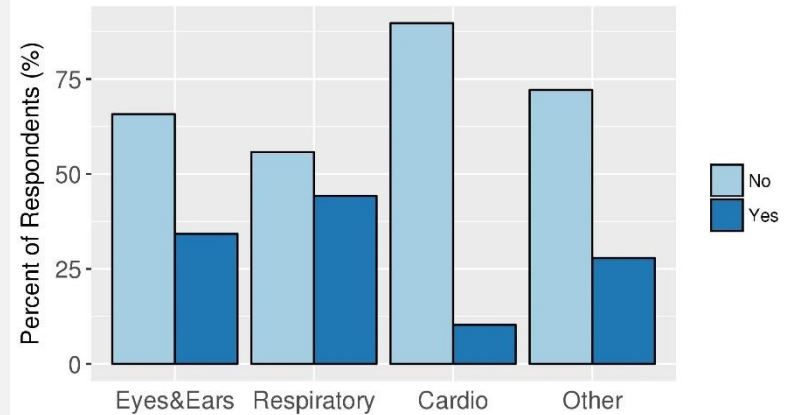
[Cardio] fast or irregular heart rate, pain or tightness in the chest, high blood pressure or similar?

[Other] tiredness, dizziness, viral infections, or other?”



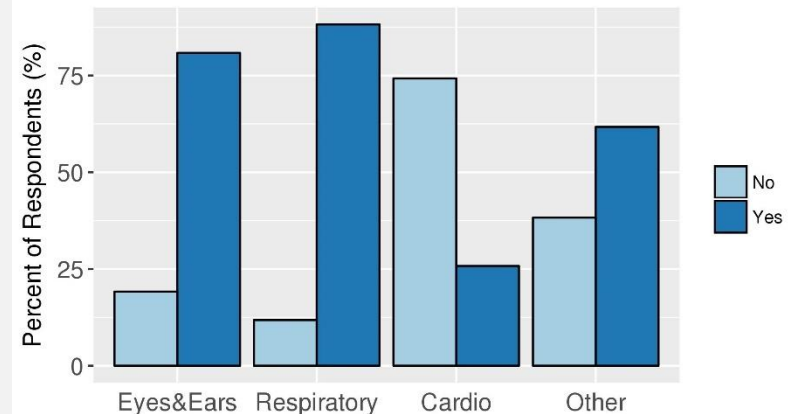
Among those NOT experiencing a smoke event:

Symptoms Experienced
Data Up to 20170919

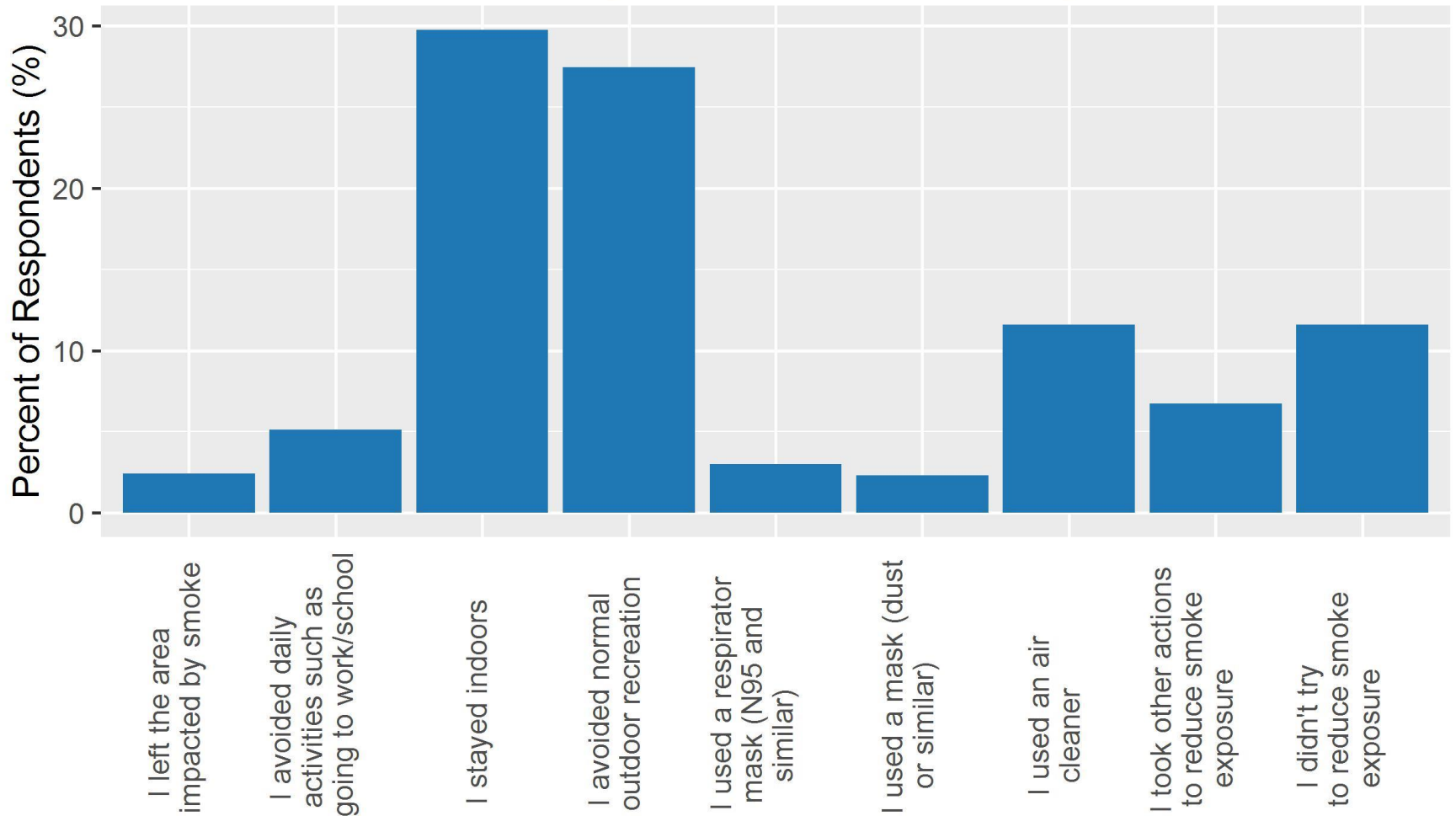


Among those experiencing a smoke event:

Symptoms Experienced
Data Up to 20170919



Did You Attempt to Reduce Smoke Exposure?





SUMMARY

Smoke Sense – delivers AQ information to the users directly and facilitates engagement with the issue.

We are working toward adding personalized health behavior and air quality messages.

Adding more features that reflect prioritization by Smoke Sense Stakeholders.

Follow us on Twitter #SmokeSense

Search “Smoke Sense at EPA”

<https://www.epa.gov/air-research/smoke-sense-study-citizen-science-project-using-mobile-app>

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Thank you

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Thank you

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