



USC University of
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Understanding mobility change in response to COVID-19: A Los Angeles Case Study

PSR Speaker Series
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Background

- COVID-19 pandemic
 - Global pandemic
 - As of Mar 24, 2021, more than 124 million cases and 2.74 million deaths globally
 - About 25% of cases and 20% of deaths in U.S.
- Non-pharmaceutical interventions
 - Social distancing
 - Wear mask/face covering
 - Non-essential business closure
 - Shelter-in-place order/lockdown
- Higher risk for disadvantaged population
 - More than 75% of COVID-19 cases were from the poorest neighborhoods in LA County
 - 58.1% of COVID-19 cases are Hispanics, only 12.2% are whites

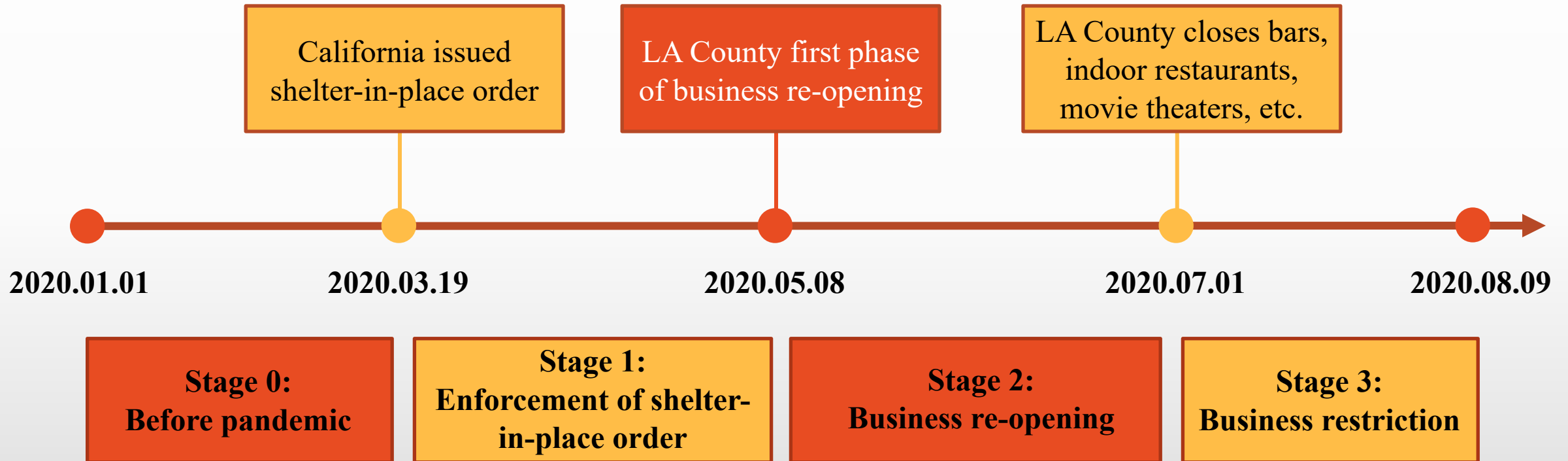
Research Questions

- How does COVID-19 affect people's travel behavior?
- Do different population groups respond differently to COVID-19?
- Do different population groups respond differently to policy restrictions on mobility?



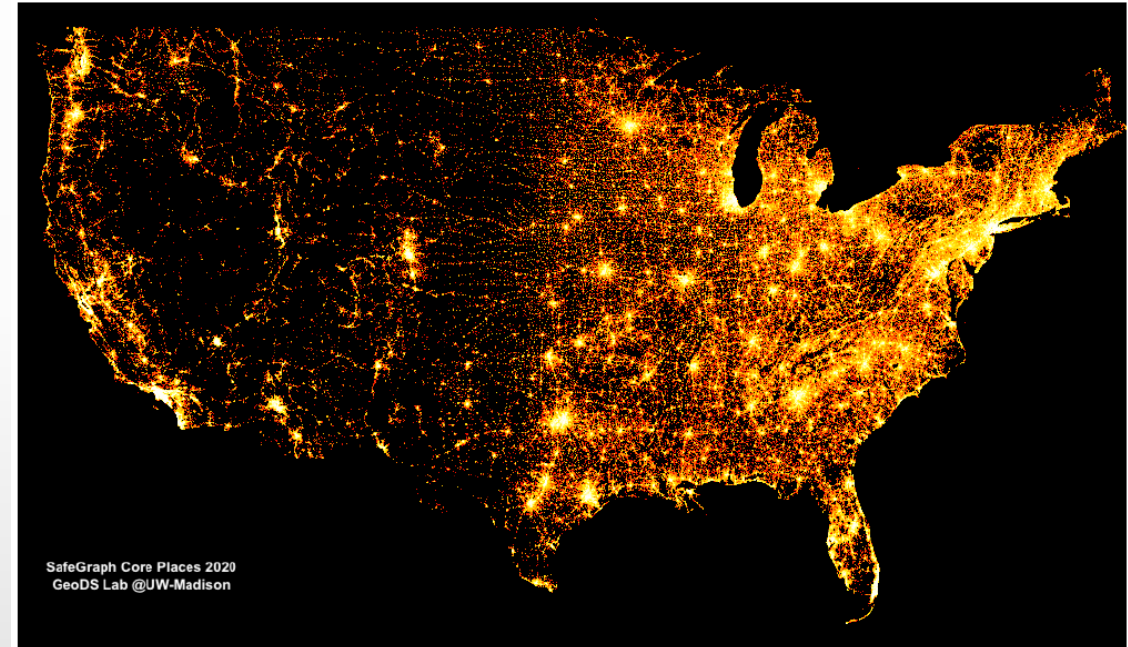
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Study Period



Mobility Data

- Mobile phone data—SafeGraph¹
 - Measure foot traffic patterns to various points of interest (POIs) based on GPS location from apps on mobile phone
 - More than 850,000 devices (~8.5% of population) in LA County
 - Anonymous and aggregated data at Census Block Group (CBG) level



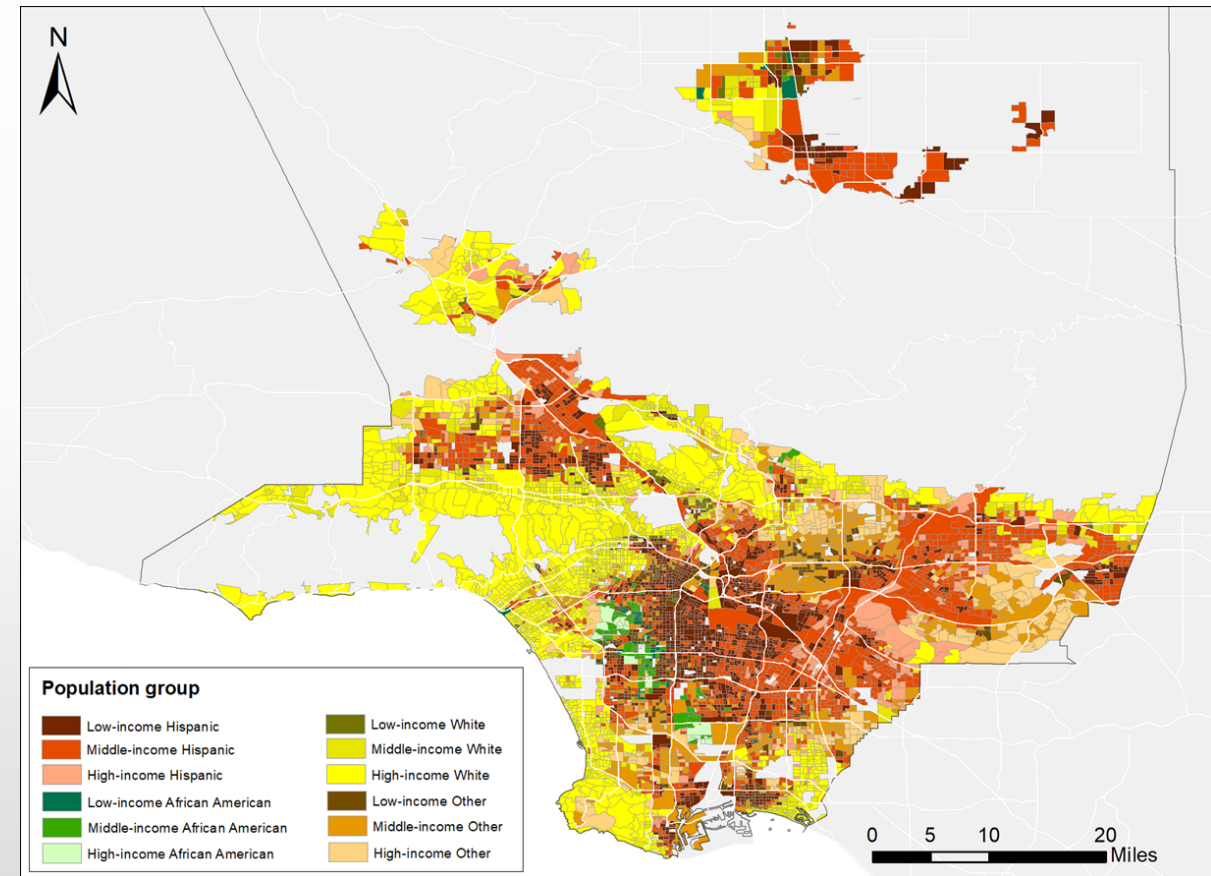
Spatial density distribution of over 3.6 million SafeGraph POIs

Other Data

- Demographics from American Community Survey (ACS) (2014–2018)
 - Ethnicity
 - Income
 - Education status
- Other data
 - Access to Internet and computer—from the University of Southern California Neighborhood Data for Social Change (NDSC)
 - Weather condition (temperature, precipitation)—from the Global Historical Climatology Network (GHCN)
 - COVID cases—Los Angeles Times

Method

- Various population groups
 - High-, middle-, low-income
 - Quartiles of median household income of each CBG
 - White, Hispanic, African American, Other (e.g., Asian, Native American)
 - Proportion in each CBG
 - Twelve population groups
 - Low-income Hispanic
 - Middle-income Hispanic
 - High-income Hispanic
 - Low-income African American
 - Middle-income African American
 - High-income African American
 - Low-income White
 - Middle-income White
 - High-income White
 - Low-income Other
 - Middle-income Other
 - High-income Other

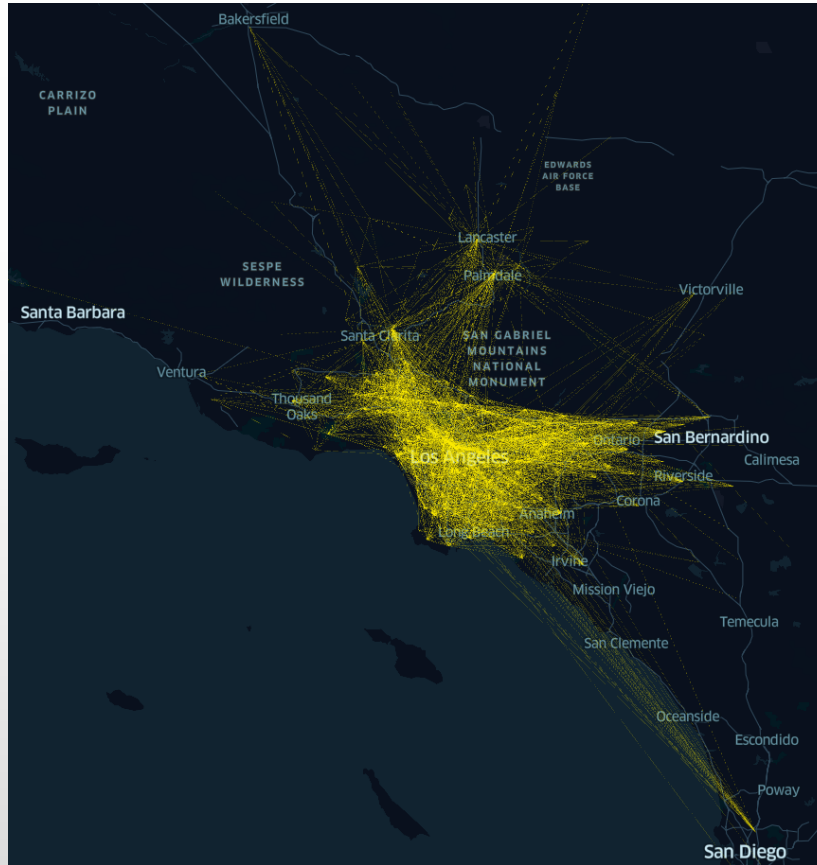


Method

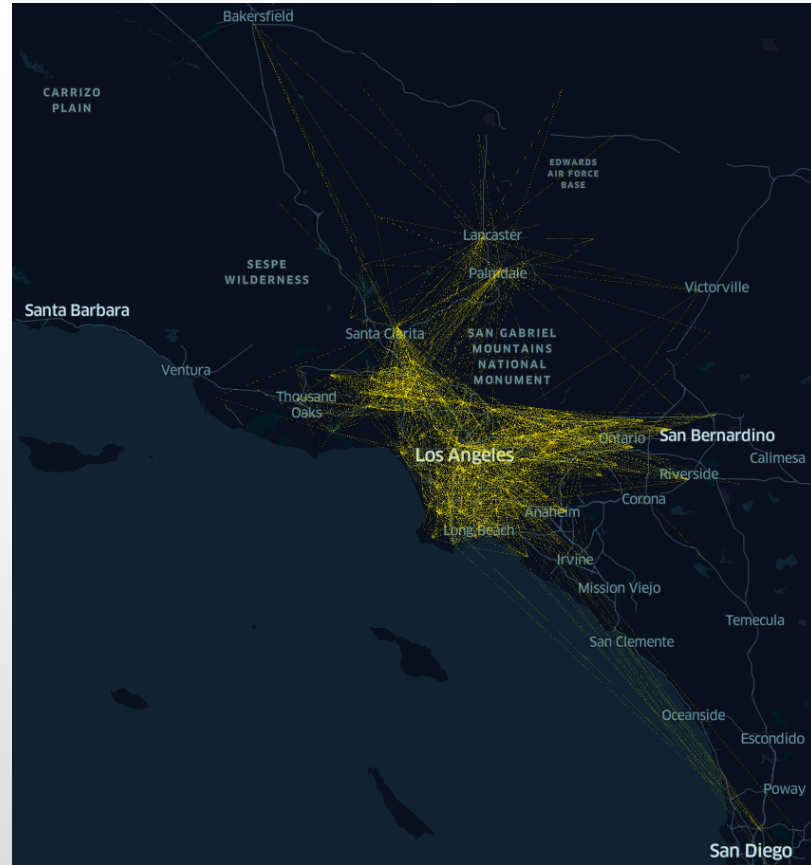
- Difference-In-Difference (DID) regression model
 - Evaluate the impact of various policies on mobility change among different population groups
 - Compare changes in mobility across four different time periods and twelve groups
 - Base time period = before pandemic
 - Base population group = low-income White
 - Mobility measurements
 - CBG visited per device
 - Proportion of devices that remain at home

Mobility change during pandemic

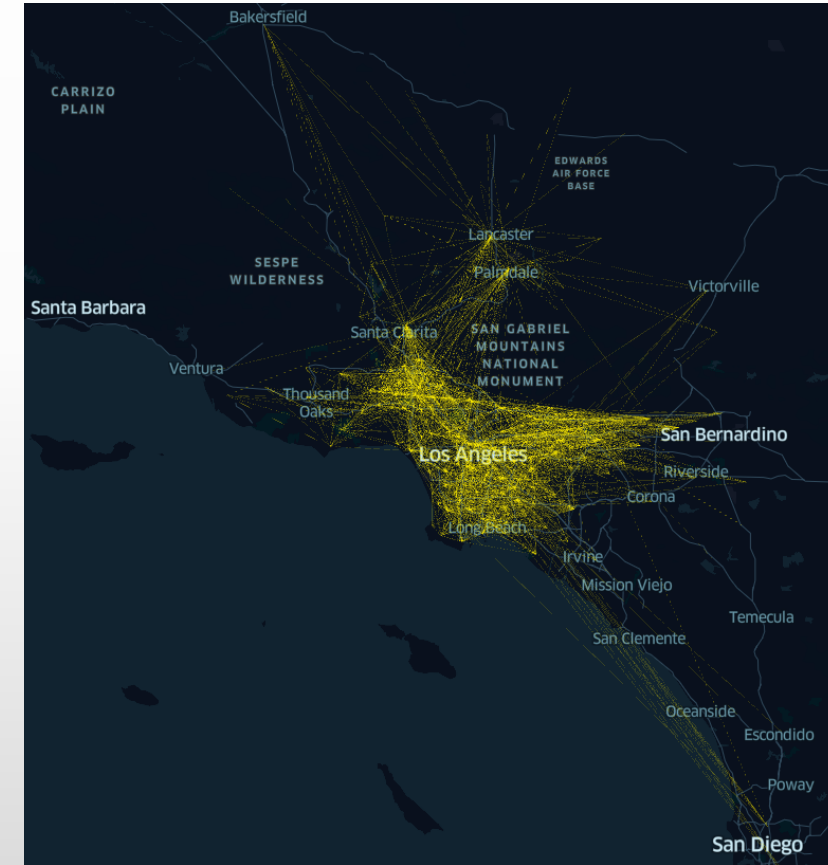
Pre-pandemic (before Mar 19)



Shelter-in-place (Mar 19-May 7)

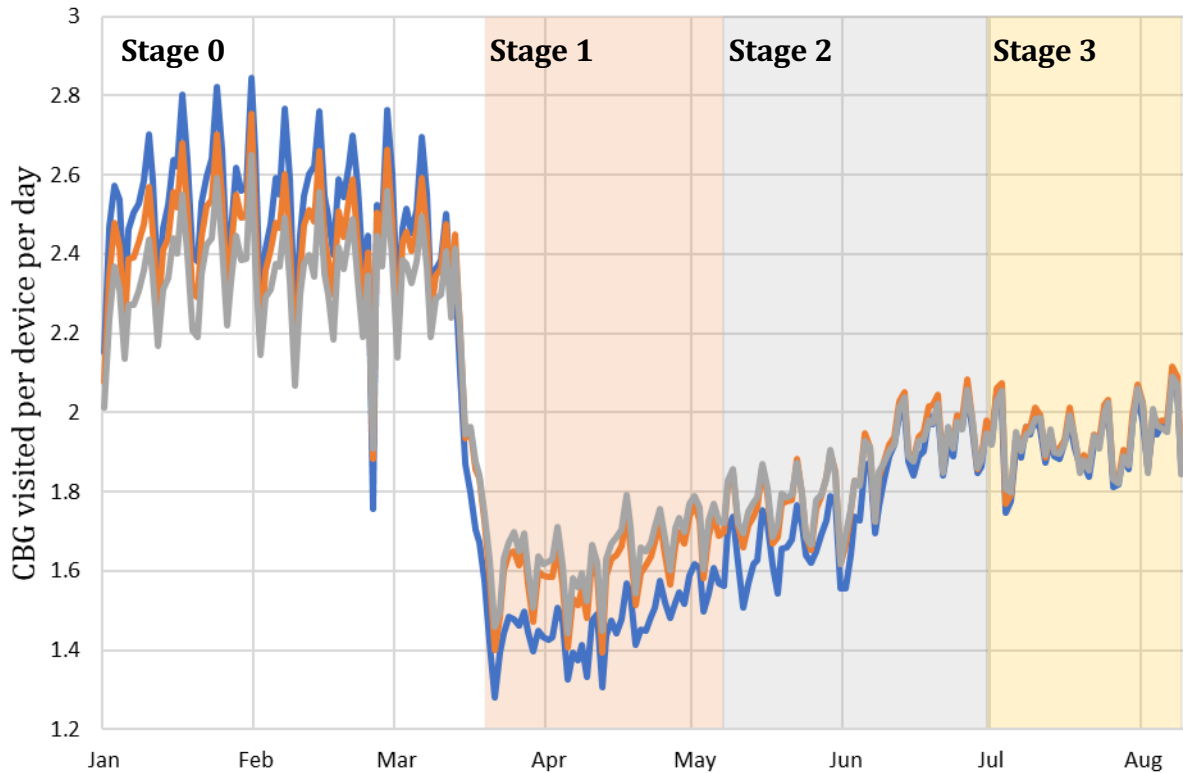


Business reopening (After May 7)

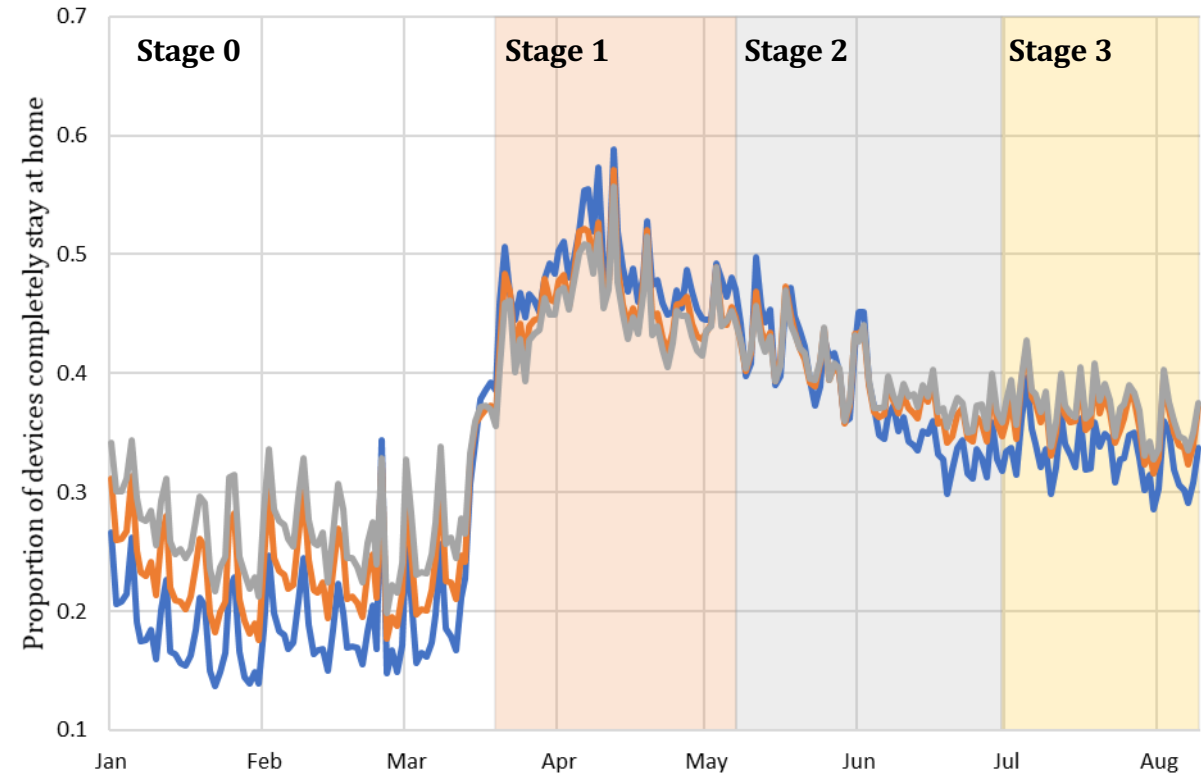


Mobility response varies by income level

Number of census blocks visited



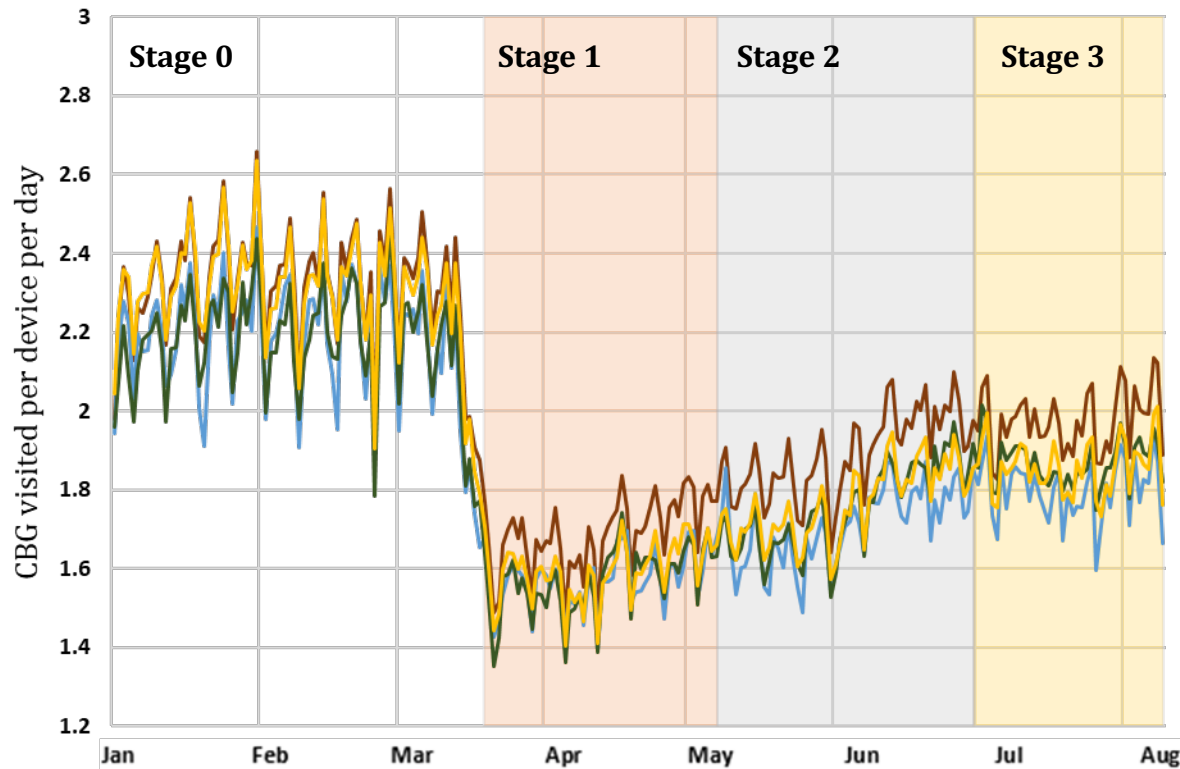
Share of devices at home CBG



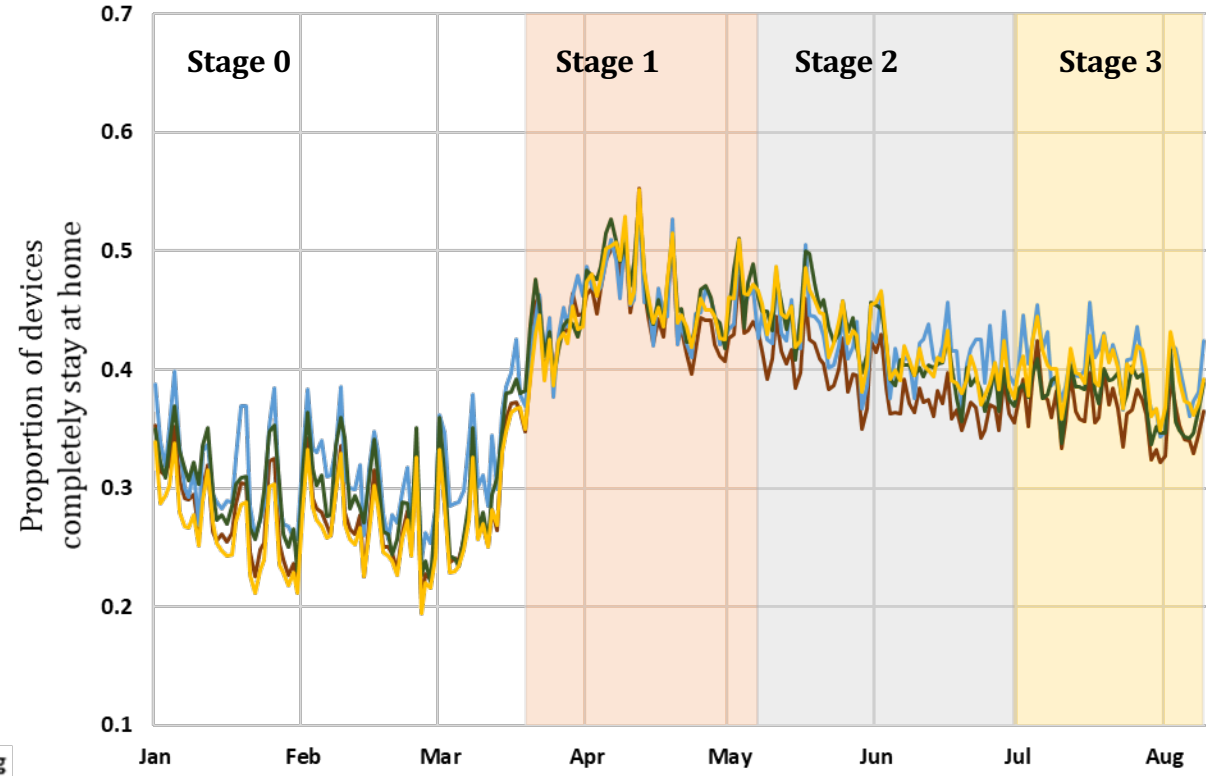
— High-income — Middle-income — Low-income

Mobility response varies by race/ethnicity, low income example

Number of census blocks visited



Share of devices at home CBG



— Hispanic — African American — White — Other

Findings

Response to gov't orders

- **Shelter in place:**
 - Mobility down 41%.
 - Stay at home up 63%.
- **Business re-opening:**
 - Mobility up 8%.
 - Stay at home down 12%.
- Thereafter, steady increase in mobility.
- Second period of restriction has no effect.

Variation across income

- **Shelter in place:**
 - High income decreased travel more.
 - Low income decreased travel less, from a lower base.
- **Business re-opening:**
 - High income increased travel more, low income increased travel less.

Variation across race/ethnicity

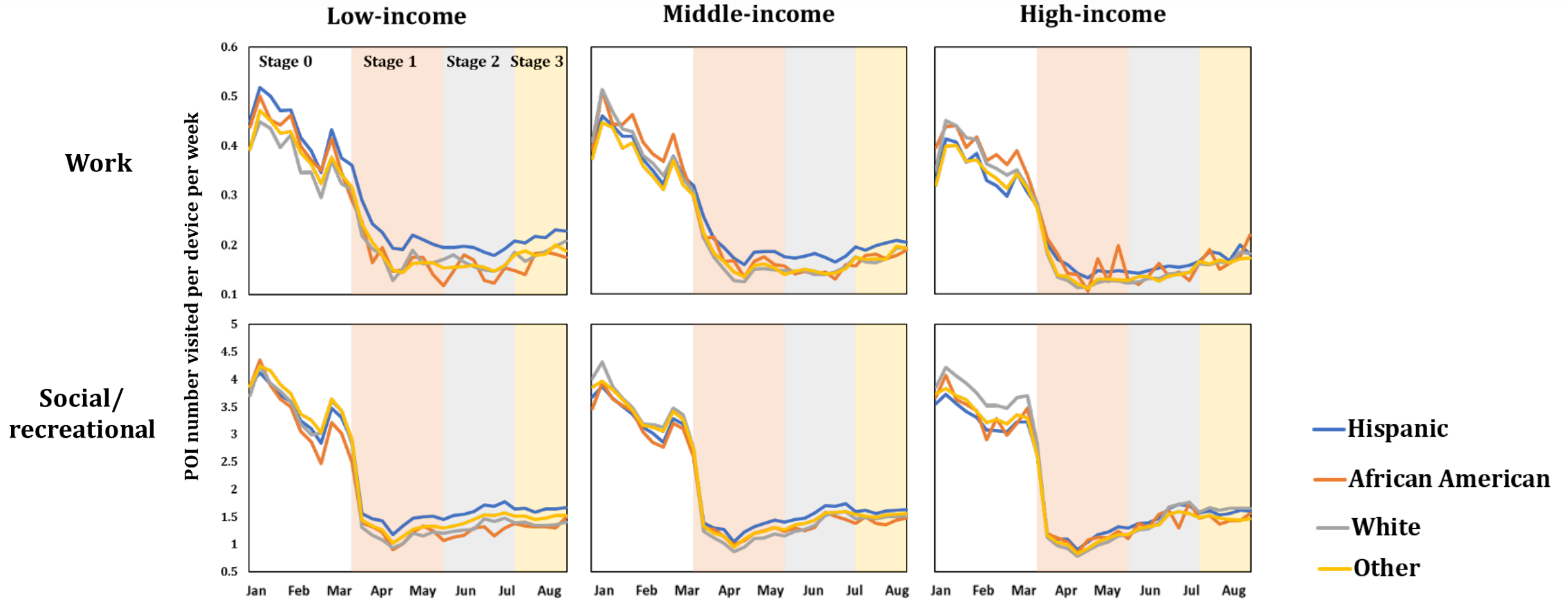
- **Shelter in place:**
 - Whites more responsive
 - Ethnic minorities less responsive.
- **Business re-opening:**
 - Whites more responsive.
 - Ethnic minorities less responsive.

COVID case rate seems to have no effect after the early period

Generating travel by purpose

Category	Sub-category ¹	Trip Purpose Categories
Discretionary Trip	Shopping	Buy goods (e.g., groceries, clothes, appliances, or gas)
	Family/personal business	<ul style="list-style-type: none"> • Volunteer activities (not paid) • Drop off/pick up someone • Attend adult care • Buy services (e.g., dry cleaners, service a car, or pet care) • Other general errands (e.g., post office or library)
	Social/recreational	<ul style="list-style-type: none"> • Perform recreational activities (e.g., visit parks, movies, bars, or museums) • Exercise (e.g., go for a jog, walk, walk the dog, or go to the gym) • Buy meals (e.g., go out for a meal, snack, or carry-out)
	Medical/dental	Make a health care visit (e.g., medical, dental, or therapy)
Non-discretionary Trip	Work	Trips undertaken for work or business purposes

Mobility change by trip purpose



Findings

Response to gov't orders

- **Shelter in place:**
 - Social/recreational and shopping trips down 110% and 94%.
 - Work trips down 100%.
- **Business re-opening:**
 - Social/recreational and shopping trips up 13% and 8%.
 - Work trips down 7%.
- **Business restriction:**
 - Social/recreational and shopping trips down 12% and 18%.
 - Work trips up 9%.

Variation across income

- **Shelter in place:**
 - High income decreased travel more for both work and discretionary trips.
 - Low income decreased travel less.
- **Business re-opening:**
 - Low-income increased travel less for work trips than middle- and high-income.
 - High income increased travel more for discretionary trips, low income increased travel less.
- **Same trend found in business restriction phase.**

Variation across race/ethnicity

- **Shelter in place:**
 - Whites and others more responsive.
 - Hispanics and African Americans less responsive.
- **Business re-opening:**
 - Hispanics and African Americans increased travel more for work trips.
 - Whites and other more responsive to discretionary trips.
 - Hispanics and African Americans less responsive to discretionary trips.
- **Same trend found in business restriction phase.**

Conclusions

- Shelter-in-place order was effective in reducing travel.
- Low-income and ethnic minority groups were more likely to leave home during pandemic both for work trips and discretionary trips.
 - Less ability to work from home.
 - Lack access to Internet and digital resources.
 - Most work at essential business (e.g. grocery stores) or business requires in-person service (e.g. restaurant).
 - Less capacity to purchase services (e.g. deliveries and in-home childcare).
- Policymakers should provide more support to low-income and ethnic minority populations.

Next steps

- Extend the time series to capture responses after August 2020
 - Impacts of holidays
 - The winter surge
- Consider implications of reduced mobility on social interactions
 - Does reduced mobility imply reduced daily interactions between different socio-economic groups?
 - Did COVID reinforce spatial segmentation?

THANK YOU

CORONAVIRUS

Globally

TOTAL CASES	DEATHS
2,134,465	142,148

IN THE UNITED STATES

TOTAL CASES	DEATHS
654,301	31,628

SOURCE: JOHNS HOPKINS UNIVERSITY

SOON

WHITE HOUSE
CORONAVIRUS BRIEFING

TONIGHT ON CNN

CORONAVIRUS
FACTS AND FEARS

8P
ET

CORONAVIRUS PANDEMIC

WHAT THE "NEW NORMAL" IN THE U.S. MAY LOOK LIKE

LIVE



2:34 PM PT

RS THIS AFTERNOON, BUT SAID IT IS UP TO THEM TO DECIDE INDIVIDUALLY | SITUATION ROOM