



Sensor Data and Health Research

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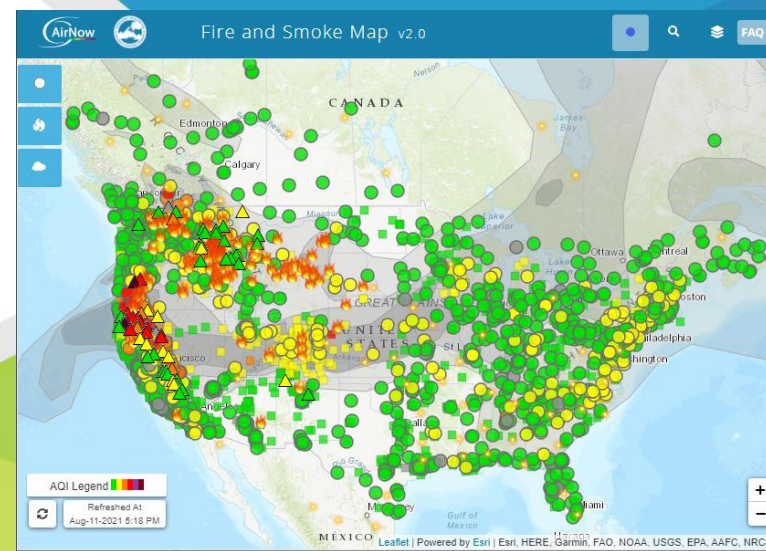
May, 2022

Office of Research and Development

Center for Environmental Measurement and Monitoring, Air Methods and Characterization Division




Smoke Sense



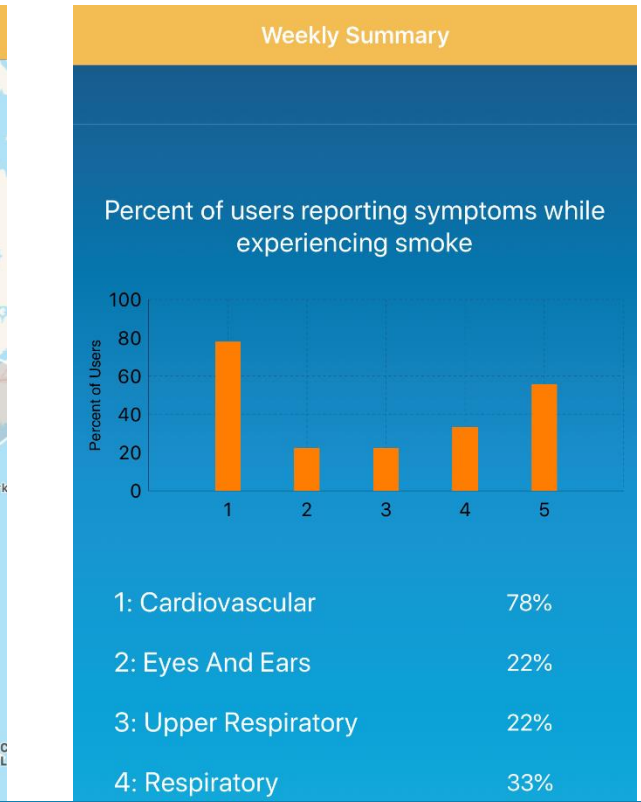
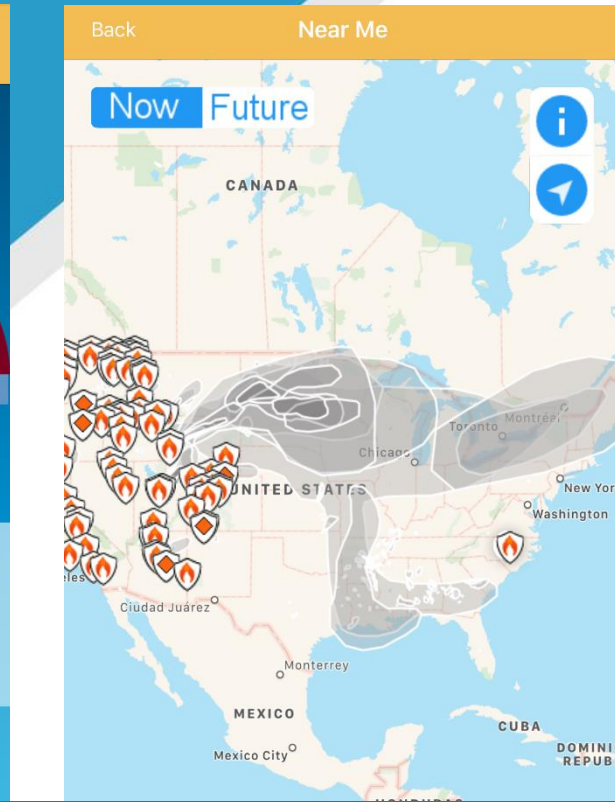
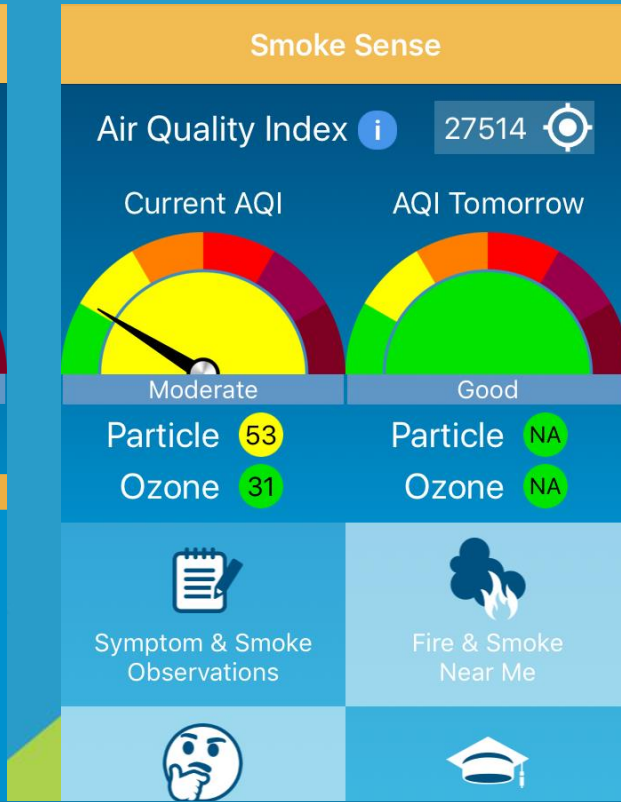
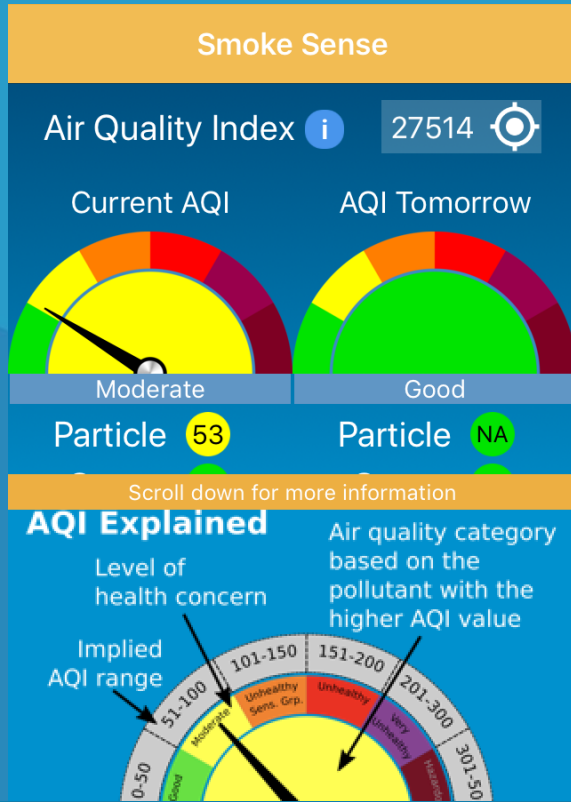
Fire.AirNow.gov

Why are Sensors Necessary?

- They are wanted; there is a demand for understanding changes in the environment
 - They support behavioral change and adoption of health protective habits
 - They enable research that provide connection between the changes in the environment and our health at the scale that is more intuitive for us to understand
- 



Problem statement: Gap between the recommended actions and the actions that individuals take to protect their health during a wildfire.

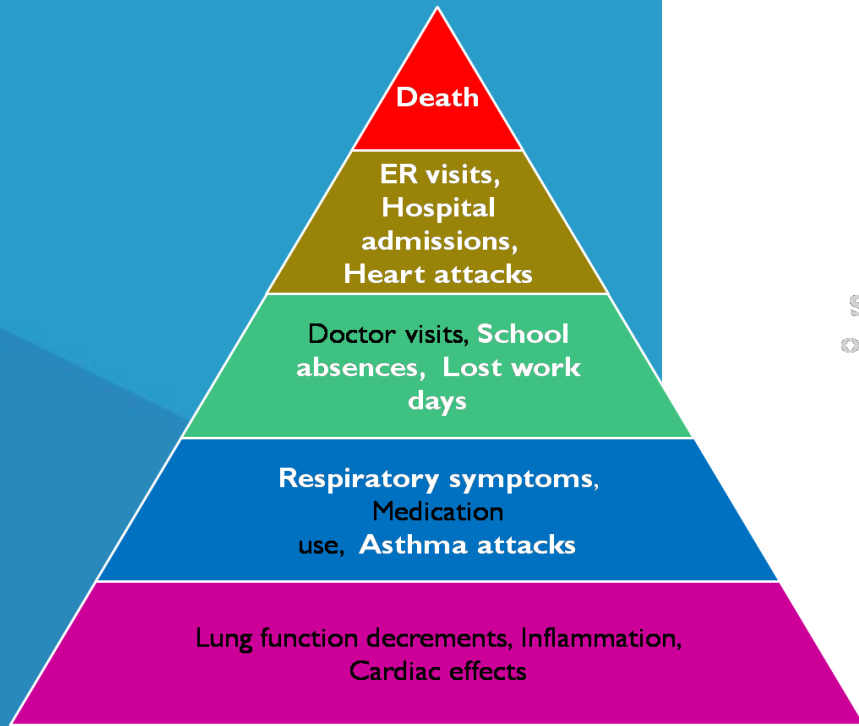





Smoke Sense: A citizen science initiative that makes smoke and health resources easily available when and where we need them and explores why and how these gaps exist.

Perceptions of Risk

- The first thing we noted in 2017 was that there was a very strong demand for understanding air quality during wildfires. Spatial and temporal availability of air quality data does not meet user's demand.
- Health was the motivation for information seeking but the lack of recognition of personal risk influences behavior.
- Participants recognize smoke as a **health risk**, but to much lower extent a **personal risk**.
- Participants clearly recognized smoke as a **health risk** and vast majority responded to smoke by taking action to **reduce exposure**. However, the exposure reduction was to **reduce symptoms rather than prevent symptoms**.
- Individuals perspective on the issue determine engagement and actions.








 No selections applied

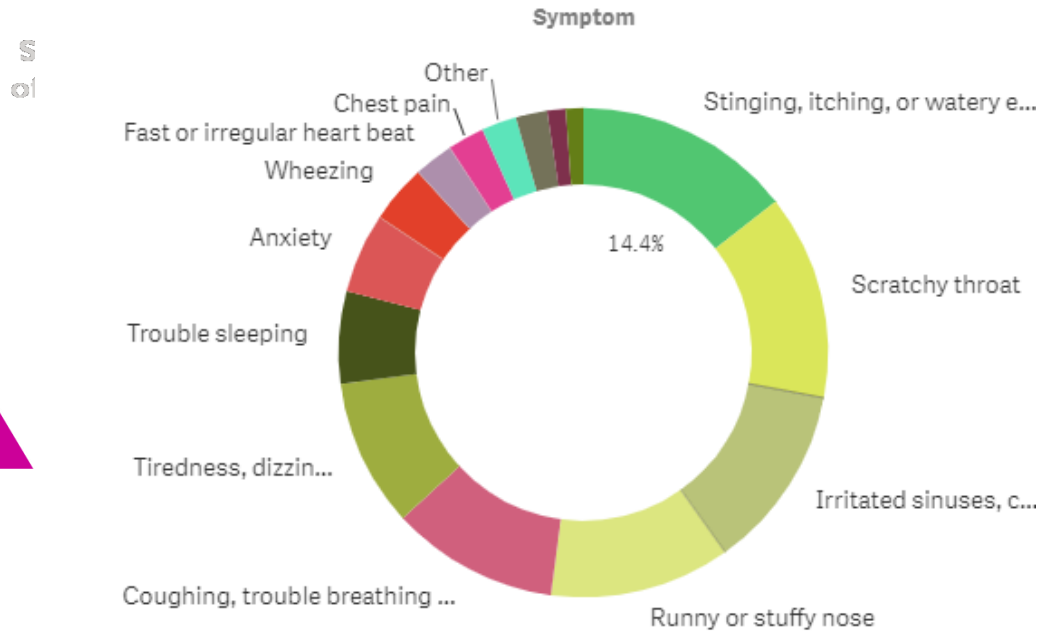
Show All Data / Clear Filters

This sheet contains three charts based on the Health Symptoms Surv...

[Smoke this week](#)
 Actions
 [Smoke this month](#)

Yes, I experienced smoke this week: Symptoms Reported

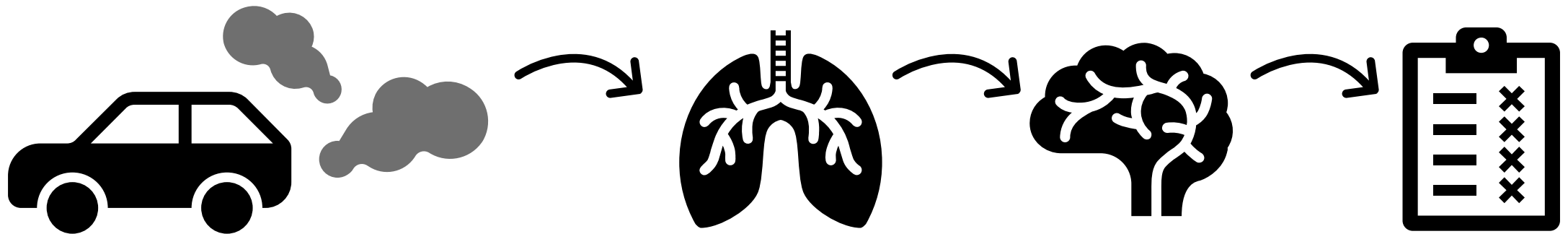
All states / All weeks



Right click on chart to export data

Cognitive Performance Effects of PM2.5 and Wildfire Smoke Exposure

- Mounting evidence of the cognitive effects of exposure to air pollution
- Most evidence is for long-term exposure, children, and the elderly



- **Knowledge Gap: What are the impacts of short-term exposure to PM2.5 and wildfire smoke on cognitive performance in the working age population?**

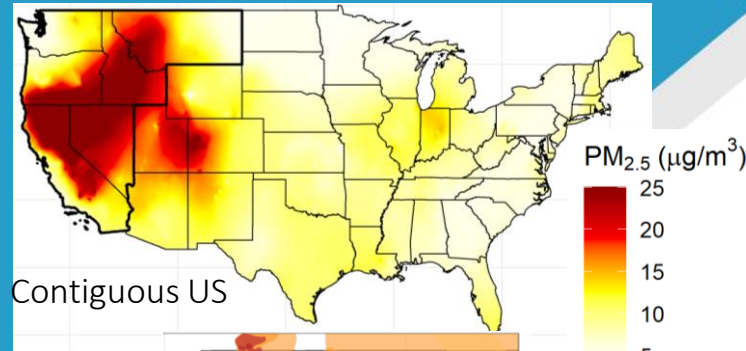


Daily and Sub-Daily
PM_{2.5} / Smoke Exposure

Linear mixed effects models

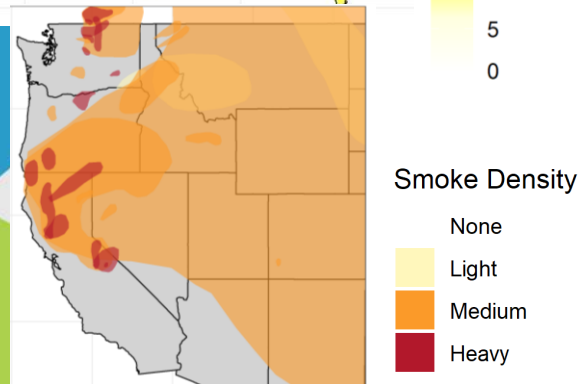
Cognitive Performance
in Adults

Data fusion of US EPA +
PurpleAir observations

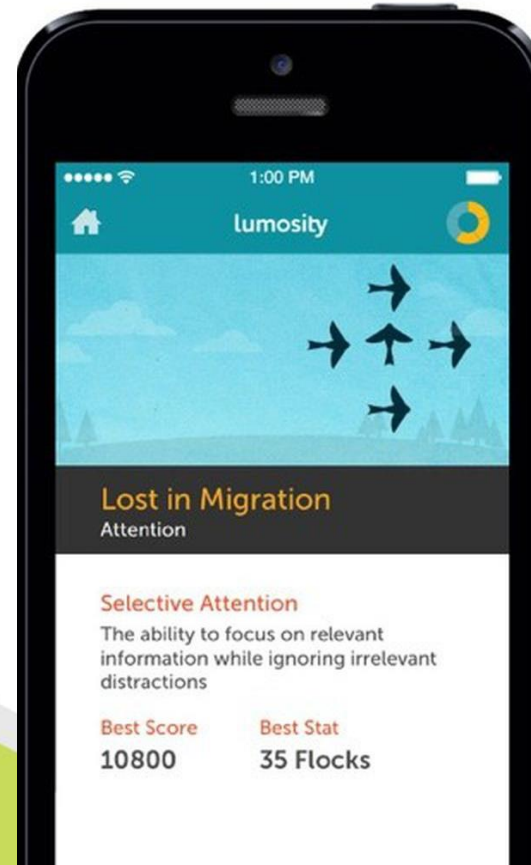


Contiguous US

Smoke density plumes from
NOAA's Hazard Mapping System



Western US
(CA, OR, WA,
NV, ID, MT)



Scores of 10,228 contiguous
US Lumosity users in 20 plays
of an attention-oriented
game


Cognitive Performance Effects of PM2.5 and Wildfire Smoke Exposure

- Significant relationships between **short-term exposure to PM2.5 and wildfire smoke and decreased attention in adults**
- Strongest associations with PM2.5 and wildfire smoke observed within a short exposure window: **first three hours following exposure**
- PM2.5 associations more pronounced in western US, possibly due to regional differences in composition or other wildfire-related impacts
- Younger (18-29), older (70+), and male users most vulnerable

Cleland et al. 2022 in Environmental Health Perspectives



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QUESTIONS



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Smoke concentrations vary in space and time

- Active fire areas can generate localized high concentration plumes
- Topography can strongly impact spatial variation of smoke concentrations
- Wind shifts and diurnal flows can cause rapid concentration changes

Sensors allow for *more* measurements, often at higher time resolution, than the ambient monitoring network → *more timely and localized public health information*

