Modeling Surge Demand for COVID-19

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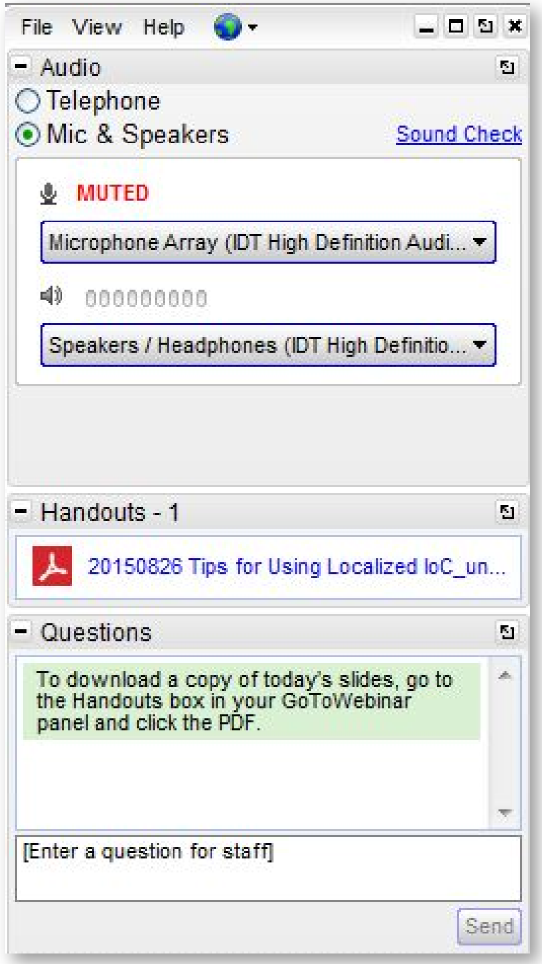
Webinar Housekeeping



YOUR PARTICIPATION

- All participants' phone lines are muted.
- Submit questions and comments via the Questions box.
- Please complete the survey following today's session.
- Today's presentation is being recorded and will be posted to Sg2.com within 24 hours.

> We're sort of planning for what's going on right now, and we're trying to make up for lost time, but I'm not sure we're planning for a month from now, or even two weeks from now.

—Christopher M Tedeschi, MD
Emergency Physician and Assistant Professor, Columbia University Medical Center

Source: Goldstein J and Rosenthal BM. Coronavirus in NY: will a surge in patients overwhelm hospitals? *The New York Times*. March 14, 2020.

Sg2 COVID-19 Surge Demand Model
BETA DESIGN

What does the calculator do?

The calculator provides a data-driven scenario planning tool for COVID-19 hospital bed, ICU and ventilator demand.

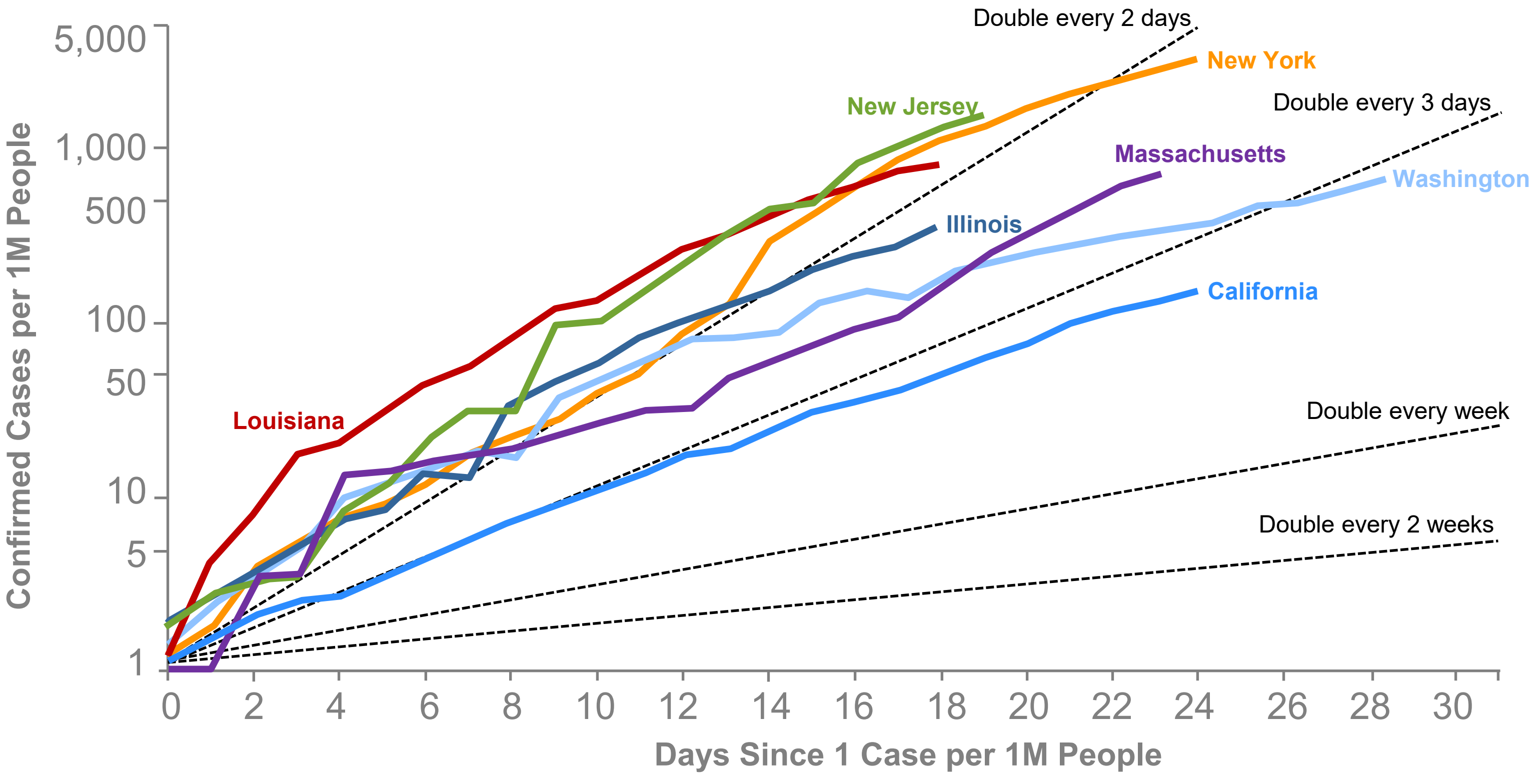
How does it do this?

1. It applies aggressive, moderate and mild scenarios of disease spread to a local population based on current international COVID-19 data and SIR modeling.
2. It applies age-adjusted COVID-19 hospital admission, ICU and ventilator rates to scenarios of local infection, and it calculates projections of hospital-specific non-ICU, ICU and ventilator demand.
3. It compares this projected demand over time to existing capacity.

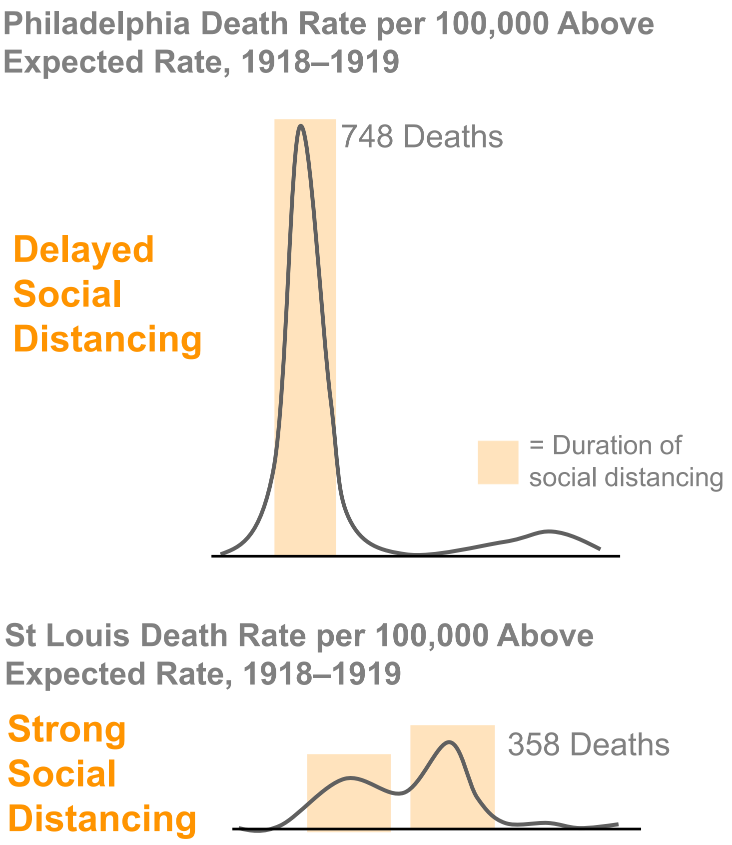
COVID-19 = coronavirus disease 2019; SIR = susceptible-infected-recovered.

Why Scenario Modeling Is Important: Early Data Point to Varying COVID-19 Impact Across US

COVID-19 Cases by Select US States, Normalized by Population



Comparison to 1918 Flu Pandemic

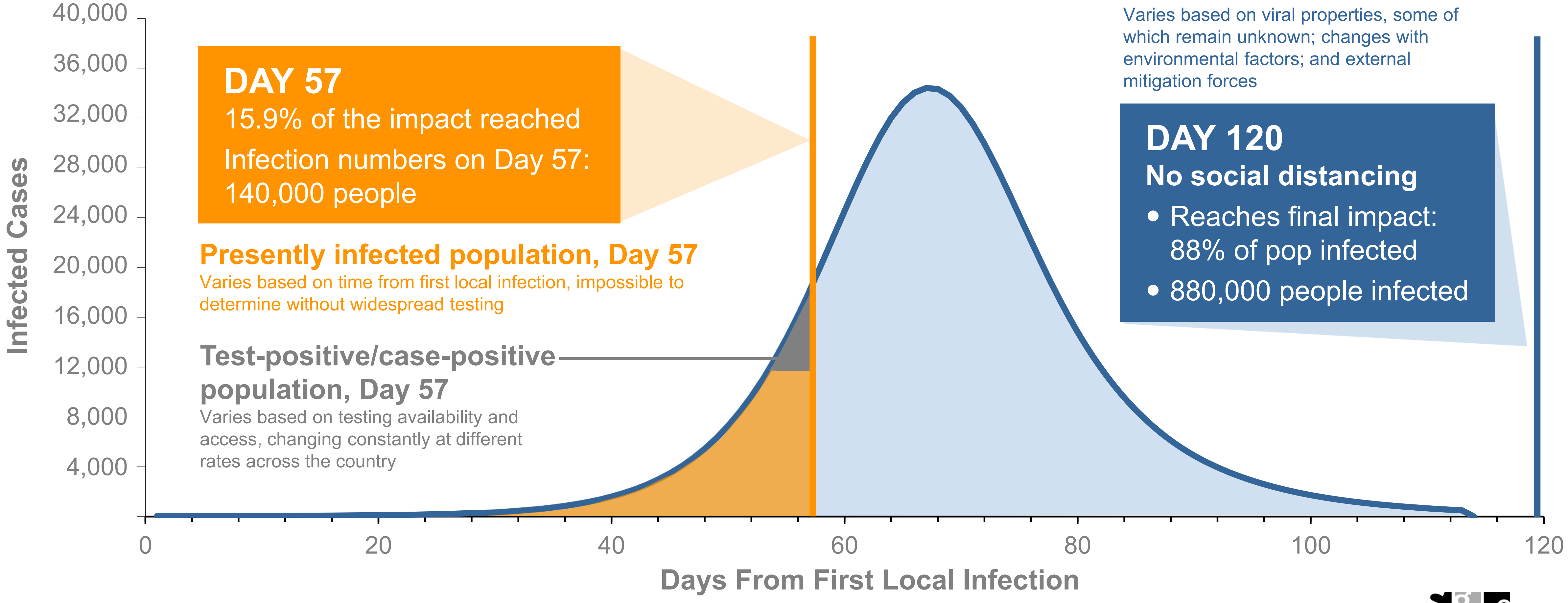


Sources: Data from 91-DIVOC #01 - COVID-19 Dataset website; Strochlic N and Champine RD. How some cities 'flattened the curve' during the 1918 flu pandemic. *National Geographic*. March 27, 2020.

COVID-19: Planning in a World of Unknowns

Scenario Illustration: Sample Population of 1 Million

R0 = 2.4 (88% total population infected)



Sg2 COVID-19 Surge Demand Calculator
KEY UNKNOWNS AND LEARNINGS

Aggressive, Moderate and Mild Scenarios of Disease Spread

Using infection rates modeled with varying R0 values to simulate impact of varied testing, practice patterns and policies

COVID-19 Known Data Points

5-day pre-infection period, 8-day infectious period

	EARLY PANDEMIC SCENARIO	MILD SOCIAL DISTANCING SCENARIO	MODERATE SOCIAL DISTANCE SCENARIO	SAMPLE MITIGATION SCENARIO
R Value	R 2.4	R 2.0	R 1.53	R 1.3
What Does This Look Like in a Population?	Uncontained COVID-19 spread	Estimated COVID-19 spread influenced by school closures, large event cancellations	Estimated COVID-19 spread influenced by voluntary social distancing	Reference scenario modeled on benchmark reproductive rate data for successful disease mitigation
Total Population Infection Rate	~90%	~80%	~60%	~40%
Reference Point	Wuhan, China; early outbreak	Estimated	Estimated	Published data, seasonal flu

Note: R = reproduction number, a mathematical term that indicates how contagious an infectious disease is (R0 or R naught). Reductions in R values are not projected to be as significant as observed in Wuhan, China, because of US delay in strict community quarantine and lack of testing availability.

Sg2 COVID-19 Surge Demand Calculator
KEY UNKNOWN AND LEARNINGS (Cont'd)

Age-Adjusted Hospital Admission Rates

COVID-19 Known Data Points

- Most published data use positive case-based hospitalization rates vs population-based hospitalization rates—***these are not interchangeable!***

Methods
"We extracted data regarding 1099 patients with laboratory-confirmed Covid-19 from 552 hospitals…primary composite end point was admission to an intensive care unit (ICU)…."

Results
"The primary composite end point occurred in 67 patients (6.1%), including 5% who were admitted to the ICU…."

- Created population-based non-ICU and ICU hospitalization rates based on published:
  a) Age-adjusted case-based hospitalization data.
  b) Age-adjusted case-based critical care rates.

Age Group (years)	% Symptomatic cases requiring hospitalization	% hospitalized cases requiring critical care
0 to 9	0.1%	5.0%
10 to 19	0.3%	5.0%
20 to 29	1.2%	5.0%
30 to 39	3.2%	5.0%
40 to 49	4.9%	6.3%
50 to 59	10.2%	12.2%
60 to 69	16.6%	27.4%
70 to 79	24.3%	43.2%
80+	27.3%	70.9%

Sources: Guan W et al. *NEJM*. February 28, 2020 [e-pub ahead of print]; Ferguson NM et al. Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand. Imperial College London. March 16, 2020.

Lessons Learned in Surge Capacity From Italy

Italy—population 60M; Lombardy epicenter represents about 1/6 the population (10.4M)

Hospitalization surge period: February 21 to projected peak of second week in April

- First test-positive infection and ICU admissions was February 20
- As of March 11, 1028 ICU beds dedicated to COVID-19
- 9% to 11% of test-positive cases required ICU admission.
- 16% of all hospitalized admitted to the ICU
- 2% death rate (test-positive cases)

Strategies used during crisis to meet surge demand:

- Italy's Emergency ICU network developed coordinated response
  - Report every positive or suspected critically ill COVID-19 patient to the regional coordinating center.
  - Create cohort ICUs for COVID-19 patients.
- Decreased ICU occupancy rates by canceling elective surgeries and transferring non–COVID-19 patients to outlying hospitals (occupancy rates decreased to 25% in Lombardy and 50% in Italy)
- Created additional cohorted ICU units *as crisis unfolded*
  - *5,200 total ICU beds, with 4,000 beds for COVID-19 at peak*
    - *1,400 additional beds needed (based on occupancy rate of 50% current beds)*
- Ventilated multiple patients on 1 machine
- Graduated medical students early

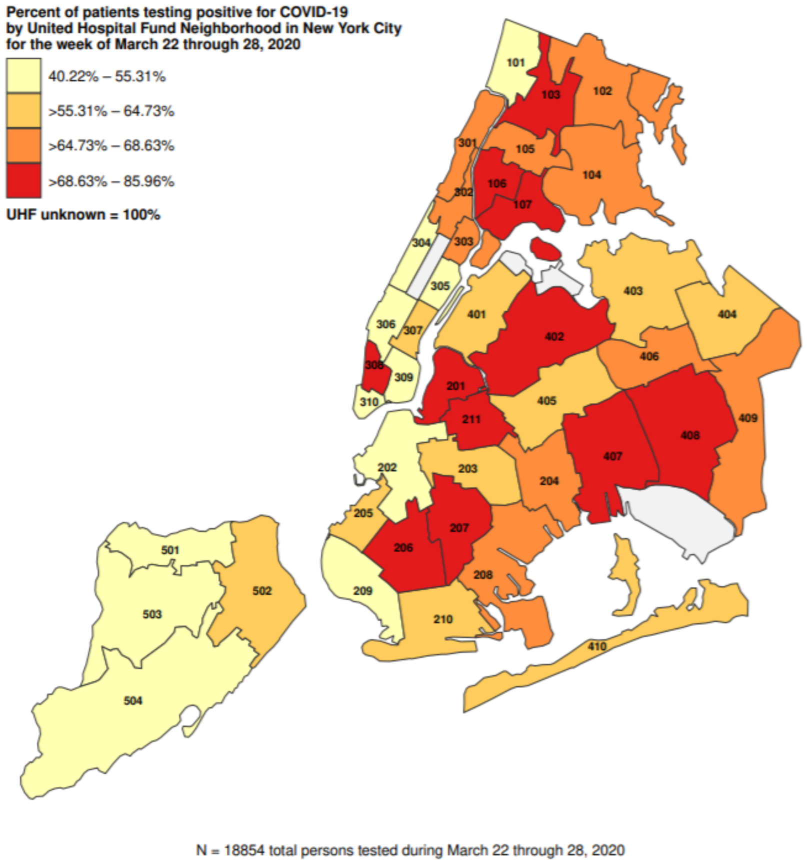
Source: Remuzzi A and Remuzzi G. COVID-19 and Italy: what next? *Lancet*. March 13, 2020.

Lessons From New York State

- Plan forward: be proactive, not reactive.
- The virus has been ahead of us from Day 1. It's time to get ahead of it.
- Regional coordination of ICU beds and adding pop-up surge capacity are critical steps.

What Does This Mean?

- Plan for the worst case, at least on paper. This includes collaborative, regional surge response discussions.
- Use existing tools to keep ahead of a changing situation—scenario model and track not only case positives but also COVID-19 admission trends daily.
- Monitor a dynamic situation—there will be a range of surge strengths and speeds across the US.
- Develop creative solutions to meet anticipated ICU demand (eg, regional diversion plans, conversion of existing hospital and nonhospital spaces to cohorted COVID-19 units).



Source: New York City Department of Health and Mental Hygiene. COVID-19 data map. Accessed March 29, 2020; New York State. Past coronavirus briefings. Accessed March 29, 2020.

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