From Space to Front Porch: Connecting Earth Observations to Health Outcomes with an Environmental Exposure Modeling System

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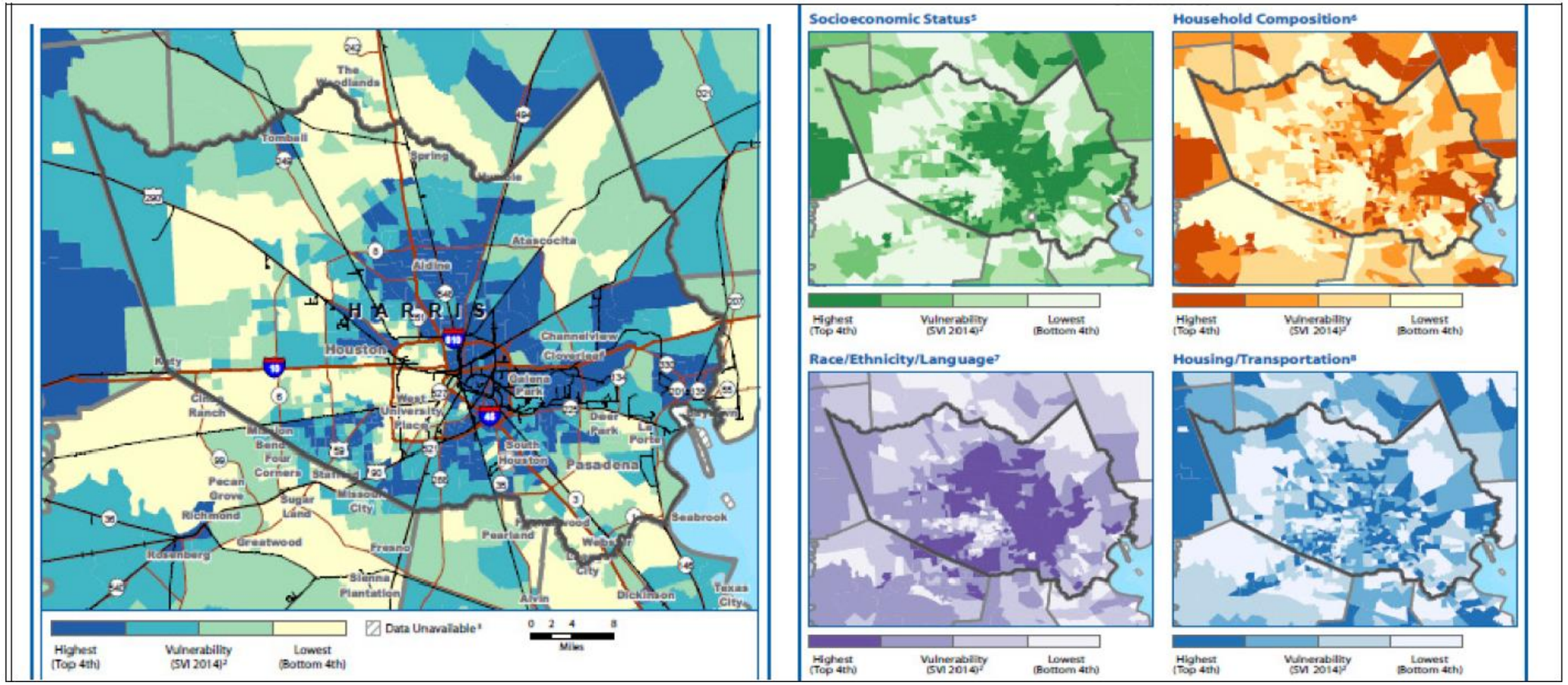
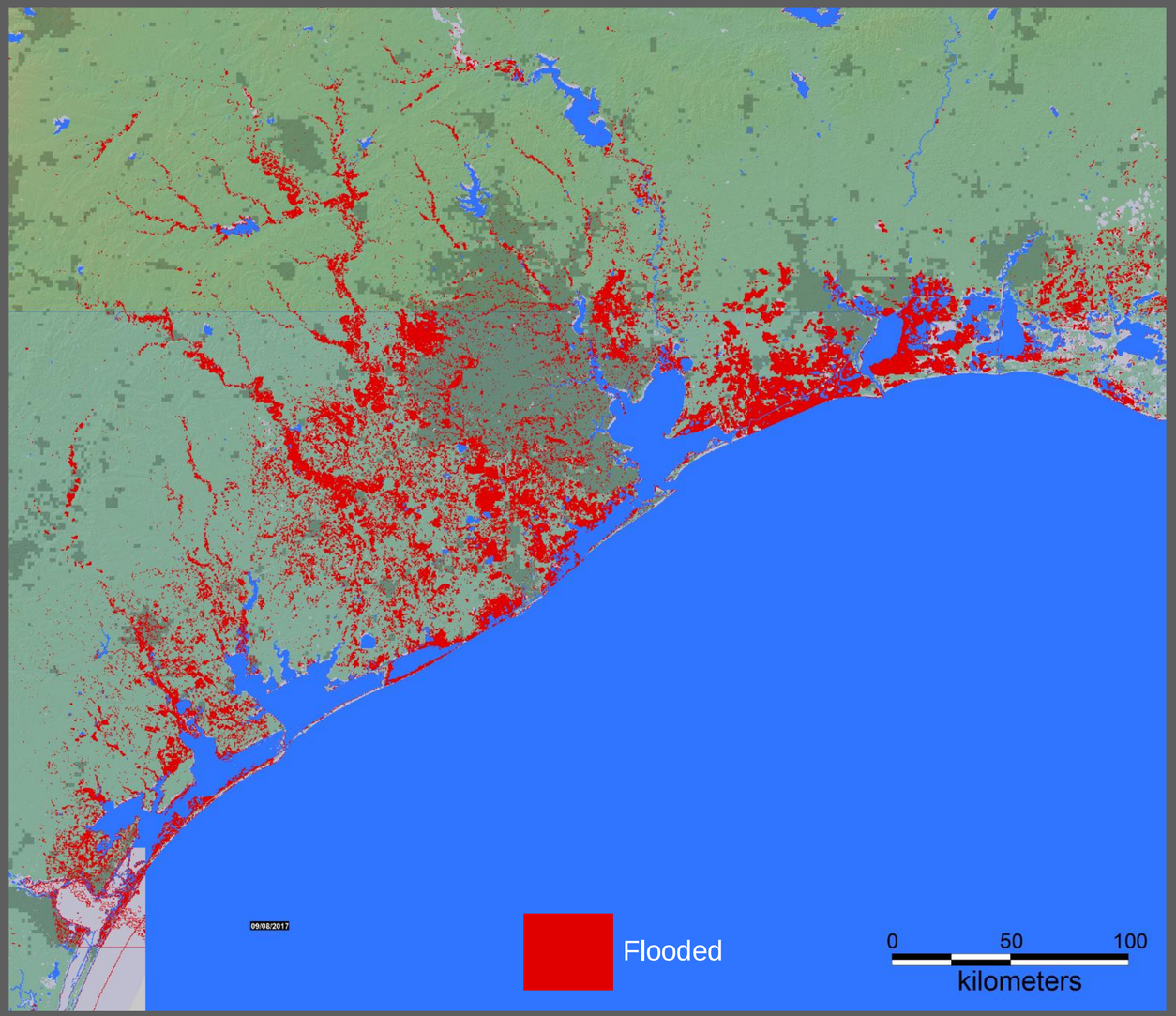
ANNUAL GRANTEE MEETING

OCTOBER 20TH, 2021

The CDC SVI is used to estimate the amount of needed supplies, locations of emergency shelters, assisted evacuations, support response



https://svi.cdc.gov/



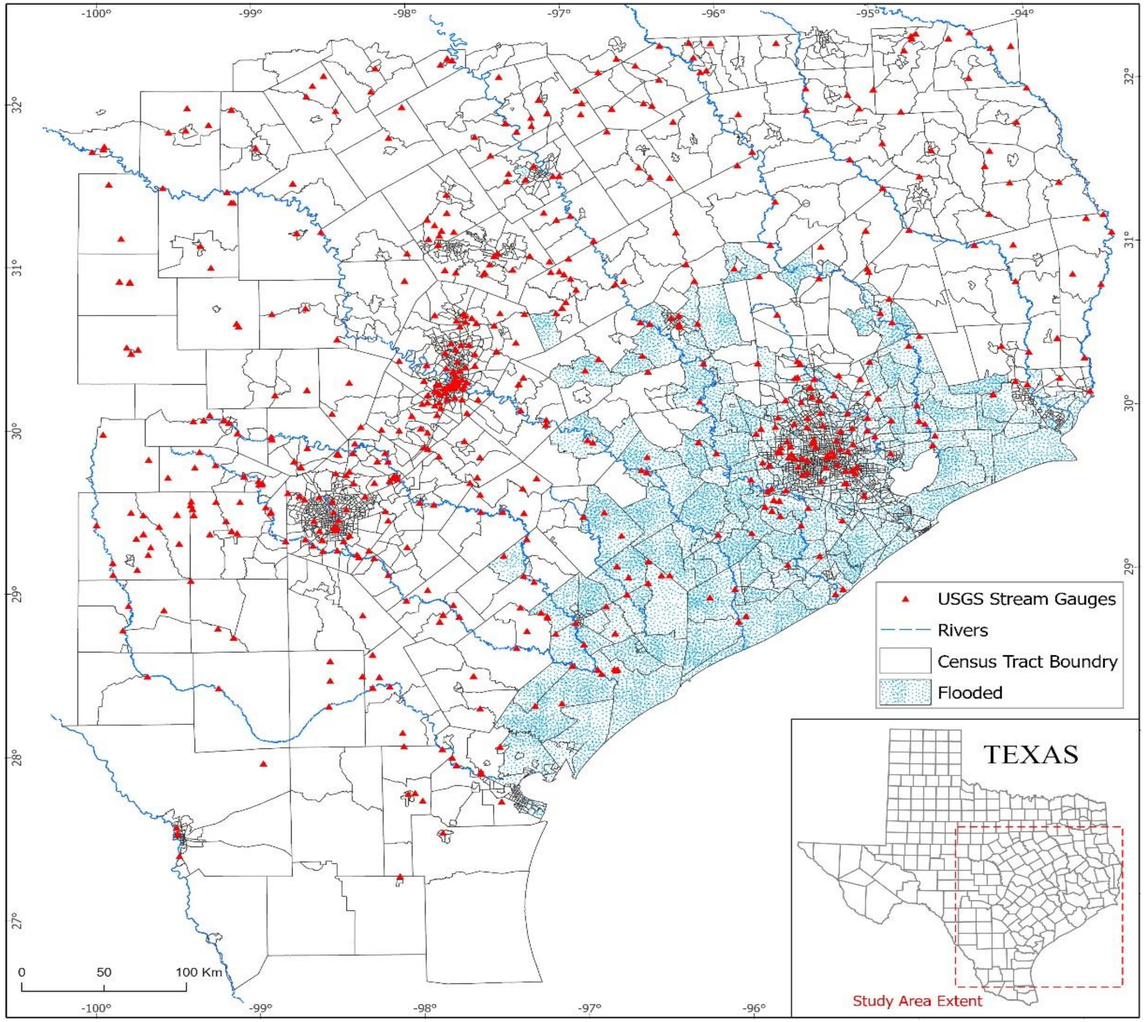
Inundation Data from Dartmouth Flood Observatory

Can EO data and synthetic population simulations enhance the CDC SVI for flooding event response?

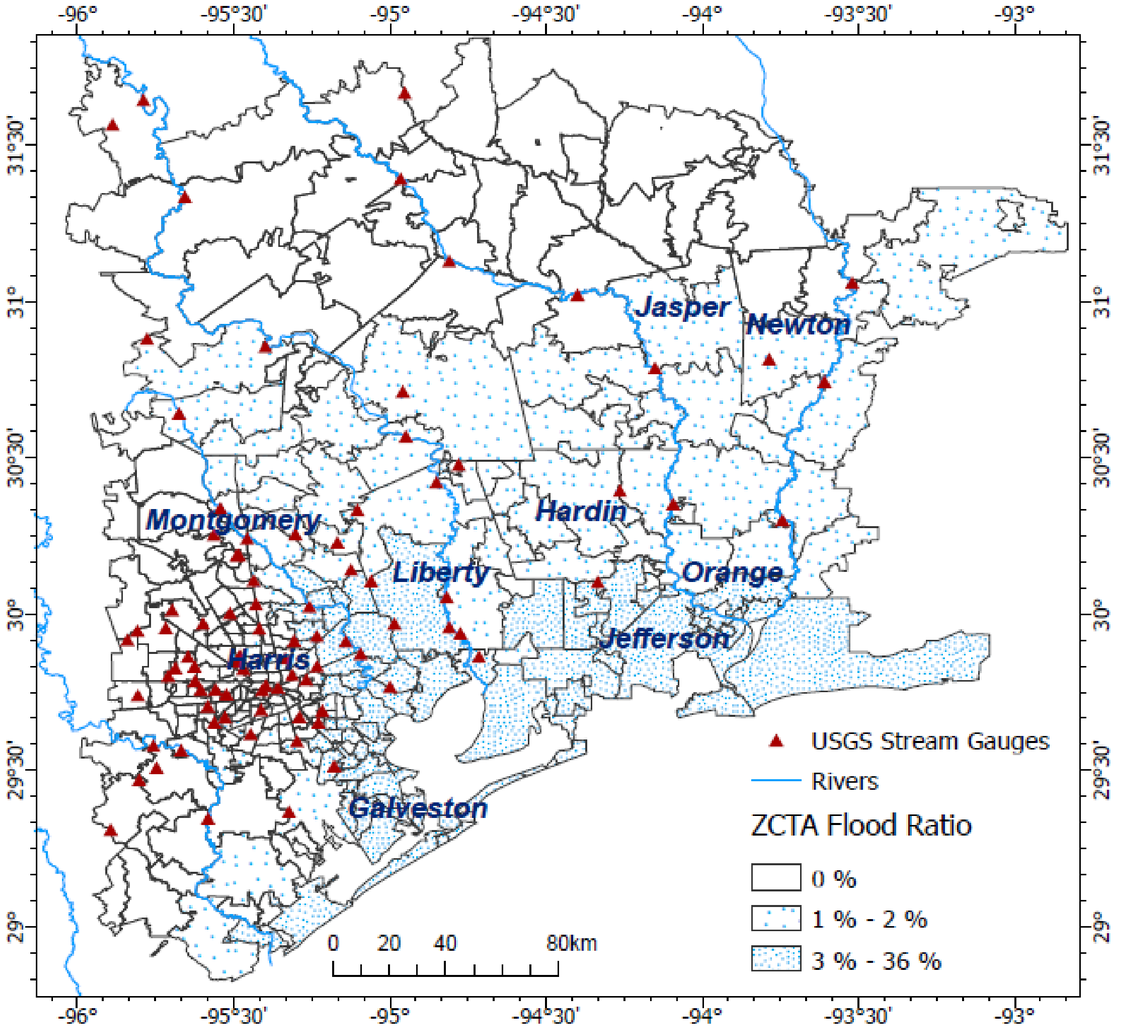
- Inundation and stream gauge data for estimating where and when exposure occurs
- Synthetic population movements for more refined exposure estimates
- Healthcare facility visits during Harvey and Imelda

Using EO to define spatiotemporal flooding extents during Hurricane Harvey (census tract) and Tropical Storm Imelda (ZCTA)

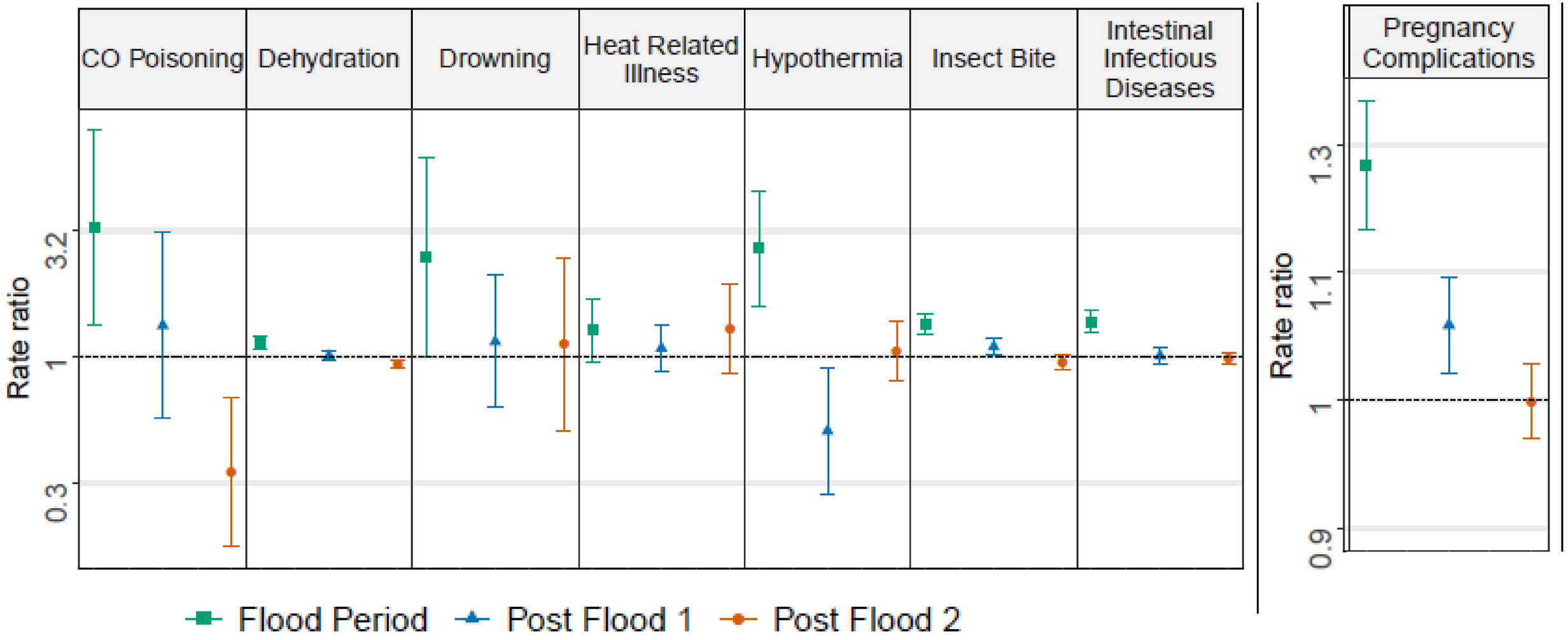
Hurricane Harvey (August 2017)



Tropical Storm Imelda (September 2019)

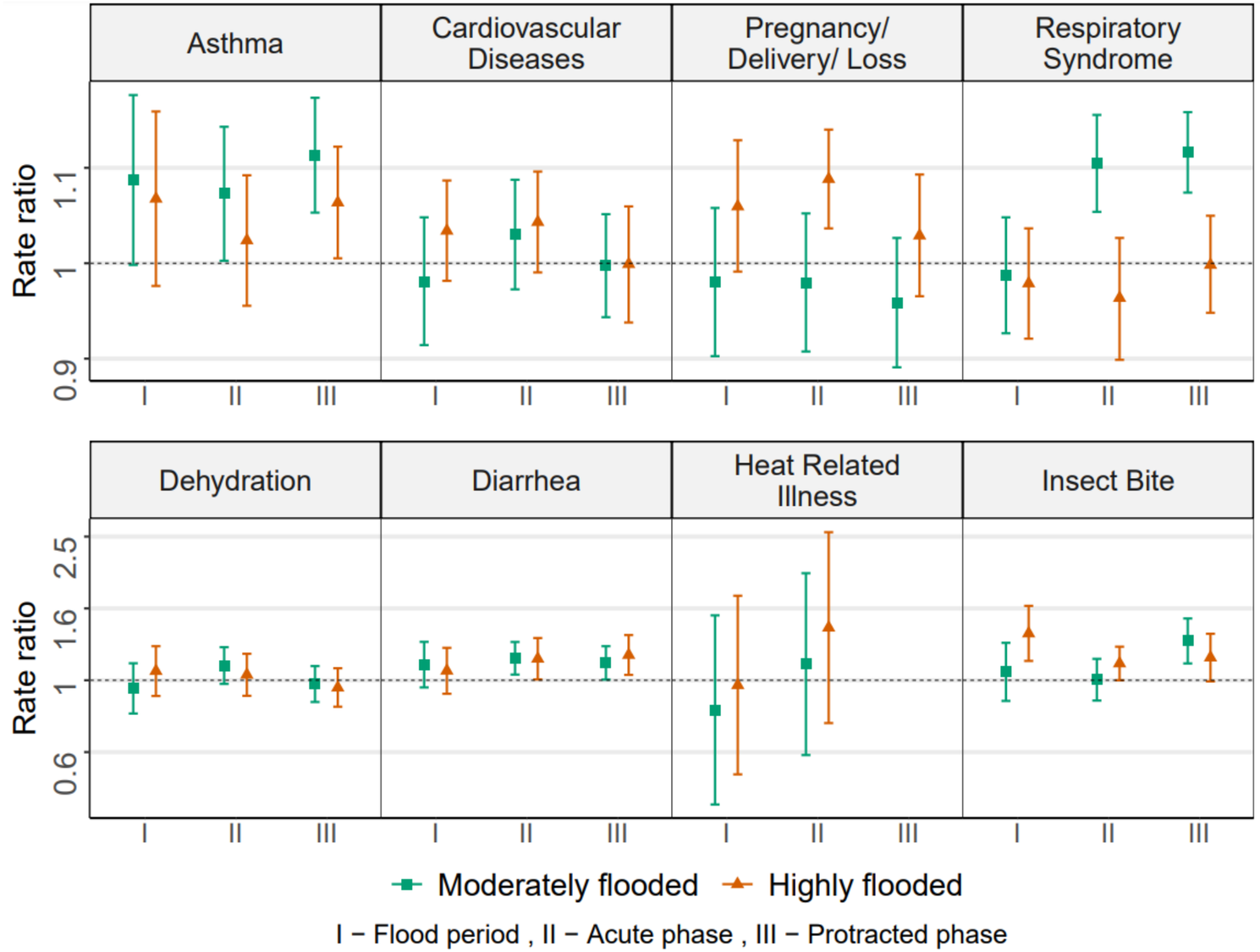


ED visits for pregnancy complications, intestinal infections, insect bites were elevated following Hurricane Harvey



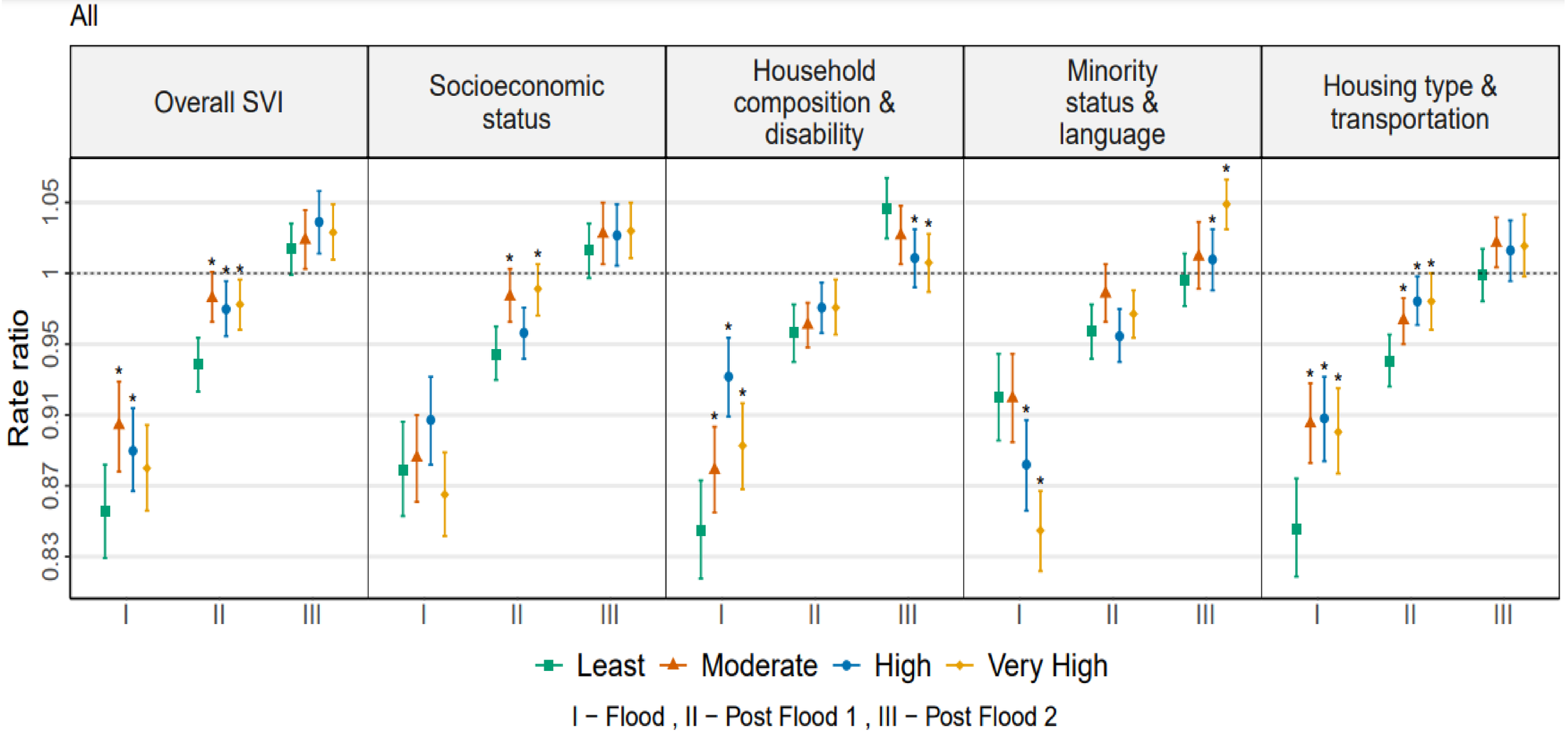
Ramesh et al. (2021) *JESEE*

Tropical Storm Imelda: similar increases in cause-specific ED visits, particularly in highly flooded ZCTAs



Ramesh et al. *Under Review*

Census tract CDC SVI modifies the effect between flooding and ED visits

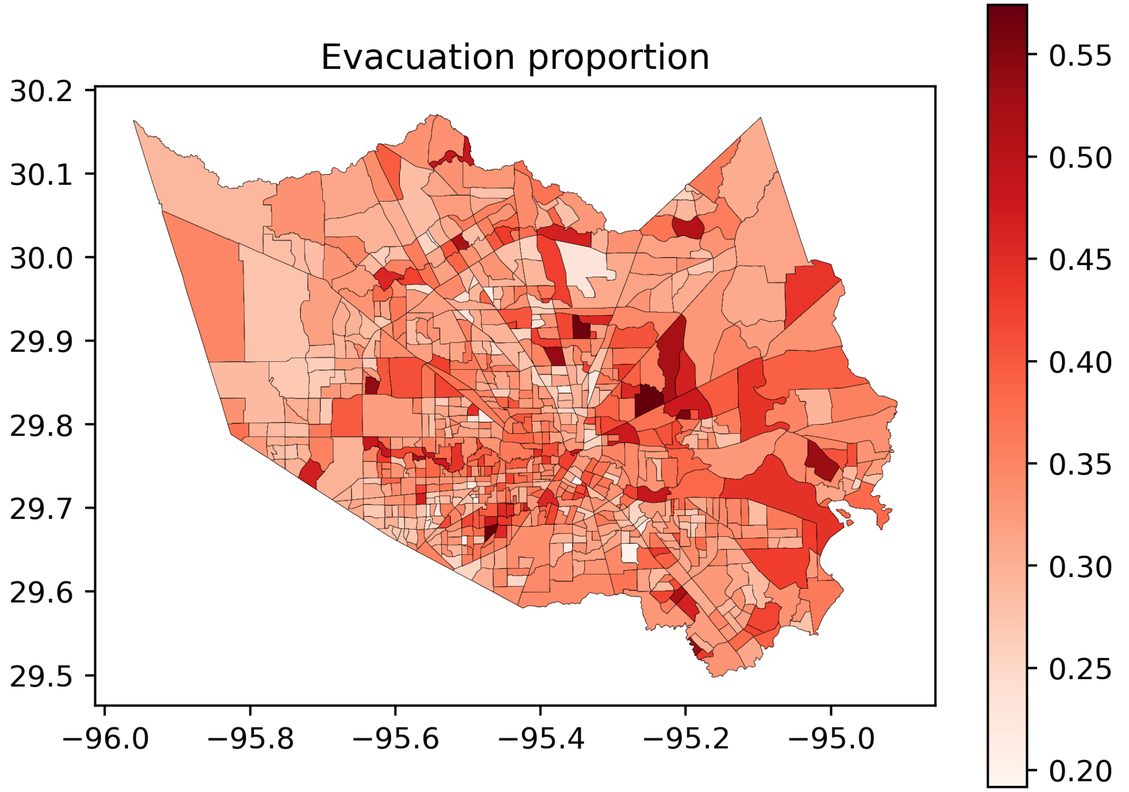


Ramesh et al. *Under Review*

In process: application of synthetic population model

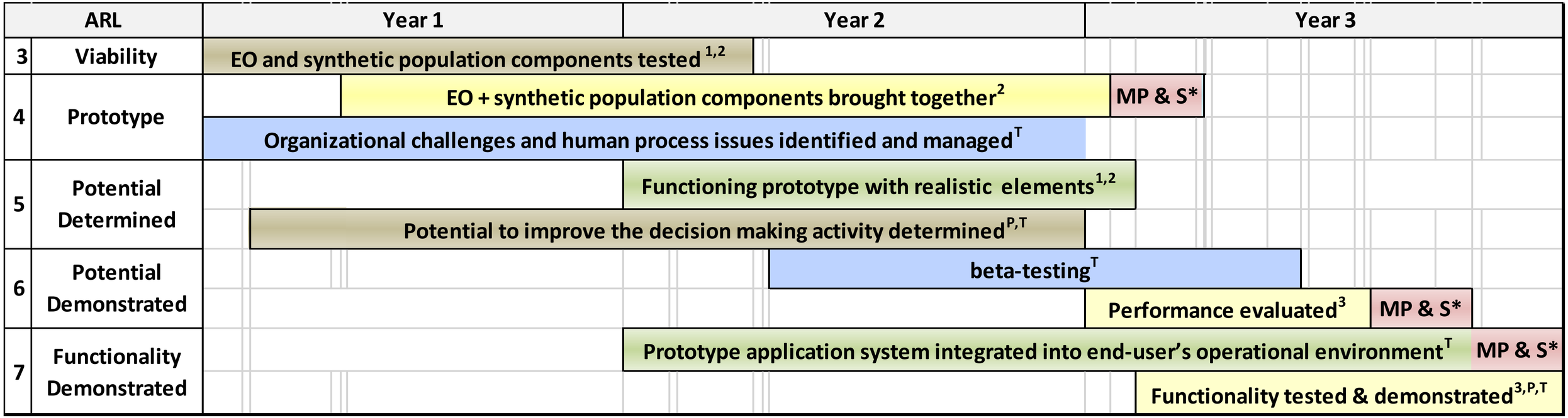
Interrupted Time Series Analysis

- Daily evacuation behavior from smartphone location data to determine when and where households evacuate from.
- Daily flood inundation data from FloodScan



*Elisa F. Long, M. Keith Chen, Ryne Rohla (2020). Political storms: Emergent partisan skepticism of hurricane risk, *Science Advances 6(37)*.

Project ARL progress



[1]Obj 1, [2]Obj 2, [3]Obj 3, [P]Performance Measures, [T]Transition Plan, *MP & S Manuscript Preparation and Submission, which includes a white paper and User's Manual as well as peer-reviewed publications.

Transition and Sustainability Plan

1. EO and synthetic population data integration into SVI workflow
2. Training workshop
3. Evaluate feasibility for integration into EH tracking and ESSENCE

Conclusions and Next Steps

EO data can be used to improve characterization of flood-related health outcomes when combined with healthcare visit data

Next steps

- Exposures beyond the home census tract or ZCTA can be modeled via a synthetic population to further refine exposures.
- Inundation data could be incorporated into real-time syndromic surveillance systems to improve situational awareness at health departments.

Project Goal and Objectives:

Enhance the CDC Social Vulnerability Index (CDC SVI) by adding exposure estimates, using Hurricane Harvey as case study:

1. Incorporating Earth Observations (EO) datasets on flooding, heat, power outages, and chemical emissions from industrial facilities.

2. Incorporating a synthetic population model of movement of people pre, during and post disaster.

3. Evaluating the utility of these enhancements through analysis of healthcare visit data collected pre, during, and post Hurricane Harvey.

Kick-off Team meeting held at CDC in Atlanta, GA on March 1st, 2019

Attendees: Upper row left to right: Elaine Hallisey (CDC), John Fleming (HHD), Barry Flanigan (CDC), Grete Wilt (CDC), Samarth Swarup (UVA), Meredith Jagger (Consultant), Anabel Carter (JHU), Ben Zaitchik (JHU), Bottom Row left to right: Suwei Wang (VT), Lauren Deanes (JHU), Molly Richardson (VT), Biru Yang (HHD), Julia Gohlke (VT) Not shown but present at meeting: Caitlin Mertzlufft (CDC), David Rickless (CDC), and Amy Wolkin (CDC)