Coronavirus outbreaks



SOURCE: Johns Hopkins University

Outline

- Mobility data: representativeness and meaning
- Testing data: biases in confirmed case reports
- Assessing timing of policies versus epidemiology: accounting for nonlinear dynamics

COVID19 Mobility Data Network:

- ~50 researchers internationally
- DUAs with Facebook, Camber Systems (incl unacast etc), Cuebiq
- Direct 1:1 connections between network members and local/state policy makers to guide response
- Standardized analyses across locations and data platforms



← → C 🌲 covid19mobility.org

COVID-19 Mobility Data Network Visualization Tools Resources About Partners Contact CCDD Member Login

COVID-19 Mobility Data Network

We are a network of infectious disease epidemiologists at universities around the world working with technology companies to use aggregated mobility data to support the COVID-19 response. Our goal is to provide daily updates to decision-makers at the state and local levels on how well social distancing interventions are working, using anonymized, aggregated data sets from mobile devices, along with analytic support for interpretation.

🖂 Contact Us

Covid19mobility.org

(Fig. 1 – **Countries** currently receiving support from the COVID-19 Mobility Data Network include: United States, Mexico, Peru, Chile, United Kingdom, Spain, Italy and India. **States** within the US include: New York, Massachusetts, Florida, Illinois, Michigan, Missouri, Louisiana, Texas, Colorado, Washington, and California. **Cities** within the US include: Boston, Cambridge, New York, Syracuse, Miami, Detroit, Chicago, New Orleans, Houston, Denver, Seattle, Santa Clara, San Jose and Los Angeles)



EDITORIAL

Mobile phone data for informing public health actions across the COVID-19 pandemic life cycle

Nuria Oliver^{1,2}, Bruno Lepri^{2,3}, Harald Sterly⁴, Renaud Lambiotte^{5,6}, Sébastien Delataille⁷, Marco De Nadai³, Emmanuel Leto... + See all authors and affiliations

Science Advances 27 Apr 2020: eabc0764 DOI: 10.1126/sciadv.abc0764



with Nishant Kishore, Mathew Kiang, Navin Vembar





U.S. county-level characteristics to inform equitable COVID-19 response

Daylor Chin,
Rebecca Kahn,
Ruoran Li, Jarvis T. Chen,
Nancy Krieger,
Caroline O. Buckee,
Satchit Balsari,

D Mathew V. Kiang

doi: https://doi.org/10.1101/2020.04.08.20058248



Data from Facebook, graphs by Nishant Kishore



Kaashok & Santillana <u>http://dx.doi.org/10.2139/ssrn.3574849</u>



Linear Regression

y = ax + b

Advantage: simple interpretation of *a*

Drawback: does not fit these data

Can we transform the variables?

Quadratic Regression

 $y = ax^2 + bx + c$

Advantage: fits the data better

Drawback: cannot interpret a and b

"SIR" Regression

$$y = f(\beta, v)$$

Advantage: fits the data well

Advantage: can interpret β and v



Collaboration with Nishant Kishore (HSPH), Nick Menzies (HSPH), Ted Cohen (Yale), Aimee Taylor (HSPH), Pierre Jacob (Harvard)



Bayesian nowcasting with adjustment for delayed and incomplete reporting to estimate COVID-19 infections in the United States

Melanie H Chitwood, Marcus Russi, Kenneth Gunasekera, Joshua Havumaki, Virginia E. Pitzer, Joshua L Warren, Daniel Weinberger, Ted Cohen, Nicolas A Menzies medRxiv 2020.06.17.20133983; doi: https://doi.org/10.1101/2020.06.17.20133983



Fresno County, California - Day 0: Mar 07, 2020

Collaboration with Nishant Kishore (HSPH), Nick Menzies (HSPH), Ted Cohen (Yale), Aimee Taylor (HSPH), Pierre Jacob (Harvard)

Washington Kansas Michigan Rhode Island Nevada Illinois Vermont Mississippi Tennessee Oregon Minnesota DC Florida Hawaii Missouri California New Mexico New Hampshire North Carolina Maine Connecticut Colorado Virginia Pennsylvania Alabama New York Wisconsin Arizona Delware T Kentucky Montana 3/18 3/19 3/20 3/21 3/22 3/23 3/24 3/25 3/26 3/27 3/28 3/29 3/30 3/31 4/1 4/2 4/3 4/4 4/5 4/6 Idaho Texas Louisiana Indiana Maryland Georgia Massachusetts New Jersey Alaska Ohio West Virginia SOURCE: KFF, State Data and Policy Actions to Address Coronavirus, https://www.kff.org/health-costs/issue-brief/state-data-and-policy-actions-to-addresscoronavirus/#note-3-10 and state government websites. HENRY J KAISER FAMILY FOUNDATION State of emergency declared, March 13

State Mandated Stay-At-Home Orders by Date of Implementation

NBA cancels season, March 11



Social Distancing is Effective at Mitigating COVID-19 Transmission in the United States Hamada Badr, Hongru Du, Max Marshall, Ensheng Dong, Marietta Squire, Lauren Marie Gardner medRxiv 2020.05.07.20092353; doi: https://doi.org/10.1101/2020.05.07.20092353



Collaboration with Nishant Kishore (HSPH), Nick Menzies (HSPH), Ted Cohen (Yale), Aimee Taylor (HSPH), Pierre Jacob (Harvard)

New reported cases by day in Texas



New reported cases by day in New York





40 Estimated prevalence (%) 10 70 40 50 60 Percent decline in commuting movements

Reductions in commuting mobility predict geographic differences in SARS-CoV-2 prevalence in New York City

Stephen M. Kissler^{1*}, Nishant Kishore^{2*}, Malavika Prabhu^{4*}, Dena Goffman^{5*}, Yaakov Beilin^{8,9*}, Ruth Landau⁶, Cynthia Gyamfi-Bannerman⁵, Brian T. Bateman⁷, Daniel Katz^{8,9}, Jonathan Gal⁸, Angela Bianco⁹, Joanne Stone⁹, Daniel Larremore³, Caroline O. Buckee², Yonatan H. Grad¹

Conclusions

- Consistency in finding that messaging and orders unlikely to have been driving factor in behavior change
- Lockdowns *were* highly effective at reducing growth rate of epidemics
- Nonlinearities and variable timing intrinsic to epidemic dynamics important
- Testing and mobility data both have limitations, not necessarily appropriate to use them quantitatively as indicators
- We are very far from herd immunity. This is going to be a long haul.