Health Effects of Regional PM2.5

A brief overview of current WSU research projects

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Participants

- WSU
  - Julie Postma, College of Nursing
  - Solmaz Amiri, College of Medicine
  - Patricia Butterfield, College of Medicine
  - Tamara Odom-Maryon, College of Nursing
  - Joe Vaughan, Lab for Atmospheric Research
  - Hans Haverkamp, College of Medicine
  - Students: Marissa Meyer, Matthew Roetcisoender, Abby DeNike

- Other
  - Ana Rappold, US EPA, Smoke Sense App
  - Matthew Kadlec, Toxicologist, WA DEQ

Current Projects

- **Deploying a Smart Exposure Information System: A Longitudinal Analysis of Air Quality, Children's Health, and School Absenteeism in Spokane**, Ramboll Fonden (Danish Foundation), Aug 2019-Jul 2021

- **Promoting risk reduction among young adults with asthma during wildfire smoke events**, NIH R21, Jun 2020-Jun 2021

- **SmokeCARE (Smoke Cardiopulmonary, Asthma and Respiratory Estimator)**, web/phone application, on-going

Spokane Schools

- Goals
  - To assess among elementary school students in Spokane, WA

    1. the association between absenteeism triggered by respiratory events as related to school air quality, and

    2. the relationship between incidence of respiratory events occurring during the school hours as related to school air quality

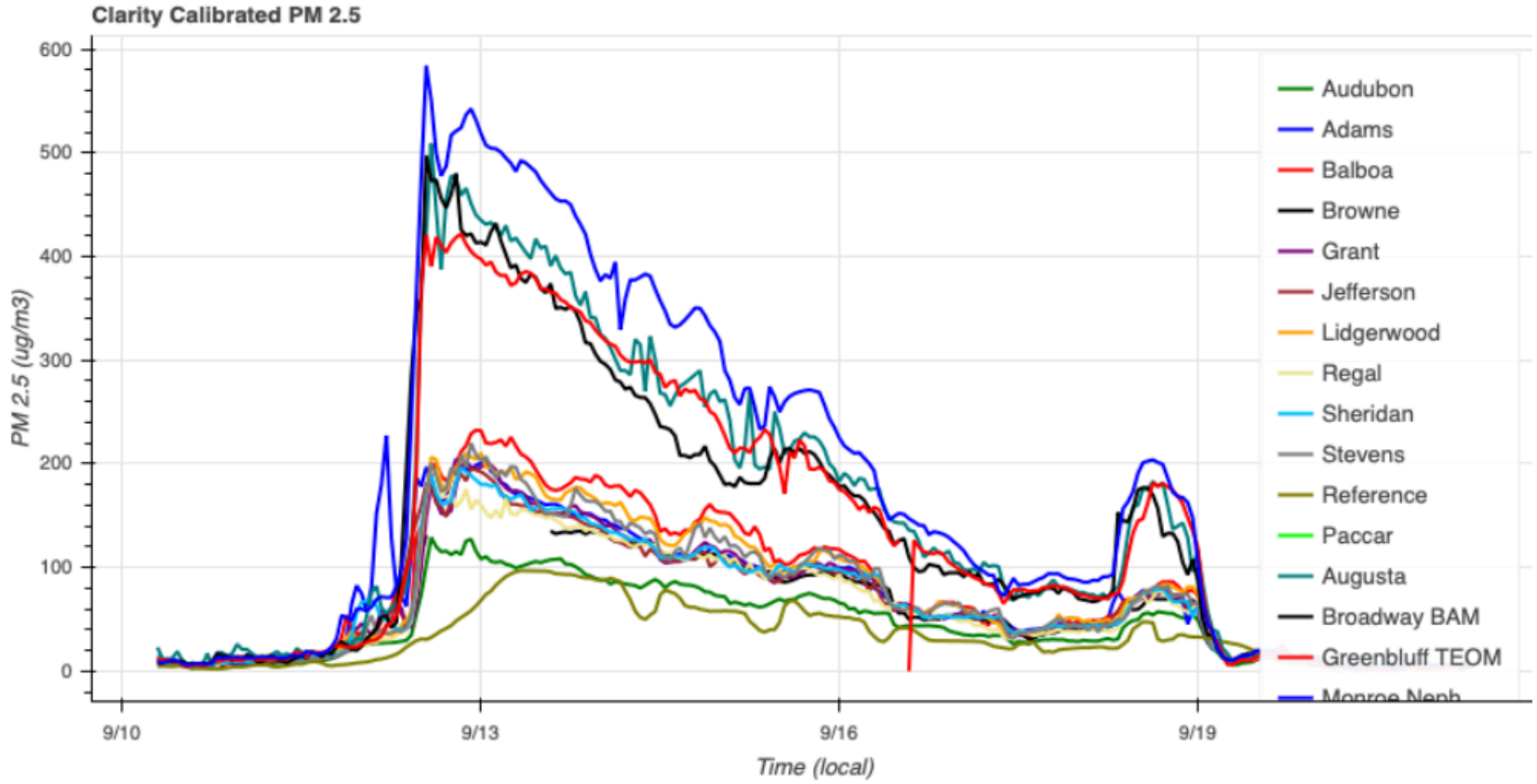
Spokane Schools

- Installed both indoor and outdoor sensors at 10 elementary schools
  - GIS study informed the choice of schools; elevation, school construction, socio-economic factors of students

Plantower PMS5003

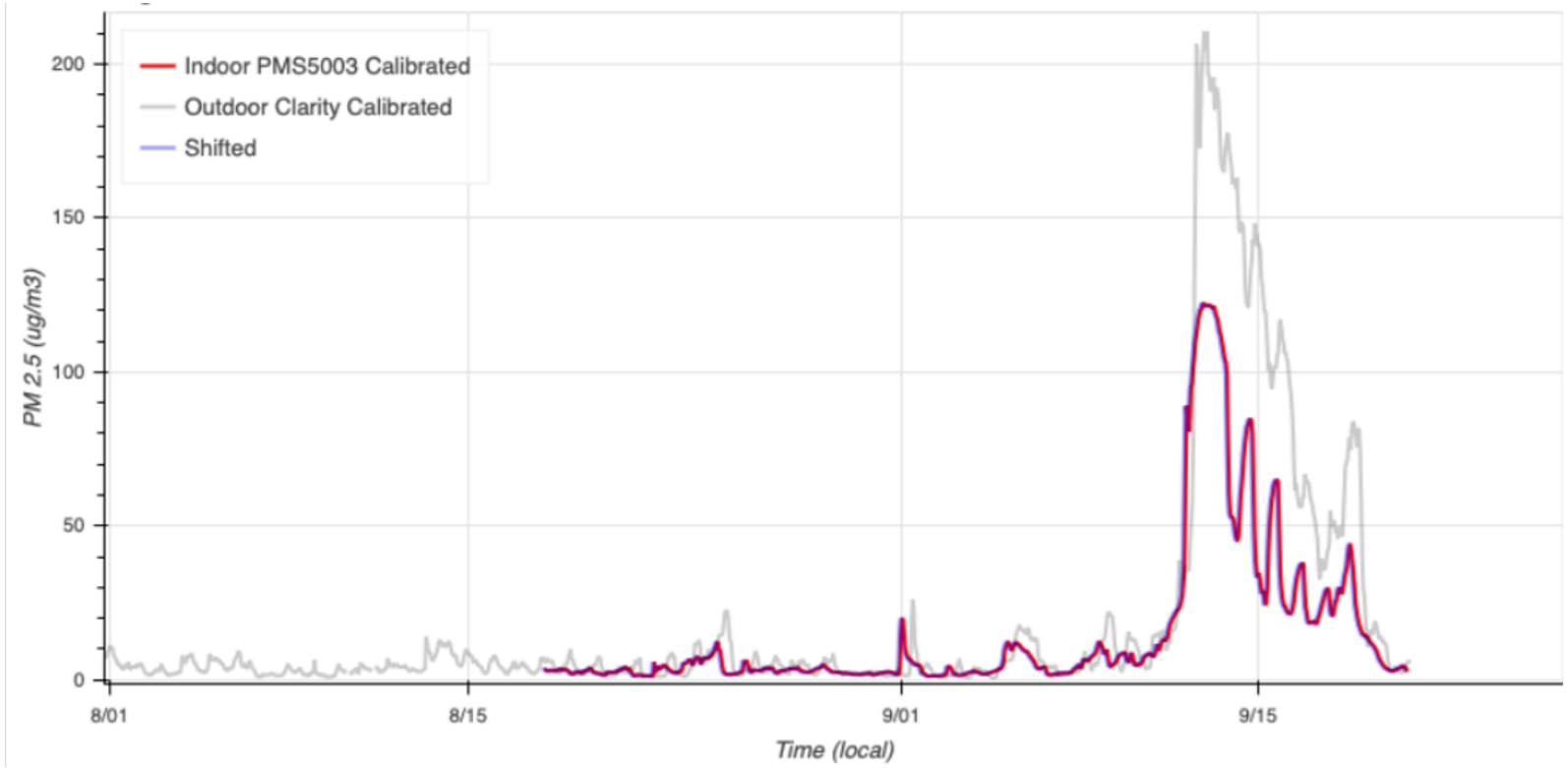
Spokane Schools

- Historically poor AQ in Spokane from 12-19 September 2020
  - Investigating poor calibration at high PM2.5 values



Spokane Schools

- Outdoor PM2.5 is being introduced into the schools, likely by the air handling systems



Spokane Schools

- Results so far…
  - The covid-19 pandemic disrupted this study, but this has provided an opportunity to measure conditions inside schools without children.
  - The previous PM2.5 record (250 ug m-3) was recently doubled during the Sept 2020 wildfire smoke event.
  - Significant PM2.5 penetrated into the schools during the Sept 2020 event.
  - LAR provided a recommendation to the Spokane School District that it would be difficult to mitigate for both covid-19 and wildfire smoke in school buildings at the same time.

Young Adults with Asthma

- Research Gaps (D'Antoni et al 2017, Fish et al, 2017)
  - Air quality alerts lack evidence of effectiveness
  - Adherence to the advice to
    - Reduce or reschedule outdoor activities: 10 to 57% (**Median 31%)**
    - Other activities (taking meds; avoiding busy roads): 18 to 98% (**Median 46%)**
  - Research
    - Relies on self-report of behavior change or *intended* change
    - Observational and descriptive
    - Needs to examine modern communication channels, channels to reach at-risk groups, and the (over) simplicity of the 'stay indoors' message

(Slides from Julie Postma, WSU Nursing)

Young Adults with Asthma

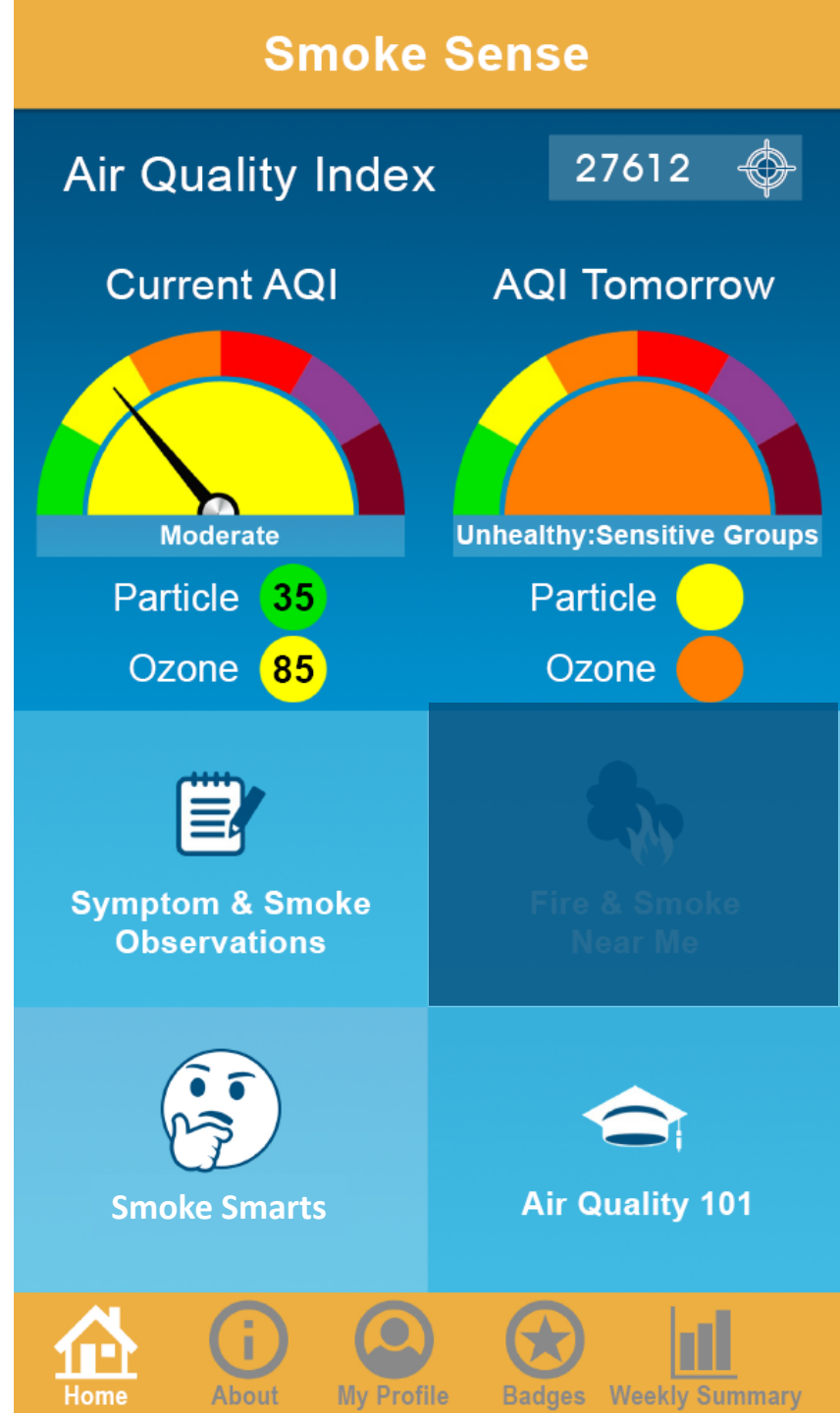
- Our study is based on the US EPA's Smoke Sense app

Smoke Sense

Smoke Sense phone app

PI: ANA RAPPOLD

ENVIRONMENTAL PROTECTION AGENCY



Young Adults with Asthma

- Enlist 60 young adults in Spokane (and PNW)
  - 3 groups; Control, Smoke Sense and Smoke Sense Plus
    - Each participant is issued a spirometer that connects to cell phone

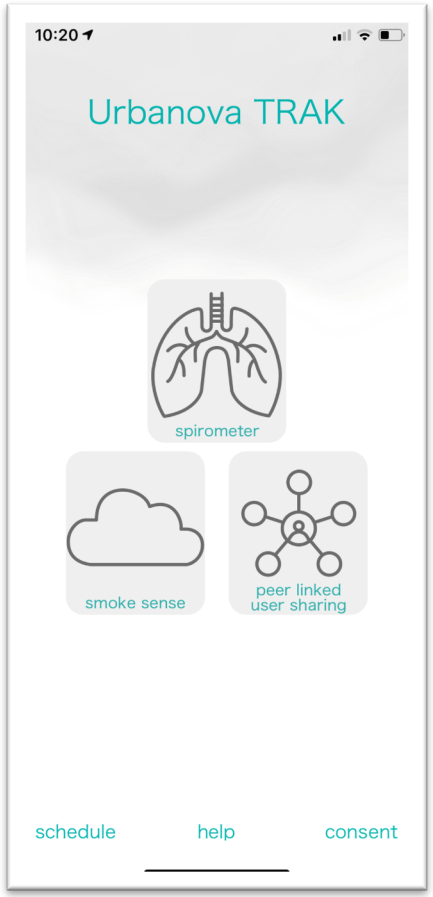
- Goals for Pilot Study
  1. Establish the feasibility and acceptability of the Smoke Sense interventions in young adults with asthma.

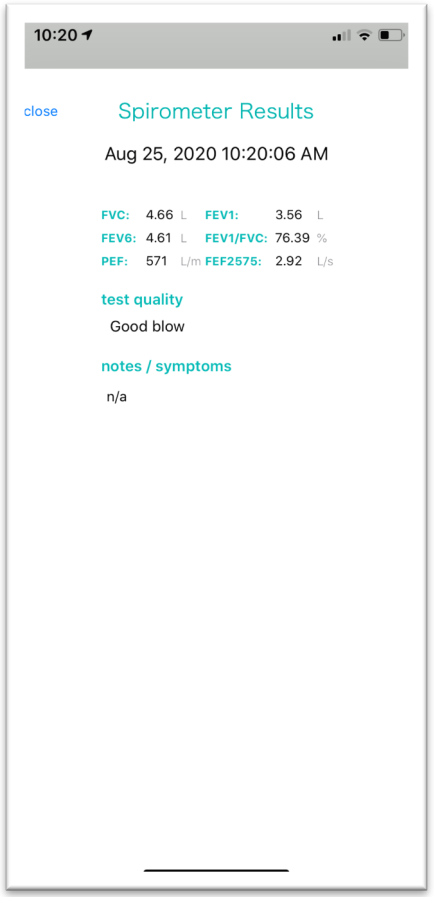
  2. Explore the preliminary impact of the Smoke Sense interventions on lung function, asthma control and quality of life.

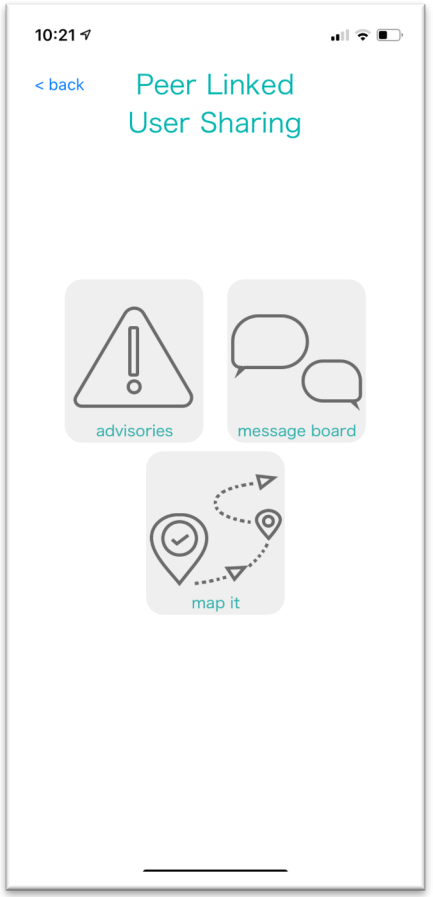
  3. Explore potential mediators and moderators to asthma outcomes.

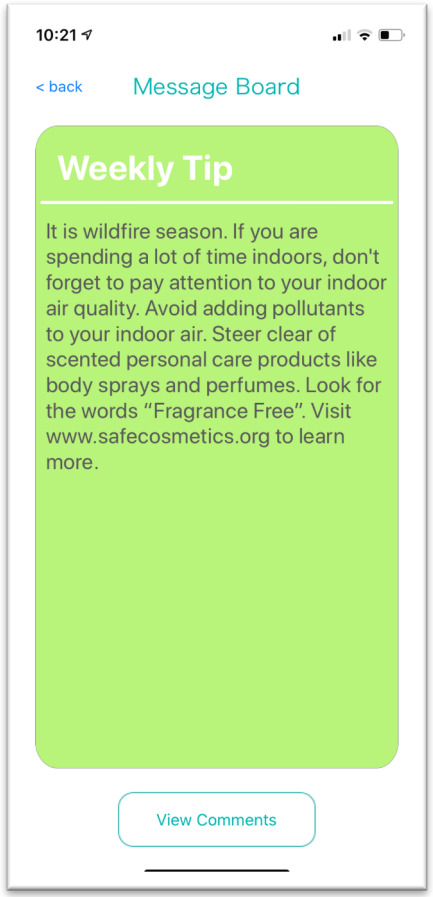
Young Adults with Asthma

- Cell Phone App









Young Adults with Asthma

- Current status…
  - 59 participants are registered and are now in the study
  - Data is streaming in from their spirometers with location (via GPS) and time
  - Using GPS data to track activities; e.g., how much time spent outdoors…
  - Using location and time to determine the AQ at the time of spirometer usage
  - Then determine how participants are using the App
    - What interventions worked best with this demographic?
  - They’re using the spirometers, but they’re not texting…

SmokeCARE

- Drs. Joe Vaughan and Matthew Kadlec collaborated to develop the concept of converting AIRPACT PM2.5 forecasts to increases in risk for various health conditions
  - Non-trauma EDV, Asthma HA, Asthma symptoms onset, COPD Emergency HA, Acute Ostitis Media, Respitory Disease HA and Ischemic heart disease HA relative to a baseline incidence rate for WA state

- Extensive literature search (by Kadlec) led to the development of concentration response functions for each condition

SmokeCARE

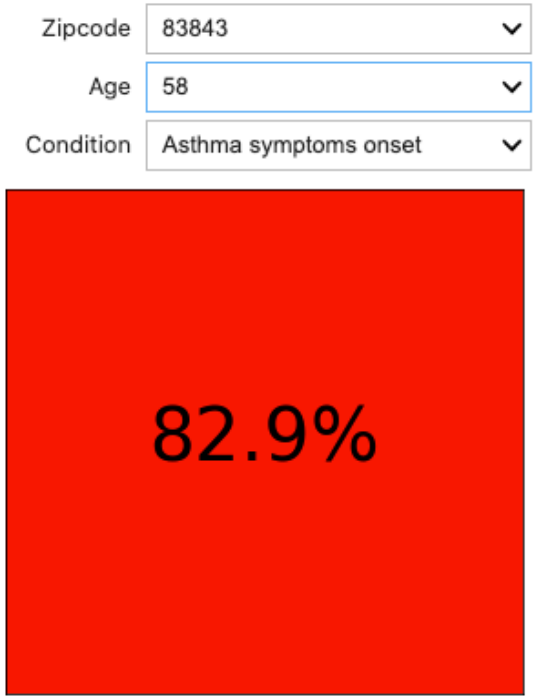
- Steps
  1. Extract AIRPACT5 PM2.5 daily forecasts (new Kalman-filtered values)
  2. Use PM2.5 values to generate CRFs
  3. Created a web-based API that returns CRF for specific (lat, lon, day, condition)
  4. Developed web application as a demonstration

SmokeCARE

Smoke Cardiopulmonary, Asthma and Respiratory Estimater

A web application for visualizing the personal health risk increase for various medical conditions related to particulate matter (PM2.5).

- AIRPACT5 forecasts from Joe Vaughan, Washington State University
- Concentration Responses Functions from Matt Kadlec, WA Dept of Ecology
- Code written by Von P. Walden, Washington State University



SmokeCARE

- Current status…
  - Use sample web app to develop similar phone app (Fall 2020)
    - Leverage functionality from the NIH R21 phone app
  - Engage health care providers (e.g., Kaiser)
  - Interest from hospitals, health care facilities, …

Conclusions

- Exciting projects at WSU related to the health effects from wildfire smoke
- Will submit a follow-on proposal to Ramboll in Feb 2021 to continue Spokane School project
- If NIH R21 pilot project is successful, we will submit a proposal for a larger study as part of a NIH R1
- Initial stages of developing a proposal to NSF Smart and Connected Health program (SmokeCARE, spirometers, phone apps, …)

Thank you!

Questions?