Health Effects of Extreme Weather in California

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Research questions

Specific Aims

- Determine the health impacts of extreme weather events in California since 2000
- Examine how this evidence can inform water policy in a new climate reality

Questions

[1] Is there a negative causal effect of extreme temperatures on adult and infant health?

[2] Do the health effects of extreme temperatures fall disproportionately on poorer communities, ethnic minorities, and communities dependent on agriculture for their livelihoods?

[3] How could the health effects of extreme temperatures be mitigated by well-designed instruments of water policy?

Health Data

I. California Health Interview Surveys (CHIS)

- 2001, 2003, 2005, 2007, 2009, annually over the period, 2011-2015
- Representative sample of 350,000 adults (18+)
- Health outcomes:
    - Self-rated health (5-point Likert)
    - Psychological distress (Kessler 6)

II. Office of Statewide Health Planning and Development (OSHPD)

- State-wide vital statistics database
    - Record of every birth, newborn hospitalization, maternal antepartum and postpartum hospital visit between 1991 and 2011
- Health outcomes:
    - Infant birth weight
    - Gestation length

Climate/Weather Data

NOAA's Global Historical Climatology Network (GHCN)

- Daily maximum and minimum temperatures
- Daily precipitation totals
- 800 network stations in California from 2000-2015

Develop the daily mean temperature series of ZIP code tabulation areas

- Five nearest stations to each ZIP code
- Stations < 20 miles from ZIP code centroid

Construct respondent unique exposure to extreme temperatures and rainfall

- Geocode respondent into ZIP code
- 12 months preceding date of interview in CHIS

Estimation strategy

Fixed effects OLS

<u>Key Assumption</u>

Variation in temperature (or precipitation) at any given ZIP code from one year to the next is essentially random

Use fixed effects to absorb any unobserved correlates of weather and adult health

For respondent ***i*** in ZIP code ***z*** and year ***t***, we estimate the model:

$$
\begin{aligned}
\text{Health}_{izt} = {} & \beta_1 \text{Days with mean temperature} \geq 100^\circ \text{ F} \\
& + \beta_2 \text{Days with mean temperature of } [95, 100)^\circ \text{ F} \\
& + \beta_3 \text{Days with mean temperature of } [90, 95)^\circ \text{ F} \\
& + \ldots + \beta_{10} \text{Days with mean temperature} < 30^\circ \text{ F} \\
& + \sum_{j=2}^{6} \gamma_j \text{ Precipitation rangej} \\
& + \alpha_z + \alpha_t + \delta X_{izt} + \varepsilon_{izt}
\end{aligned}
$$

Preliminary Results

Effects on Self-rated Health

Dependent variable: self-rated wellbeing {1 = fair/poor} {0 = good/very good/excellent}

- Extreme temperatures: statistically significant positive effect
    - An additional ten days with mean temperature of 100° F rather than moderate temperatures (50-60° F) increased fraction of adults rating own health as poor by 2.2 percent
    - One-fifth of our sample of 350,000 adults rated their health fair/poor
    - 2.2% effect = approx. 760,000 adults given current population
- Precipitation: so far, we perceive no effect

Preliminary Results

Effects on Adult Distress

Dependent variable: distress score (N = 250,000 adults)

- Extreme temperatures: no statistically significant effect detected yet
- Precipitation: a small, weakly significant positive effect
    - An additional wet month increased average distress relative to a dry month

We are still investigating the extreme weather effects on adult distress

We expect the relationships might be stronger, more negative in San Joaquin Valley

Conclusion

Research ongoing

Health consequences of climate change are vastly overlooked in California

Need systematic evidence

Exploring heterogeneity in impacts by

- Location – ag communities, beach communities, mountain communities
- Age groups – children v. adults, working age v. retirees
- Minorities
- Socioeconomic status

Comments / Feedback?