



University of California  
San Francisco

# COVID-19

## Citizen Science

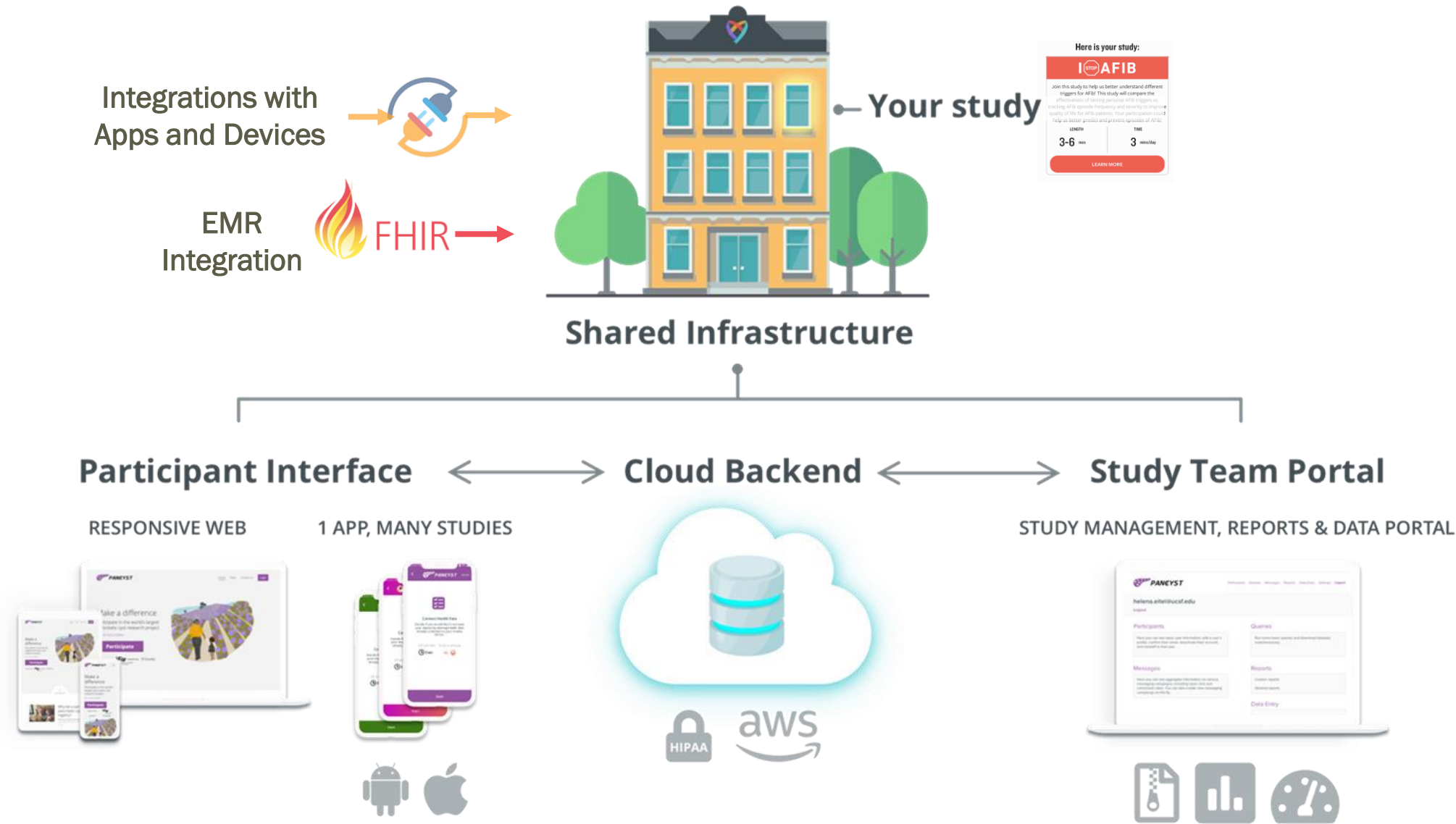
A stylized icon of a microscope with a red virus particle on the slide. The virus particle is red with several smaller red dots on its surface and a few red spikes extending from it. The microscope is white.

Gregory M Marcus, MD, MAS  
Professor of Medicine  
University of California, San Francisco



**Eureka**  
MOBILE RESEARCH

# Eureka Research Platform



# Eureka Research Platform



Integration



Here is your study:

**ICAFIB**

Join this study to help us better understand different triggers for AFIB. This study will compare the effects of two specific frequency and intensity of exercise on the risk of AFIB. You will receive a wearable device to monitor your heart rate and rhythm, and you will receive a personalized exercise plan.

LENGTH	TIME
3-6 min	3 minutes

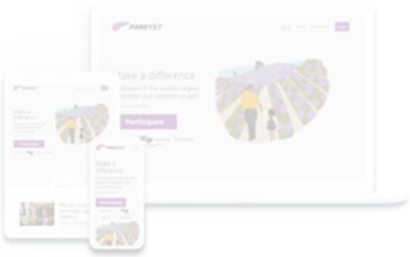
LEARN MORE

Infrastructure

Participant Interface

RESPONSIVE WEB

1 APP, MANY STUDIES



COVID-19  
Citizen Science

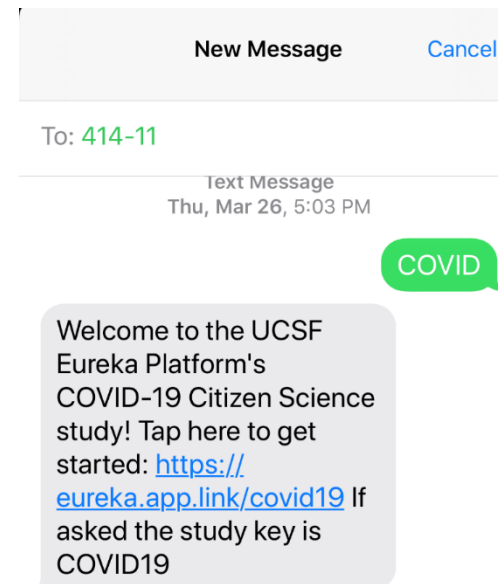
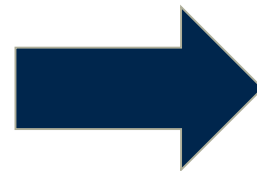
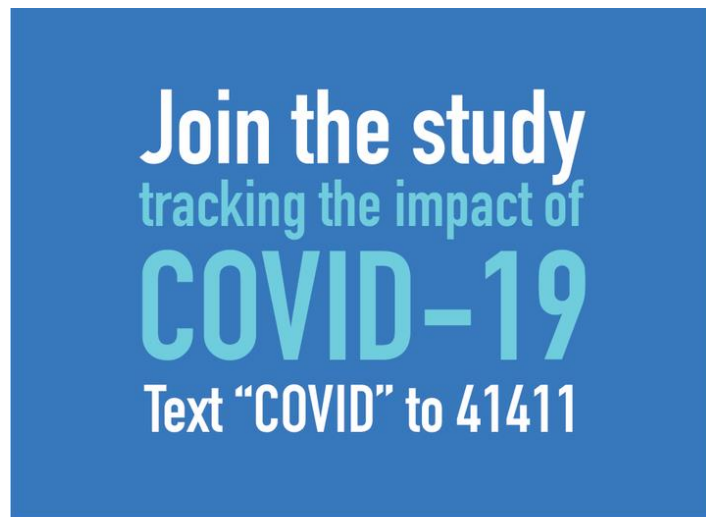


# Goals

- **To utilize mobile health technology to combat the novel coronavirus by enriching understanding via rigorous human subject-based research, including:**
  - Identifying readily modifiable risk factors of infection, transmission, and severity of disease that may inform best practices
  - Identifying other risk factors that may inform scientists and clinicians about the biology of the disease
  - Determining how policy decisions influence behavior and influence disease risk
  - Determining health-effects of the pandemic independent of viral infection
  - Serving as a platform for collaborating investigators to utilize to answer their own research questions

# Recruitment

- **Any adult ( $\geq 18$  years) with a smartphone**
  - Reads English (but COULD be translated)
- **A “deeplink” to the respective app store**
  - <https://covid19.eurekaplatform.org/>
- **Or a “text back”**



# Recruitment

- **The link and text back can be customized and tracked accordingly.**
  - For example:  
<https://covid19.eurekaplatform.org/rotary>
    - [https://covid19.eurekaplatform.org/YOUR ORANIZATION/ NAME](https://covid19.eurekaplatform.org/YOUR_ORANIZATION_NAME)
  - Or text COVIDX to 41411
  - Data can then be tracked and provided back to that person/ organization

# Onboarding and eVisit 1

- **Study card → registration → consent**
- **Baseline “eVisit”**
  - Demographic survey
  - Permissions for geolocation
  - Permissions for Healthkit (for iOS)
    - Enables collection of step counts other information added into Healthkit

# eVisit 1

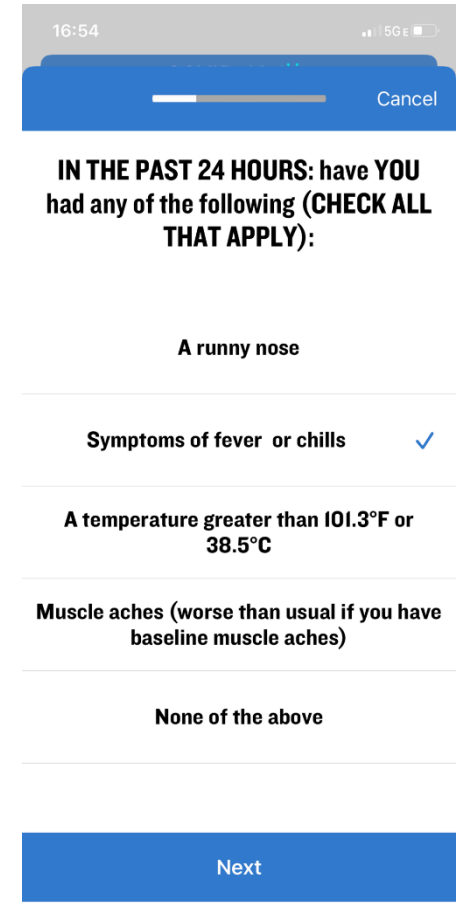
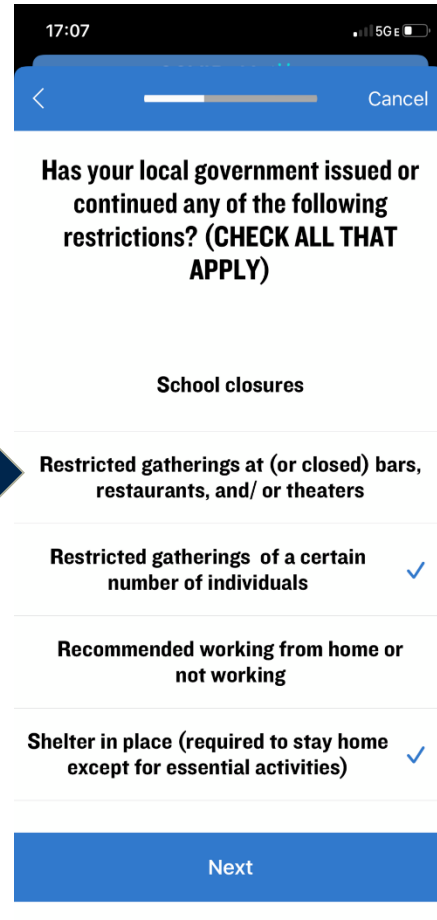
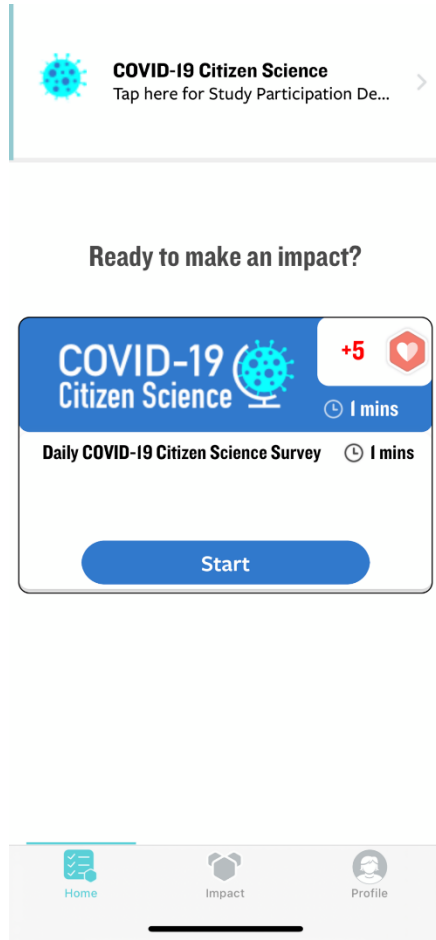
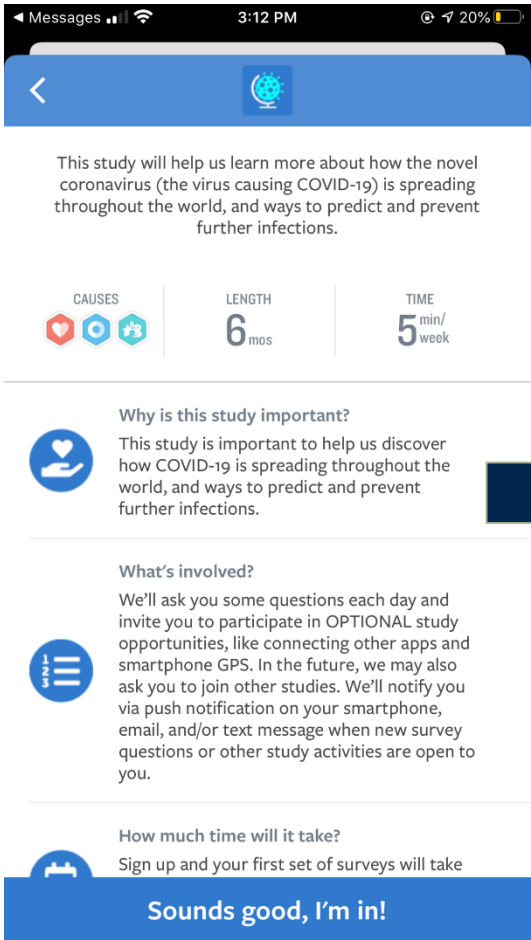
- **Baseline survey**

- Location
- Occupation
- Home conditions (kids or pets at home)
- Medical conditions survey
- Medications
- Smoking/ vaping/ marijuana use

- **To be repeated weekly**

- Tested for COVID-19 and result
- Local government ordinances
- Social distancing
  - How often visited various types of locations
- Hand hygiene
- Sleep
- Exercise
- Alcohol consumption





# Monthly Survey

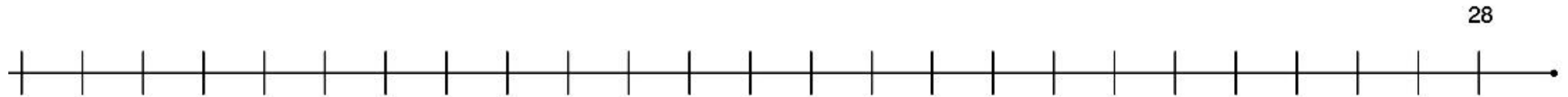
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- **Employment status**
  - Change in income
  - Working from home
- **Mood (PHQ-8 Depression)**
- **Anxiety (GAD-7)**

Download app → Consent → Baseline survey → permission for geolocation tracking → permission to access other smartphone-based (Healthkit on iOS)



Daily Survey



Day 7

Day 14

Day 21

Day 28

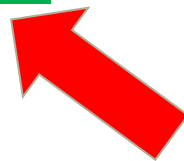
Weekly Survey

Weekly Survey

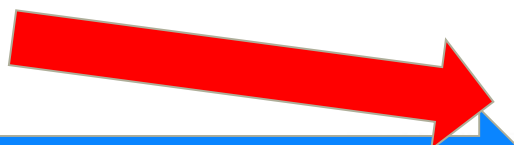
Weekly Survey

Weekly Survey

Mobile app-based push notification  
Timing (given time zone issues):  
same time started survey



Text an hour later



Day 28  
Monthly Survey

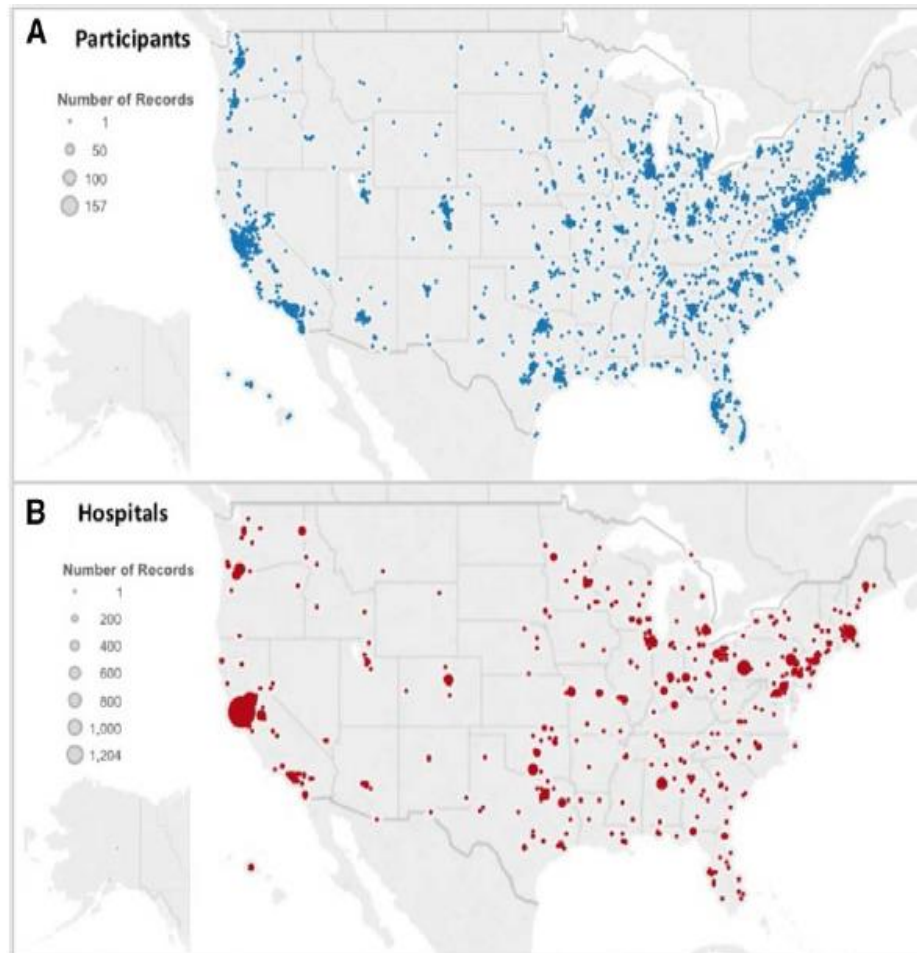


Eureka

# Smartphone-Based Geofencing to Ascertain Hospitalizations

Kaylin T. Nguyen, BS; Jeffrey E. Olgin, MD; Mark J. Pletcher, MD, MPH;  
Madelena Ng, MPH; Leanne Kaye, PhD, MPH; Sai Moturu, PhD; Rachel A. Gladstone, BA;  
Chaitanya Malladi, BS; Amy H. Fann; Carol Maguire, RN; Laura Bettencourt, BS;  
Matthew A. Christensen, BS; Gregory M. Marcus, MD, MAS

*Circ Cardiovasc Qual Outcomes.* 2017;10:e003326.



- In-person pilot (n=22):  
77% sensitivity (95%CI 55-92)
- Remote:
  - 3,443 participants in all 50 US states
  - 243 hospitalizations detected over ~1 year
  - PPV 65% (95% CI 65-72%)

<https://covid19.eurekaplatform.org/>

9/17/20 12:53 PM

**49,236**  
**PARTICIPANTS**  
and counting.



# Retention and Engagement

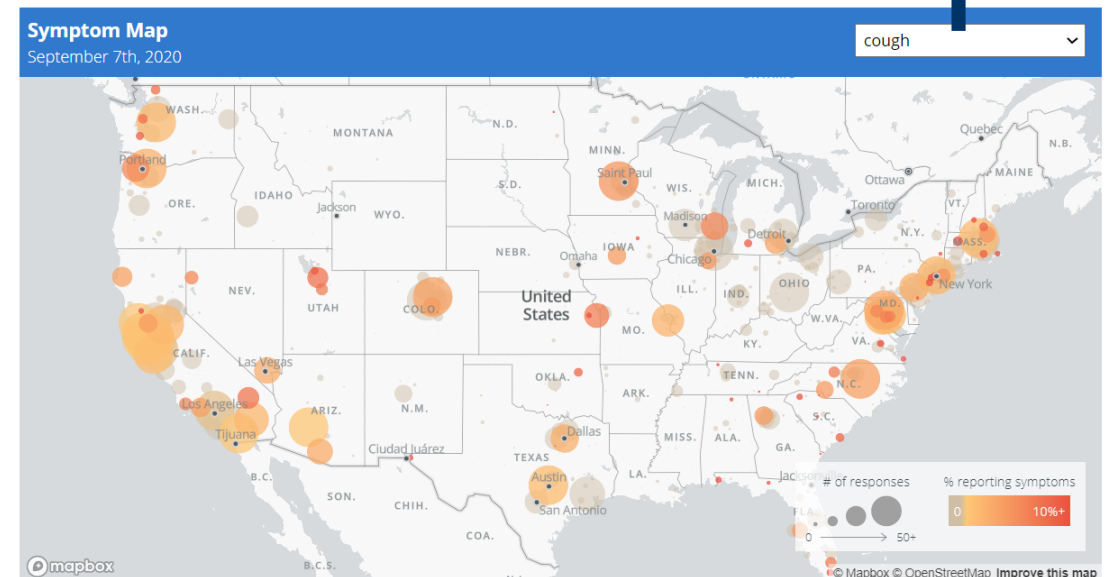
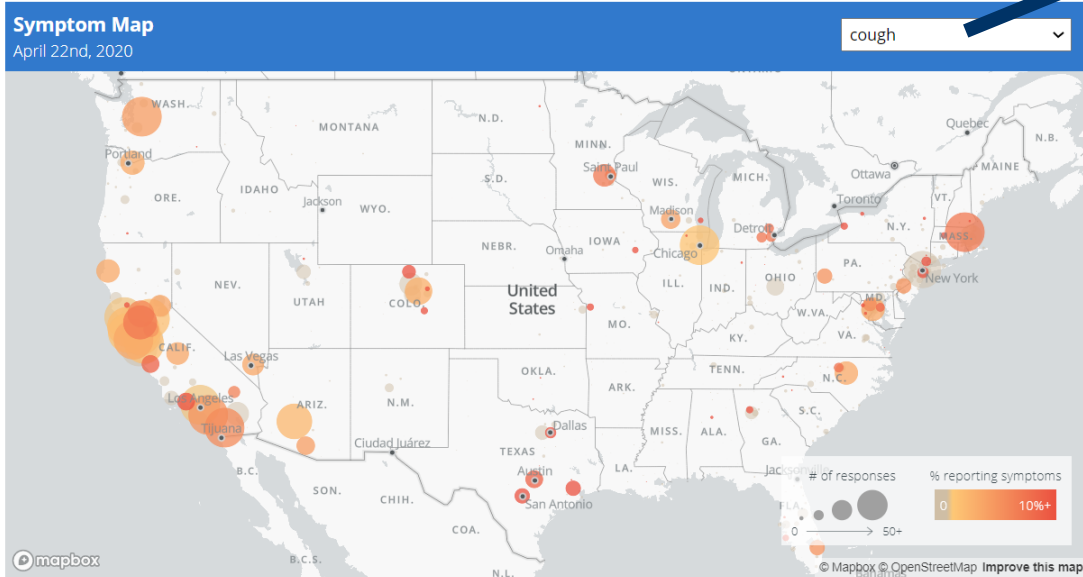
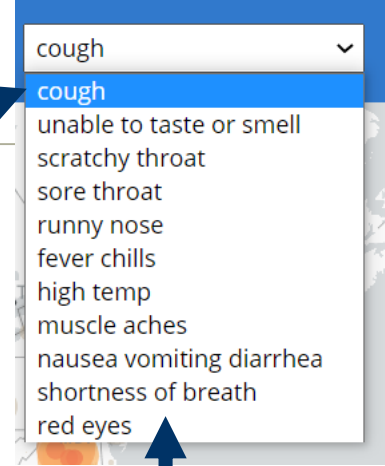
- Study Website

The screenshot shows the homepage of the COVID-19 Citizen Science website. At the top left is the logo for COVID-19 Citizen Science. To the right is a navigation menu with links for Home, Team, Study Updates, FAQs, and Contact Us. The main heading reads "Fight COVID-19 in 5 minutes a day!" followed by three bullet points: "Identify symptoms", "Help prevent infection", and "Track the impact". Below this is a call to action: "Use Study Key COVID19 on Mobile." and two buttons for the App Store and Google Play. On the right side, a white box displays "36,085 PARTICIPANTS and counting." and a note: "Everyone 18+ years old with a smartphone can participate, whether or not you have been tested for COVID-19!". At the bottom of this box is a link "See the map". The footer includes logos for UCSF (University of California, San Francisco) and Eureka.

The screenshot shows a vertical navigation menu with five items: "Our goals" (with a magnifying glass icon), "Researchers" (with a person icon), "Participation" (with a list icon), "How to join" (with a flag icon), and "Your data" (with a shield icon). Below the menu is a white box containing the text "We can't do this without you." and two buttons for the App Store and Google Play.


# Retention and Engagement

- **Toggleable symptom map**



# Retention and Engagement

- Study Blog (website, social media, app)



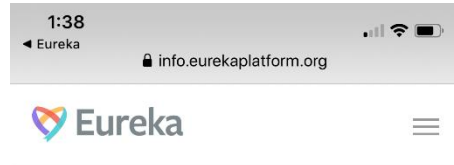
**COVID-19 Citizen Science**  
Tap here for Study Details and Updates



**You're good for now, Gregory**

You're up to date on everything your causes need for now. We'll let you know when there's a new opportunity to contribute.

[Join another study](#)

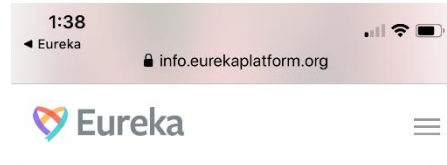


1:38  
Eureka  
info.eurekaplatform.org

Eureka

## COVID-19 Citizen Science: Study Updates

We value each contributor and will use this space to share updates and findings as the study continues. We hope everyone is staying safe and healthy. Every so often, we'll let you know when new updates have been posted. Additionally, you can find the link to this Study Updates webpage in the Eureka App by tapping the COVID-19 Citizen Science logo that appears at the top of the screen on the home page.



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Eureka  
info.eurekaplatform.org

Eureka

## The Bill & Melinda Gates Foundation Awards Grant to CCS Investigators to Study COVID-19 Transmission

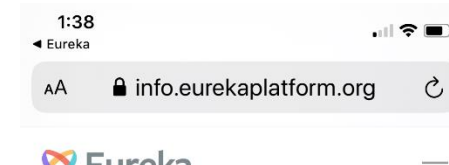
The Bill & Melinda Gates Foundation, the largest philanthropic foundation in the world, has awarded...



COVID-19 Citizen Science Research Coordinator  
September 2, 2020

COVID-19 Citizen Science

## CCS Investigators Awarded PCORI Contract to Study



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Eureka  
info.eurekaplatform.org

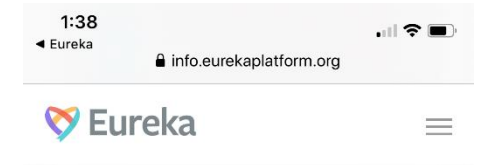
Eureka



COVID-19 Citizen Science

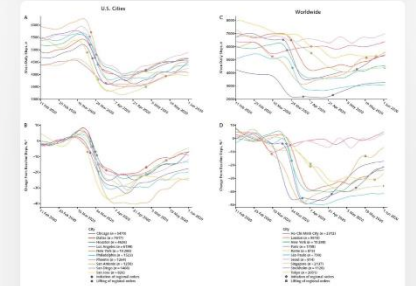
## Over 30,000 Citizen Scientists Have Joined CCS!

We've reached over 30,000 COVID-19 Citizen Scientists! Thank you for



1:38  
Eureka  
info.eurekaplatform.org

Eureka



COVID-19 Citizen Science

## CCS Investigators Publish "Worldwide Effect of COVID-19 on Physical Activity: A Descriptive Study"

CCS investigators and collaborators recently published an analysis of physical activity data from Eureka study...



# Retention and Engagement

- Spice questions

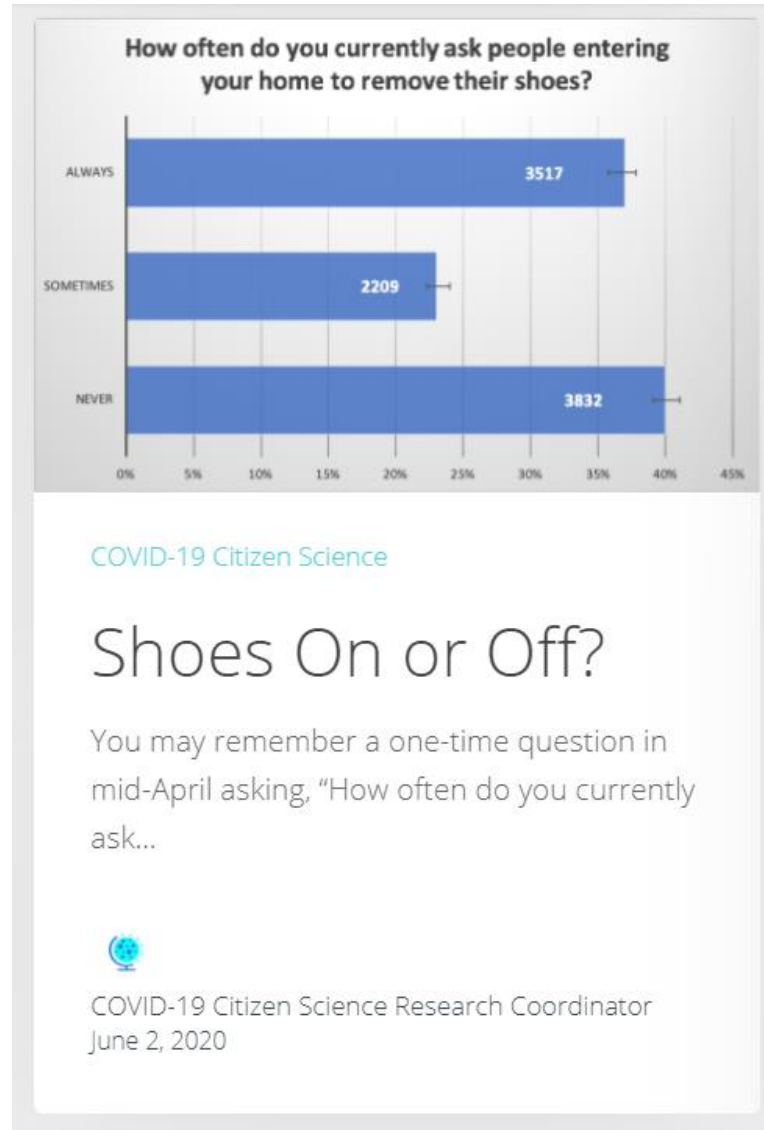


# Retention and Engagement

- **Spice questions**
- **One-time questions delivered as part of daily surveys**
  - Deliberately random (or appear that way)
  - Keep the study interesting for participant
  - A way to incorporate collaborator/ other investigator questions
  - Examples:
    - How often do you currently ask people entering your home to remove their shoes?
    - What position do you sleep in?
    - Do you currently have a child attending school in-person?

# Retention and Engagement

- Spice questions: Feedback



# Citizen Science

- **What does that mean here?**
- **Anyone can contribute in one of four ways**
  - Share their data
  - Spread the word about the study and encourage others to sign up
  - Contribute ideas for questions and analyses
  - Disseminate information as results come in

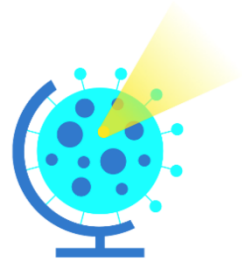
# Retention and Engagement

- Query to participants: what questions do YOU have? → >2,500 responses/ ideas



# Retention and Engagement

- Query to participants: what questions do YOU have? → >2,500 responses/ ideas



The next question is from  
Cynthia from Chicago  
Thank you Cynthia!



The next question is from  
Yosmay from Oakland  
Thank you Yosmay!



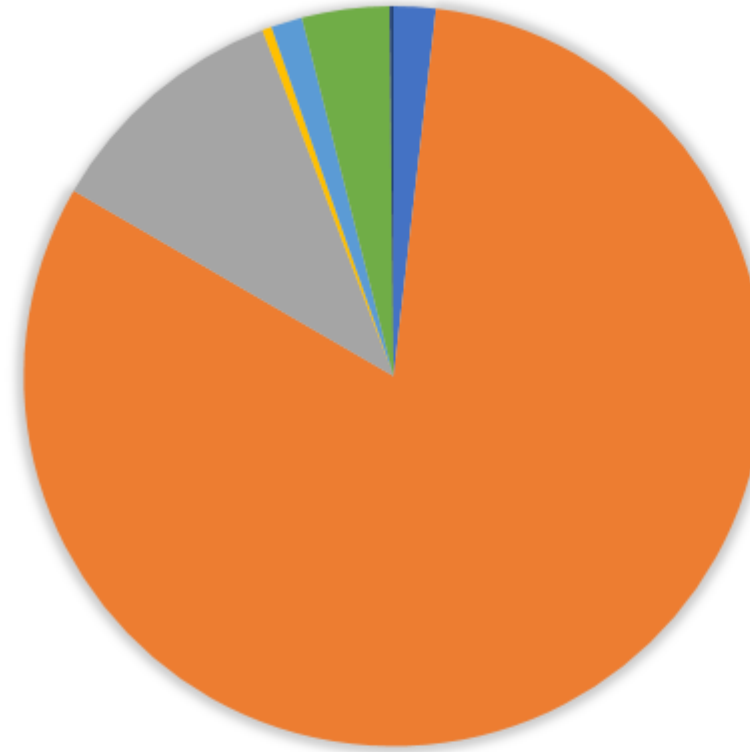
## DEMOGRAPHICS

60% female

11% Hispanic ethnicity

Prevalent virus positive= 215

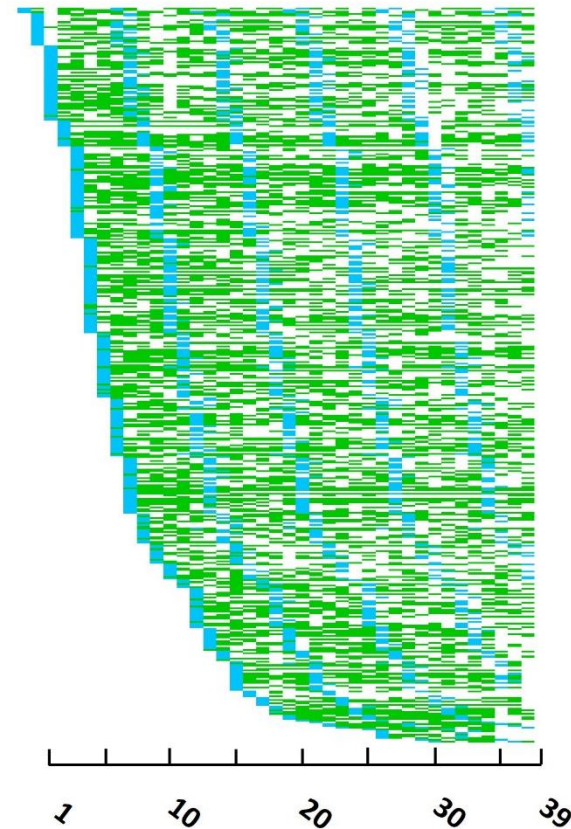
Incident virus positive=61



- Black or African American
- White
- Asian (including South Asian and Asian Indian)
- Native Hawaiian or Pacific Islander
- American Indian or Alaska Native
- Some Other Race
- Don't Know

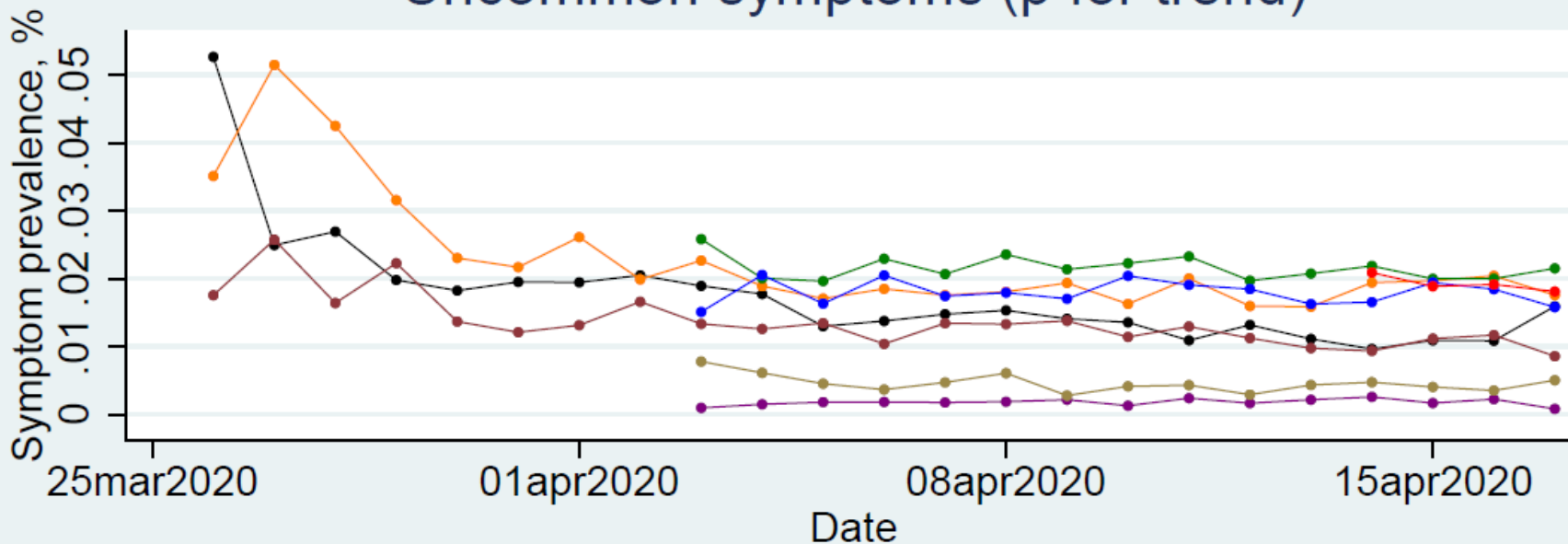
# Survey Completion

- **95-100% complete at least one survey every week**
  - Daily  $42 \pm 12\%$ , weekly  $66 \pm 26\%$

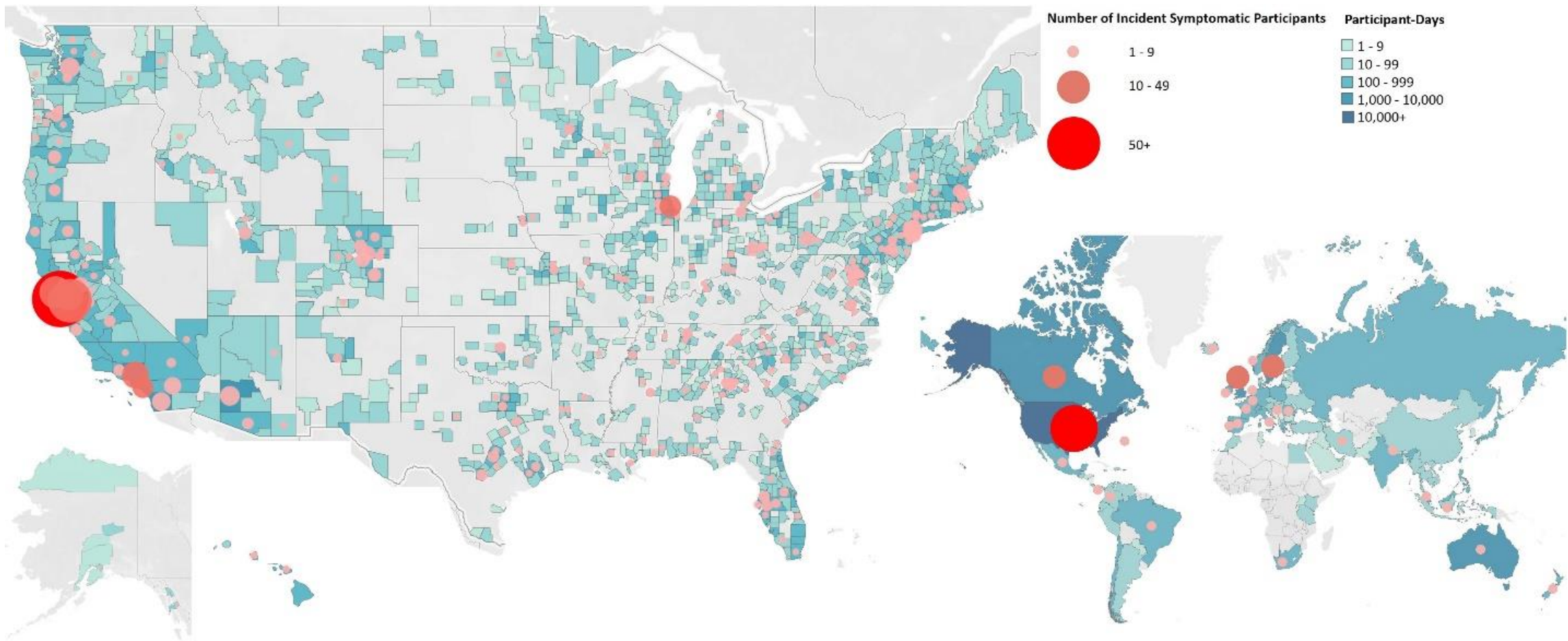




## Uncommon symptoms (p for trend)



- Painful throat ( $p < .001$ )
- Muscle ache ( $p < .001$ )
- Fever or chills ( $p < .001$ )
- High temp >38 ( $p = .79$ )
- Nausea, vomiting or diarrhea ( $p = .50$ )
- Shortness of breath ( $p = .38$ )
- Unable to Taste or Smell ( $p = .084$ )
- Red eyes ( $p = .65$ )



# Preliminary Ecological Analyses

- **CCS participant behavior as a predictor of regional incident SARS-CoV-2 infection**
  - Adjusted for US Census-base demographics, population density, and previous number of infections
  - Utilized a time lag to allow for causal effects
  - Utilized a time-updated analysis
- **From geolocation data: time spent “at home” is associated with lower infection rates**

# Using CCS as a Platform

- **Recently received a grant from the Bill and Melinda Gates Foundation to:**
  - Track and visualize symptoms and behaviors related to COVID-19 in a large population-based cohort
    - New York City Health and Hospital
    - Advocacy Aurora Health
  - Connect EHR data
  - Identify risk factors for infection and prediction models/ hot-spot identification for public health agencies
  - Pilot test home-based collection of biospecimens

# Using CCS as a Platform

- **Recently received a grant from PCORI to:**
  - Expand recruitment of vulnerable populations
  - Recruit a cohort of 240,000 pts with linked EHR and claims data from 8 health systems with differing demographics, politics and COVID-19 dynamic:
    - NY, FL, TX, LA, MS, OK, CA
  - Provide timely actionable information for policymakers that leads to better health outcomes for vulnerable populations during the pandemic
  - Publish research analyses of how policies impact health during a pandemic

# Work with the RADx initiative

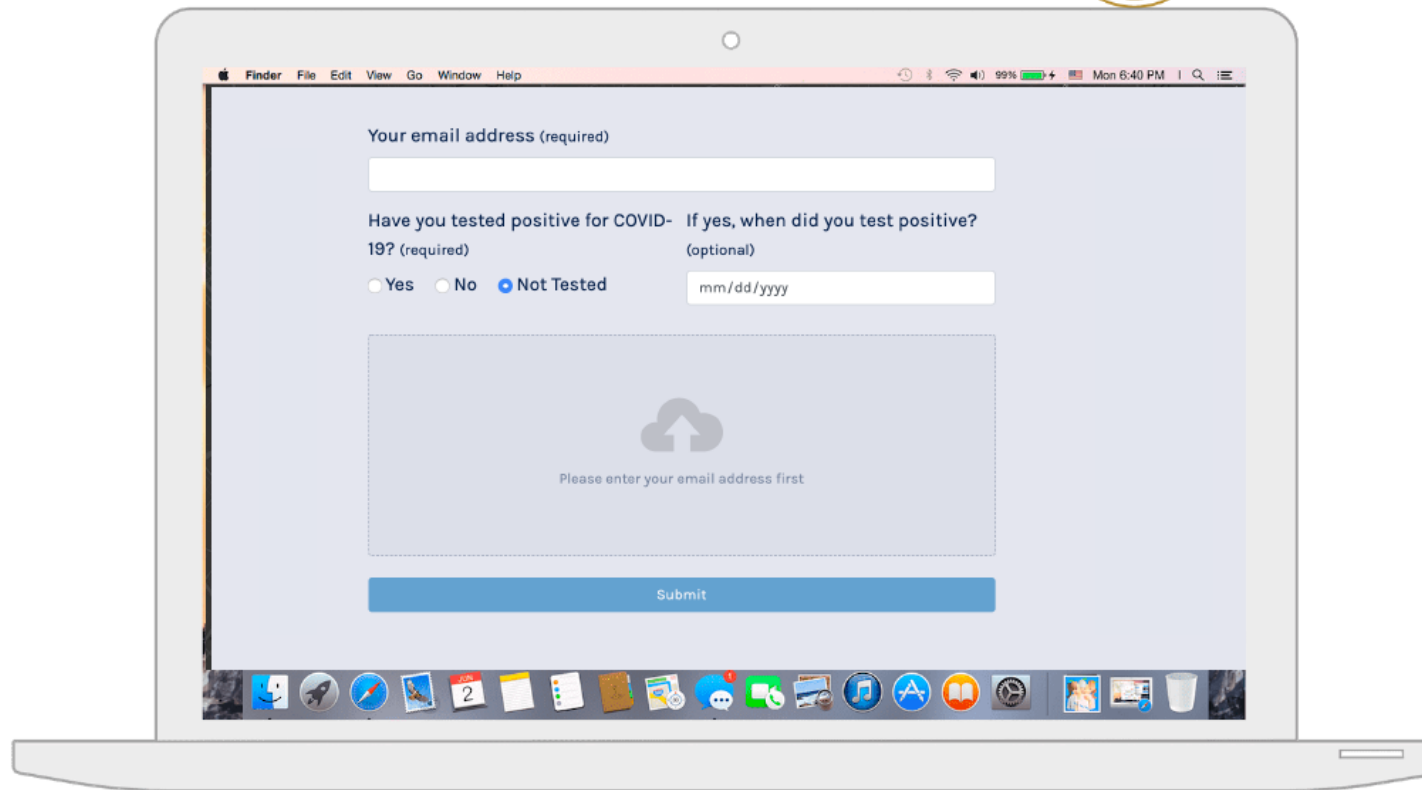
- **Recently received a subcontract via U Mass to:**
  - Use Eureka to serve as the Digital Research Platform for the RADx initiative, evaluating point of care SARS-CoV-2 tests
  - Build a mobile app and web-based digital tools to obtain consent, interface with coordinators, and collect participant reported data/ outcomes
  - Build workflows to interface with Quest labs around the US (for gold standard assessments)
  - Build a multi-language interface (toggleable)
  - Develop a method of pediatric enrollment through parental consent

# Using CCS as a Platform

- **Recently received a contract from NCI (Yulin Hswen, ScD, MPH and Marcus Co-PIs) to:**
  - Integrate an automated contact-tracing technology, Covidseeker, into COVID-19 Citizen Science
  - Perform usability testing and incorporate feedback with plan for larger public roll out
  - Engage with public health departments
  - Perform a pragmatic, randomized trial within stores/ essential businesses

# Using CCS as a Platform

USER engagement



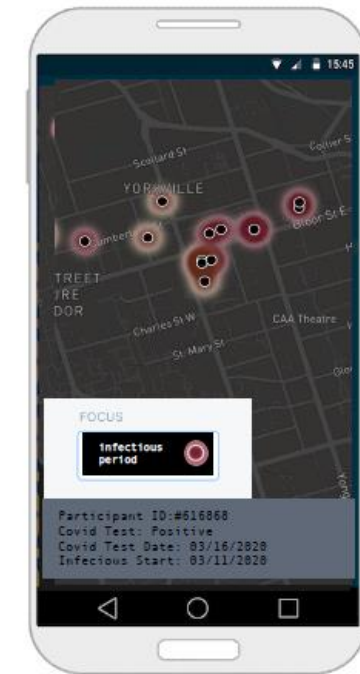
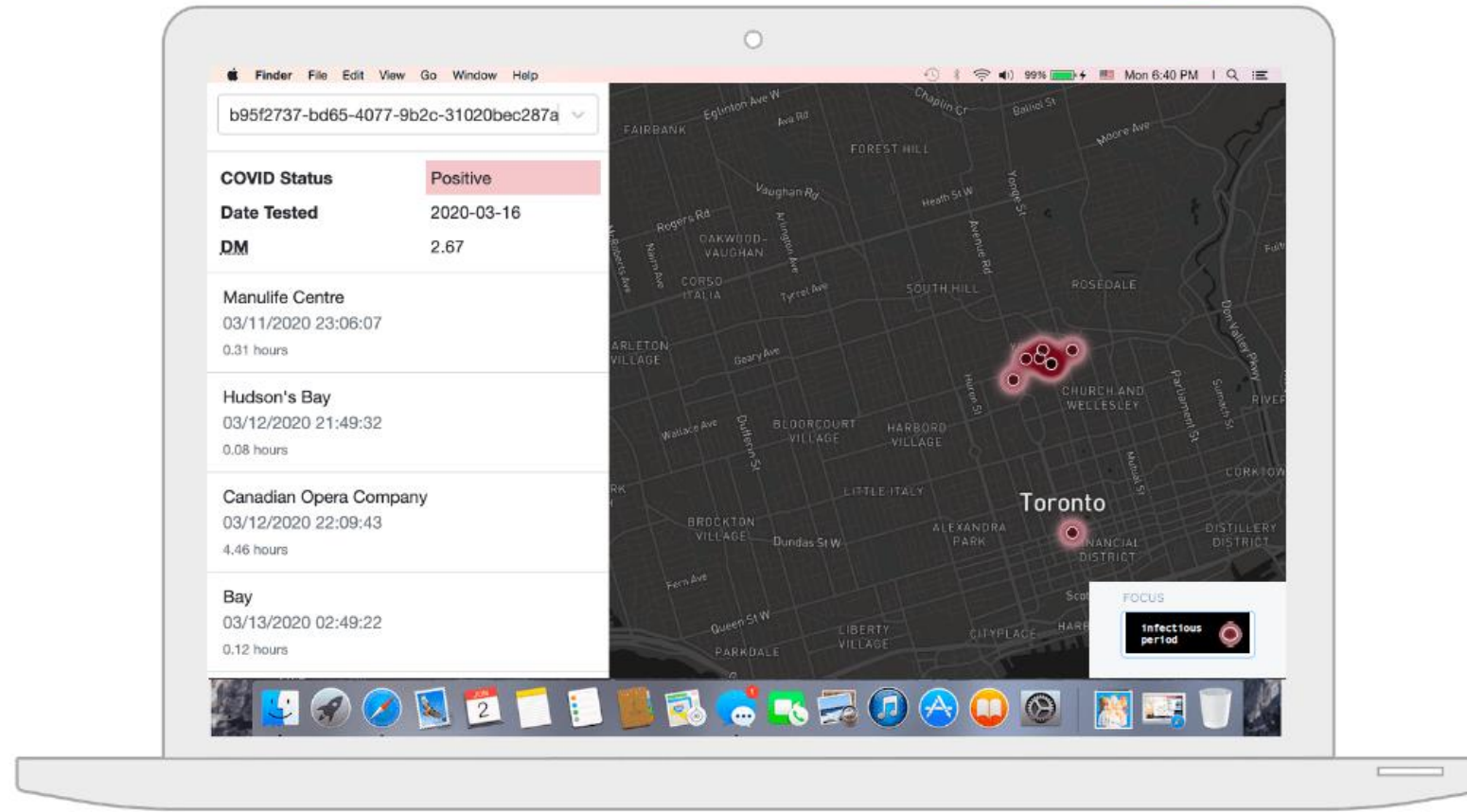


# Using CCS as a Platform

Case Investigator Dashboard



COVIDSEEKER



# Built to be Nimble



**In the past WEEK, have you or your environment been affected by wildfire or the associated smoke?**

Yes

No

Other



**Has your local air quality been noticeably affected by wildfire smoke?**

Yes

No

Other



# Built to be Nimble

- **Launched a survey regarding vaccine acceptability just prior to vaccine approval**
  - >13,000 completed surveys in ~2 days
- **Integrated monthly question to determine**
  - If vaccinated
    - Which vaccine
    - Adverse effects
    - 1<sup>st</sup> or 2<sup>nd</sup> dose
  - Reasons not vaccinated
  - Subsequent outcomes

# Built to be Nimble

- Developing a survey to gauge attitudes and beliefs regarding a SARS-CoV-2 vaccine
- Working on bringing in integrations already established as part of other Eureka studies



# Conclusions

- **Eureka is a NIH-supported Digital Research Platform built to facilitate mHealth**
  - But mHealth should be thought of broadly as a tool to facilitate clinical research broadly
- **We leveraged the extant Eureka infrastructure, regulatory approvals, and workflows to rapidly address study of the Covid-19 pandemic**
- **We continue to strive to be nimble, to adapt, to collaborate, and to contribute**

# Thank You

**Jeff Olgin (Co-PI)**

**Mark Pletcher (Co-PI)**

Yulin Hswen  
(Covidseeker)

Noah Peyser

Xochitl Butcher

Ryan Runge

Helen Eitel

David Wen

Patrick Maher

Vadim Ananyev

Armando Godinez

Alex Cabrera

Ricardo Barrera

Todd Parsnick

Jairo Vazquez

Armando Godinez

Vadim Ananyev

Jin Yu

Luis Ojeda

Dante Solorio

Abel Sierra

Efren Carbajal

Jorge Gonzalez

Niloo Abdollahi

Brittany Tadwilliams

Cathy Horner

Madelaine Faulkner

Cathy Horner