OHSU COVID Forecast

Edition: 11/11/2021

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Key Outcomes
Hospitalized Patients

As of 11/9/2021, the statewide census was 510.

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

Region 7 has still not decreased to the level of the other regions of the state.

Other regions are mostly flat in the last week.

Source: https://public.tableau.com/profile/oregon.health.authority.covid.19#!/vizhome/OregonCOVID-19HospitalCapacity/BedAvailabilitybyRegion
Oregon, Washington, and California are following very similar paths of late and have been steadily declining, though the trend in each of the states appears flat.

Source: https://carlsonschool.umn.edu/mili-misrc-covid19-tracking-project
Hospital Census by US Region

All regions below 35 persons per 100k.

Trends are generally flat or declining, with a slight uptick in New England

Source: https://carlsonschool.umn.edu/mili-misrc-covid19-tracking-project
Hospitalizations in Europe

While hospitalized patients are increasing modestly in several higher vaccinated European countries, the level of hospitalization across these countries (6 patients per 100k), is still significantly lower than Oregon at 11.9 patients per 100k.

There is no indications of increased breakthrough infections driving the increase. The increase is likely attributable to lower total immunity levels and increased indoor activity.

As of 11/8, 22% of occupied ICU beds are filled with COVID patients. This is an increase from 18% last week.
Oregon Hospital Capacity

The number of non-COVID patients is slightly higher than year when a similar number of COVID patients were in the hospital (3800 then vs. 3940 now).

These data are based on HOSCAP reports of individuals infected with COVID.

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

Case rates continue to decline but at slower rate.

Oregon is 27th highest in the US in the number of new cases per day.

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

Cases increased modestly for unvaccinated in recent week. The rate for vaccinated continued to decline.

Observed case-based vaccine efficacy remains flat.

Figure 1. COVID-19 cases per 100,000 per week, by vaccination status

Note: Observed Vaccine efficacy is calculated as 1-(CasesVac/CaseUnvac)*(PctUnvac/PctVac)

The most recent complete week (10/31/21-11/5/2021) had a test positivity of 6.4%.

Total Tests

Testing remains at elevated levels.

Review of Leading Indicators
Behavior metrics remain at near pre-surge levels.

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/
Google Mobility Metrics

Several metrics of activity continue to decrease in a pattern not too different from last fall.

Source: Google mobility reports from https://www.google.com/covid19/mobility/
As of week ending 11/9, the mask wearing rate is 81%.

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 levels increased this week.

It is possible for other viruses to be the driver of the increase.

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

Source: https://covidcast.cmu.edu/
Statewide Forecast
In order for the model to account for waning immunity of previous infection or vaccine, certain assumptions are needed. This model uses a basic structure which indicates:

1) **Wane Starts**: How many months after infection/vaccine waning begins.
2) **Wane Duration**: How long until waning is complete.
3) **Wane Share**: Percent of people who will not get boosters to prevent waning.

### Table: Model Assumptions for Waning Immunity

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Standard Vaccine</th>
<th>Infection</th>
<th>Short Vaccine</th>
<th>Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Wane Start (months)</td>
<td>12</td>
<td>12</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Wane Duration (months)</td>
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<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Wane Share</td>
<td>35%</td>
<td>50%</td>
<td>35%</td>
<td>50%</td>
</tr>
</tbody>
</table>

An increase in first doses is expected as age 5-11 become eligible.

Note: previous versions of this parameter estimated the date of first dose using total doses and counts of people vaccinated. The source of data now provides historical counts of when first doses occurred and should be more accurate.

Model Assumption-Virus Spread Rate

With no new variants measured in Oregon, the transmission rate is driven by the estimated transmission rate of the Delta variant.

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

The “Slow” scenario assume R0=6.5

Source: Actuals from https://outbreak.info/location-reports?loc=USA_US-OR, Projections by Simulation by OHSU
Recent results are showing some decrease in effect. Four scenarios are constructed to show possible paths.

1) Fear and Fatigue: this is a full cycling through forecast period.
2) Fatigue without Fear: this shows what happens if no new fear cycle begins
3) Full Fatigue: This shows what happens if fatigue continues
4) No Fatigue: maintains recent effect level

Source: OHSU COVID Forecast Model
Census Forecast-Primary Scenario

The forecast shows a flatter period before further declines in census.

The primary scenario is

- "Fear w/o Fatigue" intervention effect
- Slow Variant (Delta $R_0=6.5$)
- High hospitalization rate for Delta (2X original)
- Vaccine efficacy=90%
- Waning immunity follows standard assumptions

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 (7 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: OHSU COVID Forecast Model
The Scenarios for combinations of waning and policy/behavior assumptions are shown.

The primary specification is Fatigue w/o Fear with Standard Waning.
Previous Forecasts

The last 12 weeks of forecasts are shown.

Source: Primary scenario for each week is used
As of 11/9, the estimated population proportions are:
Susceptible: 20%
Vaccinated: 43%
Vaccinated & Infected: 11%
Infected: 25%

Source: OHSU COVID Forecast Model
Local Forecasts
Regional Forecasts

Source: OHSU COVID Forecast Model, OHA
Regional Herd Charts

Source: OHSU COVID Forecast Model, OHA
Policy Issues
Vaccination Rates

10% of the total population has received an extra dose (sometimes called a “booster”)

Source: https://public.tableau.com/app/profile/oregon.health.authority.covid.19/viz/OregonCOVID-19VaccineEffortMetrics/StatewideProgress
The pediatric census level in Oregon for confirmed positive patients under age 18 is 7 as of 11/8.

Source: https://healthdata.gov/Hospital/COVID-19-Reported-Patient-Impact-and-Hospital-Capa/g62h-syeh/data
Pediatric Census in Other States

The pediatric hospitalized census is mostly flat in the last week across key states.

Source: https://healthdata.gov/Hospital/COVID-19-Reported-Patient-Impact-and-Hospital-Capa/g62h-syeh/data
Death Forecast

The recent week of data by date of death showed an increase. This is expected to decrease and follow the hospitalization pattern.

Assumptions to project deaths from infections/hospitalizations:
1) Deaths lag infections by an average of 21 days.
2) There are 5.0 COVID hospitalizations per death from COVID.

Source: OHSU COVID Forecast Model, OHA
Influenza in Oregon

In Oregon, there have been small numbers of positive influenza tests but the second chart shows that is typical for the beginning of the flu season.

Influenza Trends

Across the globe the amount of influenza has been low when measured against previous seasons where as many as 30k infections per week were detected.

Figure from EW43, Nov 9.

Appendix
CDC forecasts flat number of admissions over the next 4 weeks.

IHME Forecast

As of 11/4, IHME shows the hospital flat and then increasing after new year.

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.

Effective R Estimates

This chart shows the effective R estimated weekly using hospitalization data in the model.

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Acknowledgements

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

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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!