OHSU COVID Forecast
Edition: 9/16/2021

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Key Outcomes
As of 9/15/2021, the statewide census was 1,067.

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

All regions have shown indications of cresting or declines in hospital census.

Region 5 still has nearly twice the number of patients per capita as other regions.

Source: https://public.tableau.com/profile/oregon.health.authority.covid.19#!/vizhome/OregonCOVID-19HospitalCapacity/BedAvailabilitybyRegion
The South and Midwest are showing some declines in census while the West and Northeast are showing flattening.
Oregon Hospital Capacity

As of 9/15, 49% of occupied ICU beds are filled with COVID patients.

Note: Percentages over 100% occur if the COVID counts are more than total beds minus COVID as percent of Occupied ICU

<table>
<thead>
<tr>
<th>Region</th>
<th>ICU</th>
<th>Non-ICU</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35%</td>
<td>15%</td>
<td>18%</td>
</tr>
<tr>
<td>2</td>
<td>46%</td>
<td>17%</td>
<td>21%</td>
</tr>
<tr>
<td>3</td>
<td>126%</td>
<td>22%</td>
<td>28%</td>
</tr>
<tr>
<td>5</td>
<td>104%</td>
<td>31%</td>
<td>39%</td>
</tr>
<tr>
<td>6</td>
<td>11%</td>
<td>32%</td>
<td>28%</td>
</tr>
<tr>
<td>7</td>
<td>37%</td>
<td>27%</td>
<td>28%</td>
</tr>
<tr>
<td>9</td>
<td>55%</td>
<td>23%</td>
<td>30%</td>
</tr>
<tr>
<td>Total</td>
<td>49%</td>
<td>19%</td>
<td>23%</td>
</tr>
</tbody>
</table>

Source: https://public.tableau.com/profile/oregon.health.authority.covid.19#!/vizhome/OregonCOVID-19HospitalCapacitySummaryTables-15965754783060/HospitalizationbySeveritySummaryTable
Oregon Hospital Capacity

The number of non-COVID patients increased slightly after weeks of decline.

These data are based on HOSCAP reports.

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

Case rates are showing continued signs of decrease in last week.

Oregon dropped to 25th in the number of new cases per day.

Source: http://91-divoc.com/pages/covid-visualization/
Cases by Vaccination Status

As of 9/9, the ratio of cases for unvaccinated to vaccinated is approximately 6:1.

Admits by Vaccination Status

As of 9/9, breakthrough hospitalizations (~5%) and deaths (0.8%) remain very rare among breakthrough cases.

Test positivity increased slightly this week.

The most recent complete week (9/5/21-9/11/2021) had a test positivity of 12.0%.

Total Tests

Testing has peaked at levels similar to fall/winter surge.

Review of Leading Indicators
Leading Indicators Comparison

Several metrics of activity are decreasing or are flat in Oregon.

While still above previous pandemic levels, the change may represent changes in behavior to avoid COVID.

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

All metrics showed slight increases in last week. This is consistent with fatigue in adherence to prevention efforts.

Note:
- Estimated percentage of respondents who went to an “indoor market, grocery store, or pharmacy” in the past 24 hours.
- Estimated percentage of respondents who went to an indoor “bar, restaurant, or cafe” in the past 24 hours.
- Estimated percentage of respondents who “spent time indoors with someone who isn’t currently staying with you” in the past 24 hours.
- Estimated percentage of respondents who “attended an indoor event with more than 10 people” in the past 24 hours.

Source: https://covidcast.cmu.edu/
As of 9/15, the mask wearing rate has dipped slightly to 82% in Oregon.

Note:
Estimated percentage of people who wore a mask for most or all of the time while in public in the past 7 days; those not in public in the past 7 days are not counted.

Source: https://covidcast.cmu.edu/
Symptoms appear to have dipped in last week in Oregon.

Note: “Symptoms” refer to community reports of COVID-like symptoms through Facebook surveys.

Source: https://covidcast.cmu.edu/
Statewide Forecast
Model Assumption-Vaccine Volume

“Fast” scenario shows a gradual decline in vaccination. It also assume 5-11 become eligible in late fall.

“Slow” scenario show previous pattern of declining vaccine providing little boost to immunity levels.

The fast uptick in delta variant is shown by a kink in the overall R0 of the circulating virus.

The “Fast” scenario assumes delta variant has an R0 of 8.0.

The “Slow” scenario assumes R0=6.5

Source: Actuals from https://outbreak.info/location-reports?loc=USA_US-OR, Projections by Simulation by OHSU
“Moderated” shows what happens with a lower amount of intervention effectiveness. “Fear and Fatigue” represents the typical cyclical pattern from previous periods of the epidemic. “Exaggerated Fear and Fatigue” represents the typical cyclical pattern from previous periods with double the amplitude.

Note: The fear and fatigue cycle is shifted upwards to account for the increased transmissibility of the virus.
Census Forecast-Primary Scenario

The forecast shows a general decrease in census levels over 2-3 months.

The primary scenario is
- “Moderated” intervention effect
- Slow Variant (Delta $R_0=6.5$)
- High hospitalization rate for Delta (2X original)
- Vaccine efficacy=95%

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.
Census Forecast-Alternative Scenarios

Scenarios:
1) Moderated behavior/policy, Slow Variant, High Delta Hosp Rate, Fast Vaccine
2) Fear/Fatigue behavior/policy, Slow Variant, High Delta Hosp Rate, Fast Vaccine
3) Exaggerated Fear and Fatigue Cycle, Slow Variant, High Delta Hosp Rate, Fast Vaccine
Previous Forecasts

The last 5 weeks of forecasts are shown.

Source: Primary scenario for each week is used
As of 9/15, the estimated population proportions are:
- Susceptible: 26%
- Vaccinated: 44%
- Infected: 21%
- Vaccinated & Infected: 9%

Projection uses primary scenario.

Source: OHSU COVID Forecast Model
Policy Issues
Oregon has given a first dose to 65.6% of population (not just eligible).

This rate ranks 19th in the US.
Pediatric hospitalization rate remains elevated but steady.

Oregon has approximately 0.2 new admissions per 100k kids per day.

Source: https://covid.cdc.gov/covid-data-tracker/#new-hospital-admissions
Demographic Change

Compared to the fall/winter surge of 2020, the share of new admits per day by age in Oregon has seen the following changes:

Age 20-29: 223% increase
Age 30-39: 232% increase
Age 40-49: 196% increase
Age 50-59: 154% increase
Age 60-69: 110% increase
Age 70-79: 20% decrease
Age 80+: 40% decrease

Source: https://healthdata.gov/Hospital/COVID-19-Reported-Patient-Impact-and-Hospital-Capa/g62h-syen/data
The current forecast of deaths per day use two key assumptions. First that deaths lag infections by an average of 21 days. Second that on average there are 5.5 COVID hospitalizations per death from COVID.

The estimated count of hospitalization per death does not require that the person who died was hospitalized.

Source: OHSU COVID Forecast Model, OHA
Appendix
The most recent forecast was issued on 9/9.

This model shows reductions based on two scenarios of transmission rates.

Figure 5: Observed hospitalized cases for Oregon and projection scenario. Black dots show observed daily counts, while the grey line shows model fit. The colored lines show hospitalizations projected assuming the estimated transmission rate of August 25 (green) or the average transmission rate of August 19 – 25 (red). Shaded areas: 2.5th-97.5th percentile ranges.

CDC forecasts show some decline over the next 3 weeks.

Source: https://covid.cdc.gov/covid-data-tracker/#forecasting_weeklycases
As of 9/9, the IHME model shows a recent peak in infections.

**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. Brand- and variant-specific vaccine efficacy is updated using the latest available information from peer-reviewed publications and other reports.
- Future mask use is the mean of mask use over the last 7 days.
- Mobility increases as vaccine coverage increases.
- 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 reference scenario assumes that mandates are re-imposed when daily deaths reach 15 per million.
- Variants Alpha, Beta, Gamma, and Delta continue to spread regionally and globally from locations with sufficient transmission.

The **worse scenario** modifies the reference scenario assumption in four ways:

- 100% of vaccinated individuals stop using masks.
- Mobility increases in all locations to 25% above the pre-pandemic winter baseline, irrespective of vaccine coverage.
- Governments are more reluctant to re-impose social distancing mandates, waiting until the daily death rate reaches 15 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 reference scenario assumes that mandates are re-imposed when daily deaths reach 38 per million. In either case, we assume social distancing mandates remain in effect for 6 weeks.
- Variants Alpha, Beta, Gamma, and Delta spread between locations twice as fast when compared with our reference scenario.

The **universal masks scenario** makes all the same assumptions as the reference scenario but assumes all locations reach 95% mask use within 7 days.

Acknowledgements

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

I would like to thank Alexandra Nielsen for developing a multi-strain simulation model, 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!