An Academic Medical Center’s Data Science Response to a Pandemic

This is a team effort across 60+ colleagues and *multiple* departments at Stanford

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Example information needs

• Operational planning
  • How many patients do we expect in our region?
  • How many floor beds, ICU beds do we need to have ready?
  • How long will our PPE supply last?

• Clinical care decisions
  • Given limited testing, who do we test?
  • Can presenting symptoms help us screen better?
  • Do patients with other viral co-infections need more aggressive care?

• Broader research questions
  • What are the effects of ACE2-altering drugs on clinical outcomes for COVID19 patients?
  • What are the characteristics of COVID-19 patients nationwide?
Responding to the information needs

Regional
• County Public Health Dept
• Census age breakdown

Institutional
• SARS-CoV-2 testing, ADT
• De-identified research data

Growth rate
Disease burden

Test positive rate
Admission rate

Clinical insights
• 9% co-infection rate with other respiratory viruses

Three Models
1. Hospital bed and resource use
2. Project county hospitalizations
3. Estimate policy impacts

Response plan
• Surge planning
• PPE usage

Partner with County
“Can we think of the County as one large hospital?”

Ian Brown, David Kim, Benjamin Pinsky, James Quinn
There are two kinds of models

- **SEIR simulations that capture the dynamics of an epidemic**
  - These models tell us the impact of policy interventions
  - These need 10-12 diverse inputs, which are all guesses at moment

- **Simple calculators that tell us about the next few days**
  - These take very few inputs: cases, hospitalizations, bed capacity
  - It hard to get reliable counts of these simple inputs
There are many SEIR simulators: we need accurate inputs

By Gabriel Goh @ Open AI
http://gabgoh.github.io/COVID/index.html

Quote from fivethirtyeight.com

Think of it like making a pie. If you have a normal recipe, you can do it pretty easily and expect a predictable result that makes sense. But if the recipe contains instructions like “add three to 15 chopped apples, or steaks, or brussels sprouts, depending on what you have on hand” … well, that’s going to affect how tasty this pie is, isn’t it?
Focus on getting the right inputs

- Growth rate
- Disease burden
Our suggestion: Use hospitalization data

- Use hospitalization data from your local region for Health system capacity planning

- Remember the 12-14 days lag between interventions and “peak demand” for hospitalization
  - Day-to-day variation in case rates can mislead
  - At a growth rate of 15%, peak demand will be 5x-6x times higher than it is when you intervened

https://tinyurl.com/SARS-COV-2-SCC
Stanford Medicine Calculators

Hospital bed and resource use projections

Teng Zhang, Kelly McFarlane, Jacqueline Vallon, Linying Yang, Jin Xie, Jose Blanchet, Peter Glynn, Kristan Staudenmayer, Kevin Schulman, David Scheinker

County hospitalization projections

Johannes Ferstad, Angela Gu, Raymond Lee, Isha Thapa, Alejandro Martinez, Andy Shin, Joshua Salomon, Peter Glynn, Nigam Shah, Arnold Milstein, Kevin Schulman, David Scheinker

https://surf.stanford.edu/covid-19-tools/
Population insights

Stanford Coronavirus Study

We are a group of Stanford University researchers studying the impact of COVID-19 on our communities. You are invited to take this 5-minute survey to help us track the impact of the virus and understand the actions individuals and households are taking in response to the epidemic. You must be 18 years of age or older to take this survey.

This research is conducted in collaboration with the Stanford Department of Epidemiology & Population Health, Stanford Department of Dermatology and the Center for Population Health Sciences.

https://pcrt.stanford.edu/covid

Eleni Linos, Julia Simard

Rusty Hofmann, Steve Goodman

COVID Counter
Stanford Data Science researchers *may* be able to help answer them.

www.tinyurl.com/sm-covid-query

MD students: Jonathan Lu, Marcello Chang + CI Fellows: Birju Patel, Keith Morse