Analytics when the Data Quality is Bad: COVID-19 Hospital Operations

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Situation on March 13

COVID-19 national emergency declared on March 13

Numbers of Santa Clara County COVID-19 infected and hospitalized are increasing exponentially
Stanford Adult Hospital Decisions to Be Made

When to stop elective surgeries?

How much staffing will be needed?

When will “surge facilities” be needed?

How to extend the inventory of personal protective equipment (PPE)?
Quality of the Data

Prior to March 13, there had been 1,118 tests done in California.¹

Enormous selection bias present in the prevalence estimates.

California is expanding coronavirus testing capacity daily.
During this interim period while testing is expanding, testing is being prioritized for people who:

- have coronavirus symptoms AND
- have one of these risk factors:
  - are a first responder,
  - have had contact with a person who has tested positive for COVID-19, OR
  - work in a healthcare facility, OR
  - are in prison OR
  - are over 60 years old, have a compromised immune system, or have serious chronic medical conditions.

California Covid-19 Testing guidance. Screenshot on March 26.²

Lack of Scientific Understanding

Length of infectious period

Impact of social distancing on new infections/infected individual

Degree of and duration of immunity for recovered individuals
The Role of Analytics

Present well-supported models to decision-makers that make clear the range of potential outcomes as a function of:

- the decisions made
- the scenarios related to the key uncertainties

Guiding Model-building Philosophy:

- ease-of-use / transparency
- focus on scenario analysis
- aim for consistency in level of modeling granularity utilized
Starting from March 13th, the number of days until ICU capacity is met is 41 days.
Starting from March 13th, the number of days until the General Medicine Floor capacity is met is 41 days.
Starting from March 13th, the number of days until the Ventilator capacity is met is 49 days.

Projected ICU Census

Projected General Medicine IP Floor Census
### PPE Model

#### Policies

<table>
<thead>
<tr>
<th>Policy #</th>
<th>For On Admission</th>
<th>For Ambulatory</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>N95</td>
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<td>Level 1-2</td>
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<tr>
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<td>Level 2</td>
<td>Level 3-4</td>
</tr>
<tr>
<td>2</td>
<td>N95</td>
<td>N95</td>
</tr>
<tr>
<td></td>
<td>Level 1</td>
<td>Level 1-2</td>
</tr>
<tr>
<td></td>
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<td>Level 3-4</td>
</tr>
<tr>
<td>3</td>
<td>N95</td>
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<td></td>
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<tr>
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<tr>
<td></td>
<td>Level 1</td>
<td>Level 1-2</td>
</tr>
<tr>
<td></td>
<td>Level 2</td>
<td>Level 3-4</td>
</tr>
</tbody>
</table>

#### Parameters

<table>
<thead>
<tr>
<th></th>
<th>PPE</th>
<th>Overall Capacity</th>
<th>Total</th>
<th>Ratio</th>
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</thead>
<tbody>
<tr>
<td>Inventory</td>
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<td>0</td>
<td>30000</td>
<td>N95</td>
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<tr>
<td>Supply</td>
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<tr>
<td>N95</td>
<td>30000</td>
<td>0</td>
<td>30000</td>
<td>N95</td>
</tr>
<tr>
<td>Procedural Mask</td>
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<td>0</td>
<td>40000</td>
<td>N95</td>
</tr>
</tbody>
</table>

#### Assumptions

1. Initial Census
2. Ratio of Pts in Different levels
3. # PPEs per pt per day
4. Reuse rate, waste rate
5. Doubling time of PUs

#### Comparison of PPE Usage for 1 Day for Policies 1-4

<table>
<thead>
<tr>
<th>Policy #</th>
<th>SHC PPEs per Day (without Surge)</th>
<th>LPCH PPEs per Day (without Surge)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N95</td>
<td>N95</td>
</tr>
<tr>
<td></td>
<td>Procedural Masks</td>
<td>Procedural Masks</td>
</tr>
<tr>
<td></td>
<td>N95 with Reuse</td>
<td>N95 with Reuse</td>
</tr>
<tr>
<td></td>
<td>Procedural Masks with Reuse</td>
<td>Procedural Masks with Reuse</td>
</tr>
</tbody>
</table>

#### Growth of # PUs

- Initial Census in SHC
  - Data: 3/14
  - # Pts: 500
  - # PUs: 60

- Initial Census in LPCH
  - Data: 3/14
  - # Pts: 200
  - # PUs: 10

- Daily Increase: 1.02
  - For SHC: 699
  - For LPCH: 10
ED Model

**Doubling Time for Cumulative PUIs In Hospital:**
25

Our assumption is that the number of cumulative PUIs grows exponentially. You need to put your estimation of PUIs before first date in the historical datafile you uploaded, or before 2020/4/1 which is the default projection starting day if you didn’t upload datafile.

**PUI High Cumulative:**
100

**PUI Low Cumulative:**
800

Please enter in the high acuity fraction of PUIs and Non-PUIs or keep as default. Please note that the fraction of low acuity PUIs is 1 - the fraction of high acuity PUIs and that the fraction of low acuity non-PUIs is 1 - the fraction of high acuity non-PUIs.

**High Acuity Fraction of PUIs:**
0.15

**High Acuity Fraction of Non-PUIs:**
0.33

If you didn’t upload arrival file, then the Non-PUIs of different levels should be set via your estimation in boxes below:

**Non-PUI High Acuity Arrival Day Mean**
Summary and Current Work

- These models were utilized by hospital management in making key COVID-19 decisions

- Current work:
  - Building model to support ongoing decision-making as hospital re-allocates some capacity back to pre-COVID bed use
  - Key Challenge: incorporate stochasticity into COVID hospitalization rates (consistent with SIR models)

ED Model link: https://surf-5eb441cf67d6894af55a803d-5eb441ee67d6890cb25a804b.platform.matrixds.com/