Key Outcomes
Hospitalized Patients

Census levels have declined by 50% over last 3 weeks.

As of 6/9/2021, the census was 164.

Model: The OHSU state hospital census forecast is an SIR model that includes traditional assumptions about first transmission (2/1/2020), doubling rate (5 days), days from exposure to admissions (12 days), length of stay (8 days, 13 days for ICU), and recovery period (14 days). It has an innovative feature which is that it includes a factor that moderates transmission rates which is called policy effectiveness. The factor is estimated historically for key policy dates and/or weekly intervals. It also allows future policies to be projected.

Source: https://public.tableau.com/profile/oregon.health.authority.covid.19#!/vizhome/OregonCOVID-19HospitalCapacitySummaryTables_15965754787060/HospitalizationbySeveritySummaryTable
Regional Hospital Census

Continued decline in Region 7

Some increase in Region 9.

Other regions are flat or decreasing.

Source: https://public.tableau.com/profile/oregon.health.authority.covid.19#!/vizhome/OregonCOVID-19HospitalCapacity/BedAvailabilitybyRegion
Hospital Census by US Region

The average state census (per 100k) is decreasing in all regions and is approaching the lowest level since beginning of pandemic.

Source: https://public.tableau.com/profile/oregon.health.authority.covid.19#!/vizhome/OregonCOVID-19HospitalCapacity/BedAvailabilitybyRegion
Oregon Hospital Capacity

As of 6/9, of the 560 occupied ICU beds, 36 (6%) are filled with COVID patients.

<table>
<thead>
<tr>
<th>Region</th>
<th>ICU</th>
<th>Non-ICU</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6%</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>2</td>
<td>8%</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>3</td>
<td>6%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>5</td>
<td>6%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>6</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>7</td>
<td>10%</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td>9</td>
<td>0%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Total</td>
<td>6%</td>
<td>3%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Source: https://public.tableau.com/profile/oregon.health.authority.covid.19#!/vizhome/OregonCOVID-19HospitalCapacitySummaryTables_15965754787060/HospitalizationbySeveritySummaryTable
New Cases per Capita

Cases continue to decline.

Oregon still has 15th highest rate of cases per capita.

Source: http://91-divoc.com/pages/covid-visualization/
Hospitalization Rate

For the most recent week (5/23-5/29) of complete data, the hospitalization rate is 5.3%.

Source: https://public.tableau.com/profile/oregon.health.authority.covid.19#!/vizhome/OregonHealthAuthorityCOVID-19SummaryTable_15889676399110/OregonsEpiCurveSummaryTable
Test Positivity

Positivity rate is flat but above 5% threshold.

The most recent complete week (5/23-5/29) had a test positivity of 4.5%.

Testing rates have declined in recent weeks.

Statewide Forecast
Vaccine Rates by Age

Older age groups are plateauing in vaccine rates and younger groups are beginning to increase.

As of week of starting 6/2, below are percentages that have received first dose:

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>80+</td>
<td>81%</td>
</tr>
<tr>
<td>70 to 79</td>
<td>84%</td>
</tr>
<tr>
<td>60 to 69</td>
<td>72%</td>
</tr>
<tr>
<td>50 to 59</td>
<td>64%</td>
</tr>
<tr>
<td>40 to 49</td>
<td>62%</td>
</tr>
<tr>
<td>30 to 39</td>
<td>60%</td>
</tr>
<tr>
<td>20 to 29</td>
<td>51%</td>
</tr>
<tr>
<td>10 to 19</td>
<td>32%</td>
</tr>
<tr>
<td>9 and younger</td>
<td>0%</td>
</tr>
</tbody>
</table>

Model Assumption-Vaccine Volume

Both fast and slow scenarios show a decline. The difference between them and the alternative scenarios provides an ability to observe how sensitive this factor is to the census.

The primary variants have been renamed as Alpha (UK), Epsilon (CA), and Gamma (Brazil) to avoid unhelpful association with places.

Source: Actuals from https://outbreak.info/location-reports?loc=USA_US-OR, Projections by Simulation by OHSU
Model Assumption—Virus Spread Rate

The two scenarios for strain composition produce different transmission levels for the circulating virus.

The “Fast” scenario assumes the P1 virus has an R0 of 5, while the “Slow” scenario assumes the R0 is just 4.3 (similar to the UK variant).

Source: Actuals from [https://outbreak.info/location-reports?loc=USA_US-OR](https://outbreak.info/location-reports?loc=USA_US-OR), Projections by Simulation by OHSU
Model Assumption- Policy/Behavior

This chart shows the effectiveness of the policy amongst those assumed to be susceptible.

A sixth consecutive week of good policy effectiveness is recorded.

Future data points are likely to be less effective due to significant relaxation of policies.

Note: The estimated intervention effectiveness includes increased transmissibility due to the variant. Thus, if the estimated $R$ is the same but the variant has increased it will mean the intervention effectiveness, shown in the chart, has increased.
Model Assumption-Policy/Behavior (Adjusted for Population Susceptible)

This chart is showing the effectiveness of policy on an absolute level knowing that a portion of people are no longer susceptible.

Thus it reflects that less stringent policy is needed to keep the virus from growing.

Given the increasing transmissibility of circulating disease and slower rate of vaccination, some residual amount of policy/behavior (from pre-pandemic patterns) may be needed to prevent growth.

Source: OHSU Forecast Model
The census showed sharp drop corresponding with “Extreme” risk level. A slower drop is expected thereafter.

The primary scenario is
- Slow Policy Fade
- Slow Variant
- Fast Vaccine

Source: OHSU COVID Forecast Model
Previous Forecasts

Previous forecasts can help assess accuracy of the model.

The model fit from the previous slide helps indicate current model fit. This is typically very high because each week is given a parameter and thus is very flexible to the data.

Source: Primary scenario for each week is used
Census Forecast-Alternative Scenarios

Scenarios:
Variant
a) Fast (ie. P1 grows fast)
b) Slow (ie. P1 grows slower)

Policy/Behavior:
a) Fast Fade in policy restrictions
b) Slow Fade in policy restrictions
c) No Fade in policy restrictions

Vaccine:
a) Fast (quicker distribution)
b) Slow (slower distribution)
As of 6/2, the estimated population proportions are:
Susceptible: 41%
Vaccinated: 40%
Infected: 14%
Vaccinated & Infected: 6%

Projection uses primary scenario.

Source: OHSU COVID Forecast Model
Review of Leading Indicators
Leading Indicators from google are showing mild increasing trend.

Source: SDI from: https://data.covid.umd.edu/
DEX from https://github.com/COVIDExposureIndices/, Google mobility reports from https://www.google.com/covid19/mobility/
Higher Risk Behaviors

Restaurant, Time w/Others, and Shops are all increasing steadily.

Large events are increasing slowly.

Source: https://covidcast.cmu.edu/
Mask Wearing

Mask wearing has fallen to the lowest level since the beginning of the fall surge.

Source: https://covidcast.cmu.edu/
Symptoms

After dropping during spring surge decline, symptoms have slight uptick in last week.

Source: https://covidcast.cmu.edu/
Policy Issues
Vaccine Administration

Oregon has provided first dose to 56.1% of population as of 6/10. Oregon ranks 18th in the US by this metric.

Source: https://covid.cdc.gov/covid-data-tracker/#vaccinations
Vaccine Hesitancy: Reasons

Chart shows reasons people give for being hesitant (of those who haven’t had a vaccine).

Top reasons are “Side Effects” and “Distrust Government”.

The reason “Low priority” has declined over time (perhaps as people with that response have become vaccinated).

Source: CMU
Vaccine Hesitancy: Don’t Need Reasons

Chart shows reasons people give for not getting vaccine.

Top reasons are not spending time with high risk and not being high risk.

Source: https://cmu-delphi.github.io/delphi-epidata/api/covidcast-signals/fb-survey.html#reasons-for-believing-vaccine-is-unnecessary
Vaccine Hesitancy: Information Sources

Chart shows what source they believe to provide accurate news and information about COVID-19.

Top sources are doctors and friends.

Source: https://cmu-delphi.github.io/delphi-epidata/api/covidcast-signals/fb-survey.html#reasons-for-hesitancy
The most recent forecast was issued on 5/13.

The model shows two scenarios.
CDC Forecast-Ensemble

To the right is the ensemble forecast (similar to average) of multiple models with shaded 95% confidence interval.

Below are the specific models that are averaged.

Source: https://covid.cdc.gov/covid-data-tracker/#forecasting_weeklycases
As of 5/13, the IHME model is shown below.

Projections and scenarios

We produce three scenarios when projecting COVID-19. The reference scenario is our forecast of what we think is most likely to happen:

- Vaccines are distributed at the expected pace.
- Governments adapt their response by re-imposing social distancing mandates for 6 weeks whenever daily deaths reach 8 per million, unless a location has already spent at least 7 of the last 14 days with daily deaths above this rate and not yet re-imposed social distancing mandates. In this case, the scenario assumes that mandates are re-imposed when daily deaths reach 15 per million.
- Variants B.1.1.7 (first identified in the UK), B.1.351 (first identified in South Africa), and P1 (first identified in Brazil) continue to spread from locations with (a) more than 5 sequenced variants, and (b) reports of community transmission, to adjacent locations following the speed of variant scale-up observed in the regions of the United Kingdom.
- In one-quarter of those vaccinated, mobility increases toward pre-COVID-19 levels.

The worse scenario modifies the reference scenario assumptions in three ways:

- First, it assumes that variants B.1.351 or P.1 begin to spread within three weeks in adjacent locations that do not already have B.1.351 or P.1 community transmission.
- Second, it assumes that all those vaccinated increase their mobility toward pre-COVID-19 levels.
- Third, it assumes that among those vaccinated, mask use starts to decline exponentially one month after completed vaccination.

The universal masks scenario makes all the same assumptions as the reference scenario but also assumes 95% of the population wear masks in public in every location.

Model Assumption: Population w/First Dose

This is the schedule used by the model for the percent of population w/first dose by week and age group.

The vaccination rate projections will be updated to reflect younger ages next week.

Source: OHSU COVID Forecast Model
Model Assumption: Hosp Rate

This shows the assumed hospitalization rate projected based on the change in susceptible population from vaccination.

The actual hospitalization rate has not followed this and remains high. It is believed that the hospitalizations per infection may have exhibited more of a decline.

Source: OHSU COVID Forecast Model
Model-Key Parameters

Key Assumptions

1) Vaccine schedule follow “slow” schedule with prioritized age groups
2) Vaccine acceptance rate, varies by age group.
3) Lagged affect on protection (2 weeks until vaccinated have protection)
4) Efficacy of vaccine (54% at first dose, 95% after second dose at 24 days)
5) Policy Scenarios have constructed to account for likely reduction in policy restrictions.
6) Ascertainment rate- True infected are estimated to be 3.5 times larger than cases.
7) Virus strain R₀ values (B117=4.62,4.3, B1427/9=3.7, P1=4.3/5Other=3.08)
8) Hospitalization rate has been adjusted to reflect higher risk individuals being vaccinated within age groups.

Source: OHSU COVID Forecast Model
Acknowledgements

Each week this model requires updates, input and expertise from many people.

I would like to thank Michael Jensen for his volunteer efforts to update our vaccine information, Chris Ellertson for his volunteer efforts to track vaccine projections, Brian O’Roak and Xuan Qin, at OHSU, for their expertise to understand genetic sequencing information, and the hospital forecasting workgroup for their feedback on weekly forecasts, including collaboration with Julie Maher and Erik Everson at Multnomah County PDES.

I would also like to give a special thank you to Michael Johnson from St. Charles Health who helped develop an early version of the model that has proven to be a good structure to handle the many twists and turns the problem has required.

Thank you!