STATUS UPDATE: COVID-19 EPIDEMIC TRENDS AND PROJECTIONS IN OREGON

Results as of 12-3-2020, 11am

PURPOSE OF THIS STATUS UPDATE

This update describes trends in COVID-19 transmission over time and projects trends over the next month assuming different scenarios. This report complements the extensive epidemiologic data (e.g., demographic trends in cases, testing patterns) for Oregon available at the Oregon Health Authority (OHA) COVID-19 webpage.

RESULTS UPDATED EVERY THREE WEEKS

Please note that the COVID-19 data used for the modeling are continually being updated. (For daily up-to-date information, visit the OHA COVID-19 webpage.) The results in this brief will be updated every three weeks as more data become available, the science to inform the model assumptions expands, and modeling methods continue to be refined. The model serves as a useful tool for summarizing trends in COVID-19 transmission in Oregon, and for understanding the potential impact of future scenarios. Point estimates should be interpreted with caution, however, due to considerable uncertainty behind COVID-19 model assumptions, limitations to the methods, and changes in COVID-19 testing volume.

ACKNOWLEDGEMENTS

OHA wishes to thank the Institute for Disease Modeling (IDM) for their support. For this status update, Niket Thakkar at IDM provided the software, programming scripts, technical assistance, and reviewed a draft of this report. This report is based on aspects of IDM's technical reports (IDM COVID Reports) and Washington State Department of Health's COVID-19 Situation Reports (WA Situation Reports), adapted for Oregon.

METHODS

For this status update, we used the COVID-19 modeling software Rainier. Rainier is software designed by the Institute for Disease Modeling (IDM) to algorithmically estimate the effective reproduction number (R_e) over time based on local data and to conduct simple projections. Rainier fits a stochastic SEIR (susceptible – exposed – infectious – recovered) model to testing, severe case, and mortality timeseries. This software has been used to generate regular situation updates for the State of Washington overall and by two regions within Washington (Example WA Report).

Results are based on COVID-19 data compiled December 2 from the Oregon Pandemic Emergency Response Application (Opera) on COVID-19 testing, total diagnosed cases,[1] severe cases,[2] and deaths among people living in Oregon. To account for delays in reporting, diagnosed cases with a specimen collection date after November 24 were not used; we used the same cutoff date for hospital admissions and deaths.[3] In the model, cases tested on November 24 are reflective of exposures that occurred around November 19.

Revisions since the last status update include:

- We are using an updated prevalence model, which considers cases as a leading indicator of hospitalizations in the recent past. This results in better fits to both hospitalizations and case counts. For more information, please see the November 23 WA Situation Report.
- Our scenario projections now include daily new severe cases.

Additional information about the methods can be found in Appendix 1.

RESULTS

Effective reproduction number

From the model results (Figure 1), we estimate the statewide R_e on November 19, one day after the statewide freeze started (Press Release), was likely between 1.18 and

[1] Total diagnosed cases include confirmed (positive test) and presumptive cases (symptoms with epidemiologic link).
[2] Severe cases include both cases admitted to the hospital and individuals who died but were not hospitalized. Approximately 7% of severe cases are deaths that were not hospitalized or of unknown hospitalization status. New severe case date is the date of hospital admission (if available) or is the estimated date of onset of severe symptoms.
[3] This date reflects the cutoff through when individuals had a test specimen collected, were admitted to a hospital, or died. Any of these events may have been reported to OHA at a later date.

1.33, with a best estimate of 1.25. The best estimate of the statewide R_e has been above one since September 22.

It is important to note that these estimates are based on averages statewide, but the growth in cases in Oregon has varied by county (OHA County Dashboard), race, ethnicity, and age (COVID Weekly Report Dec 2).

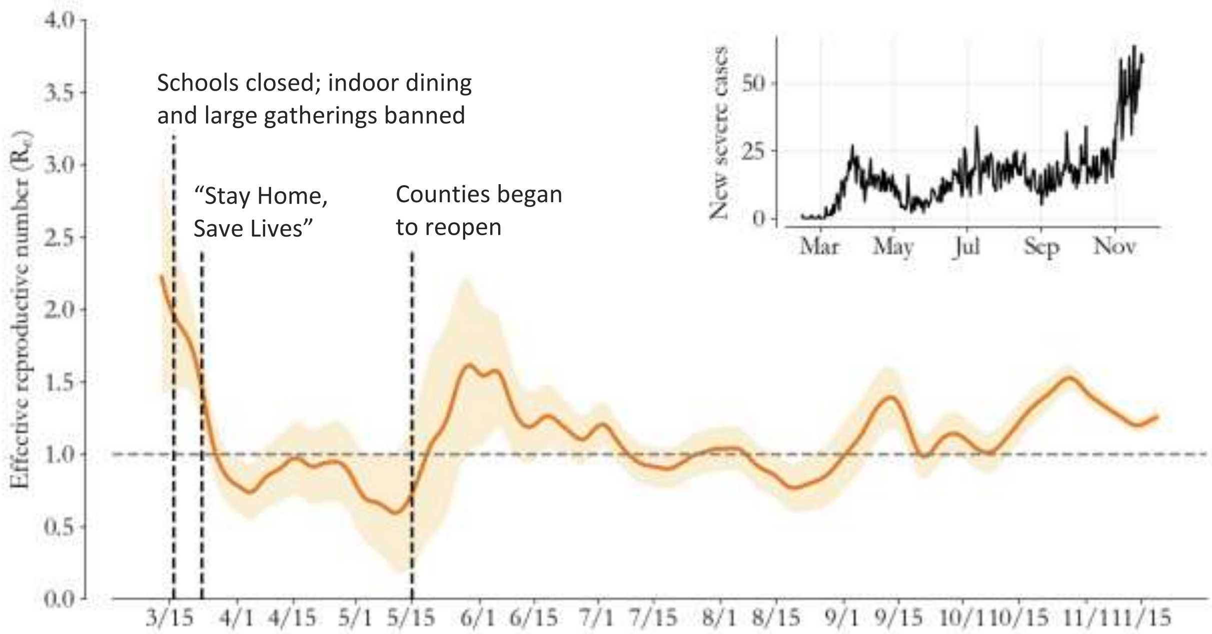

Figure 1: *R_e estimates over time for Oregon, with shaded 95% confidence interval. Graph insert is the number of new severe cases over time in Oregon, a key input for the estimates. Re = 1 is the threshold for declining transmission.*

Our best estimate of the R_e as of November 19 (1.25) is somewhat higher than the most recent estimates[4] from Covid Act Now (1.11; 90% confidence interval: 1.01-1.21), CMMID (1.1; 90% credible interval: 0.9-1.3), and covid19-projections.com (1.14). The most recent estimate from RT Live (1.54) is higher, although our best estimate falls within their 80% credible interval (1.23-1.88). Oregon's high value on RT Live is an outlier among its state-level estimates; this could be due to misinterpretation of how Oregon testing data is reported.

[4] Accessed December 2, 2020.

Recent case trends

These R_e estimates are based on a model that used data on diagnosed cases, severe cases, and deaths, while taking into account changes in testing volume and practice. Examination of these outcomes confirms that cases are rising. As shown in Figure 2, the 7-day rolling average numbers of new diagnosed cases and new severe cases in Oregon had temporarily declined in early October, but both have been increasing since mid-October. The slope for new severe cases appears to be flattening somewhat since around November 10. The number of daily deaths has been increasing since early November.

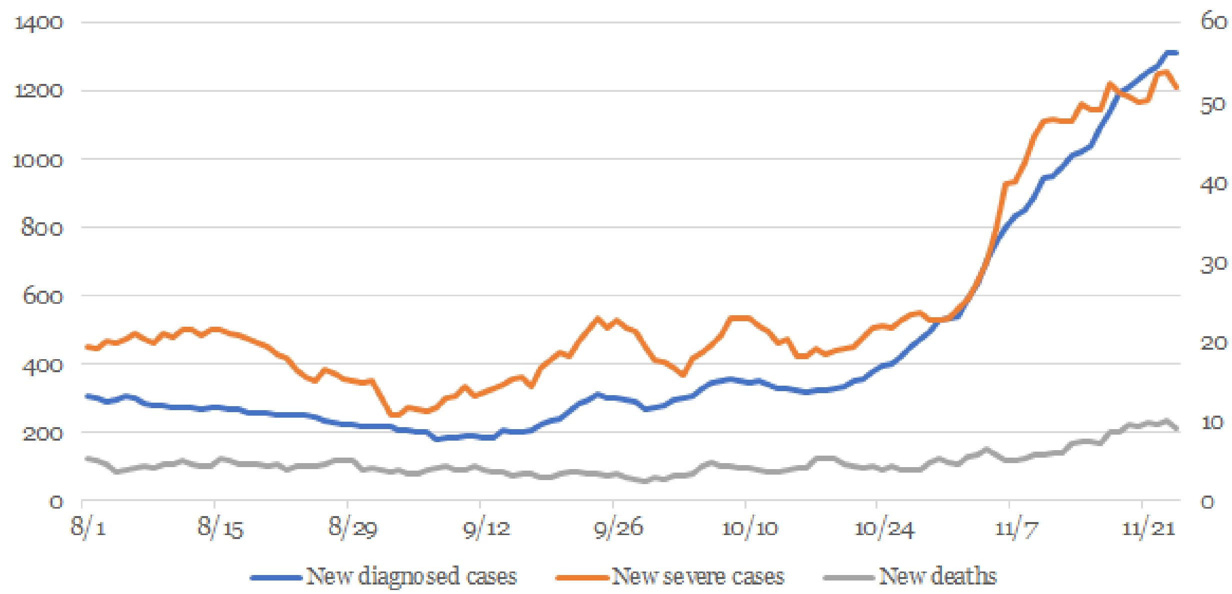

Figure 2: *Seven-day rolling average numbers of new diagnosed cases (left axis), new severe cases (right axis), and new deaths (right axis) due to COVID-19. Dates reflect when individuals had a test specimen collected (diagnosed cases), had symptoms severe enough to be hospitalized (severe cases), or when they died.*

Model fit to Oregon COVID-19 data

In Figure 3, one can see that the transmission model captures trends in the daily Oregon COVID-19 outcomes over time.

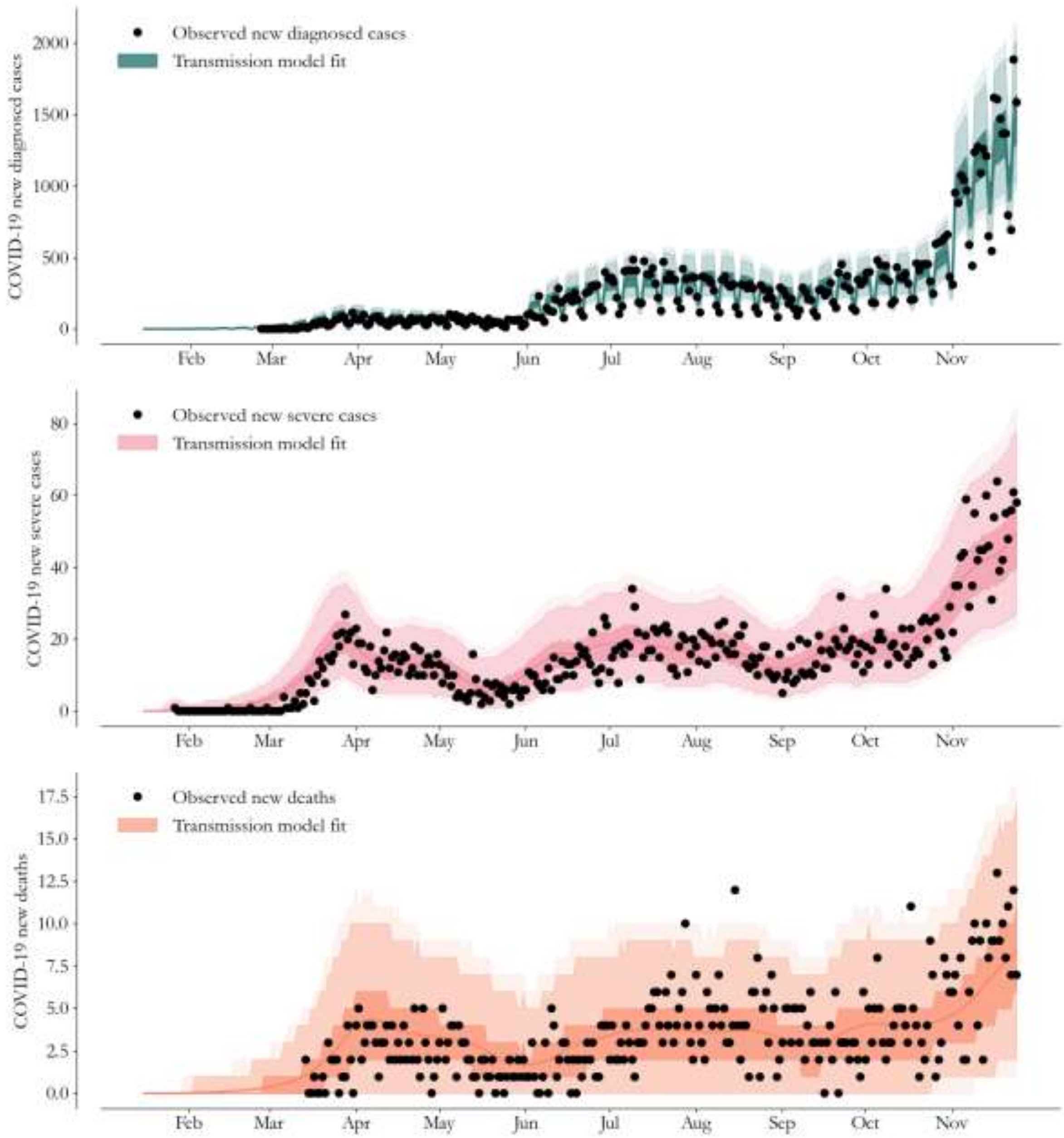

Figure 3: *Fitting the transmission model to Oregon's COVID-19 data on diagnosed cases, severe cases, and deaths. The lines represent the mean of 10,000 runs; the 25th-75th percentiles are given in dark shaded areas, 2.5th-97.5th percentiles in the lighter shade, and 1st-99th percentiles the lightest shade. The black dots are observed data. Top panel: Modeled cases (teal) capture the trend in observed, daily new diagnosed cases based on* R_e *estimates and a free number of importations on January 20 and February 1. Middle panel: Simultaneously, the model (pink) captures the trend in observed daily new severe cases by assuming severe disease is independent of testing volume. Bottom panel: With its time-varying infection fatality ratio, the model (orange) captures the observed trend in daily deaths.*

Delays in case reporting

The Opera data file for these analyses was obtained on December 2 but counts for recent days were incomplete due to reporting delays. To reduce the chances of underestimating recent case counts, new diagnosed cases with specimen collection date after November 24 were not used; we also used the same cutoff date for hospital admissions and deaths. We examined counts of hospital occupancy for COVID-19 in Oregon from the HOSCAP data system, which is updated daily, to see if trends in occupancy have changed since November 24; those data show an increasing trend in hospital occupancy from October 26 through November 30, followed by a slight decrease in occupancy on December 1 and 2.

Scenario Projections

With the fitted model, we can explore outcomes under future scenarios. Predicting future trends in COVID-19 is extremely challenging. As illustrated in Figure 1, the estimated R_e has fluctuated above and below 1 since reopening began in May. Indeed, the spread of this virus appears very sensitive to changes in how people are interacting with each other (e.g., wearing masks, physically distancing, being indoors with large groups). Unfortunately, we do not have measures of risk and protective behaviors over time, nor can we accurately predict them. Hence, we modeled two future scenarios with different assumptions about the R_e value after November 24.[5]

Figures 4 and 5 illustrate what could happen over the next month:

- If R_e were to be maintained at the estimated November 19 level (1.25): We would continue to see an exponential increase in new diagnosed cases. For the two-week period between December 11 and December 24, the projected number of new diagnosed cases would reach 660 per 100,000 people. This rate translates to a daily average of 2,000 new diagnosed cases. New severe cases would increase to 75 per day by December 24.

- If we were to see an increase in transmission around Thanksgiving to the same level as late-October (R_e = 1.50) and that transmission level was maintained: New diagnosed cases would increase to 920 per 100,000 people for the two-week period between December 11 and December 24, an average of 2,700 new diagnosed cases per day. New severe cases would increase to 110 per day by December 24.

These results highlight how the level of COVID-19 activity depends strongly on the collective success of mitigation efforts in the coming months.

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[5] While our model estimated R_e through November 19, we assumed this transmission level to be constant through November 24 in all scenarios.

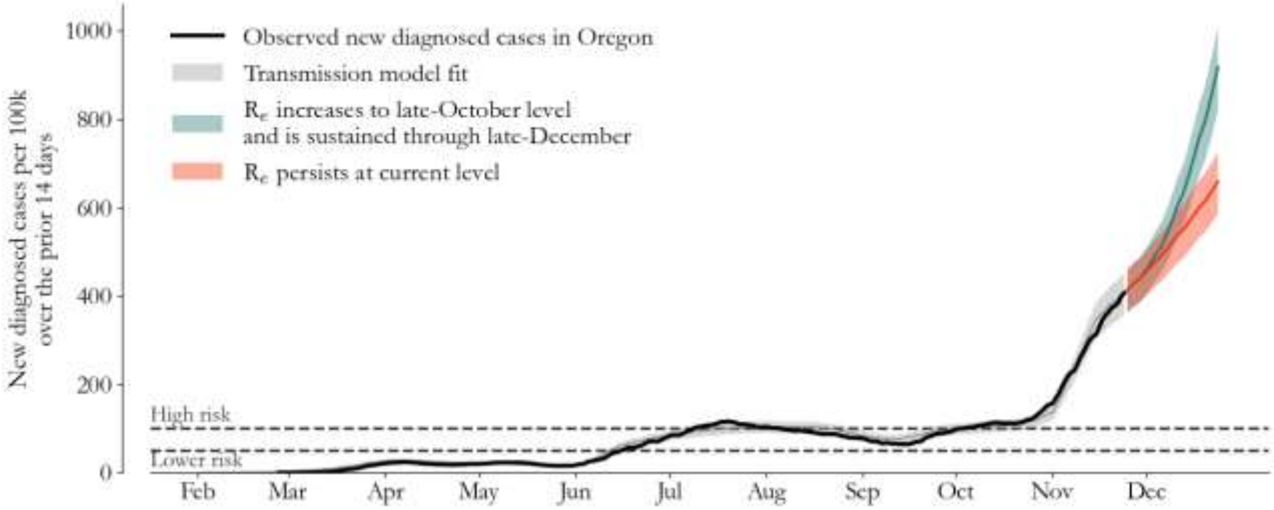

Figure 4: *Observed diagnosed cases (per 100k population over the previous 14 days) for Oregon and projected cases under two scenarios. The black line shows observed cases, while the grey shaded area shows the 25th-75th percentile range of the model fit. The red line shows diagnosed cases projected if the transmission level estimated for November 19 persists, while the teal line shows projected cases assuming transmission increases to the level of late-October (shaded areas: 25th-75th percentile ranges). The lower- and high risk levels of COVID activity (dashed horizontal lines) are defined by the Oregon Framework for County Risk Levels.*

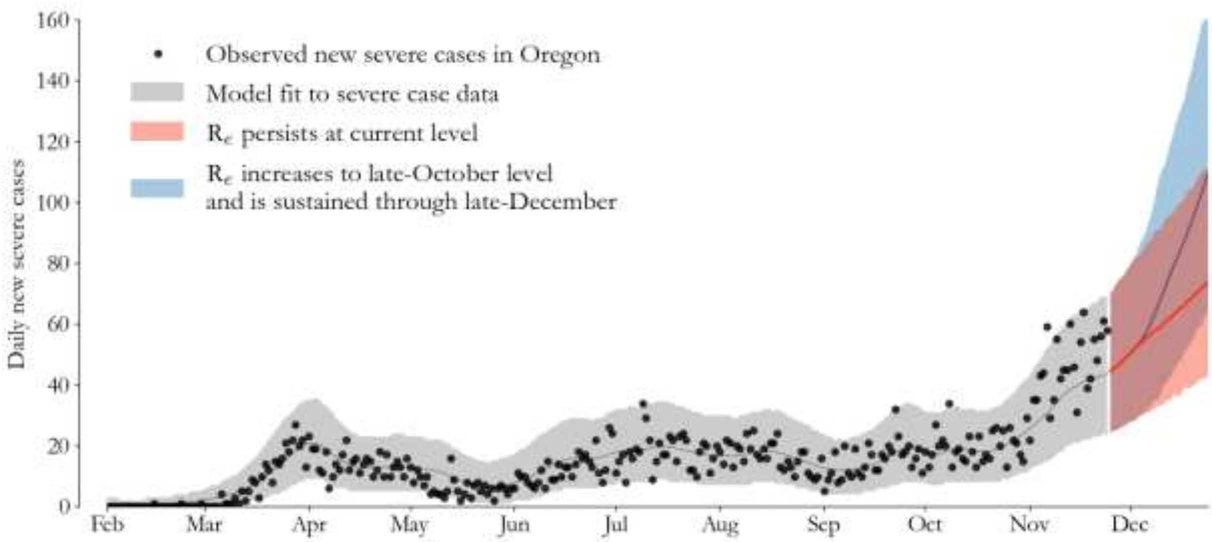

Figure 5: *Observed severe cases for Oregon and projections under two scenarios. Black dots show observed daily counts, while grey region is the model-based 95% confidence interval. The red line shows daily severe cases projected if the transmission level estimated for November 19 persists, while the blue line shows projected severe cases assuming transmission increases to the level of late-October (shaded areas: 25th-75th percentile ranges).*

Appendix 1: Additional assumptions and limitations

We used a COVID-specific transmission model fit to Oregon data on testing, confirmed COVID-19 cases, severe cases, and deaths to estimate the effective reproduction number (R_e) over time. The key modeling assumption is that individuals can be grouped into one of four disease states: susceptible, exposed (latent) but non-infectious, infectious, and recovered.

- For an in-depth description of our approach to estimating R_e and its assumptions and limitations, see IDM's technical report for detailed information on modeling methods, as well as the November 23 WA Situation Report for recent methodology updates.
- As described previously, estimates of R_e are based on an adjusted epidemiologic curve that accounts for changing test availability, test-positivity rates, and weekend effects, but all biases may not be accounted for.
- We included only diagnosed cases, severe cases, and deaths occurring at least 8 days before our Opera data file extract to account for delays in reporting. If reporting delays are longer than that, the last few days of our model input data may undercount COVID-19 events.
- Estimates of R_e describe average transmission rates across Oregon. This report does not separate case clusters associated with known super-spreading events from diffuse community transmission. In addition, this report does not estimate R_e separately for specific populations, who might have higher risk of exposure because of their occupation, living arrangements, access to health care, etc.
- This report describes patterns of COVID-19 transmission across Oregon, but it does not examine factors that may cause differences to occur. The relationships between specific causal factors and policies are topics of ongoing research and are not addressed herein.
- Point estimates should be interpreted with caution due to considerable uncertainty behind COVID-19 model assumptions, limitations to the methods, and recent changes in COVID-19 testing volume.
- We assumed free / undefined numbers of importations occurring on January 20 and February 1, and specified changes in testing volumes occurring around June 1, July 17, and November 1.
- In contrast to recent reports for Washington State, we assumed age-specific infection hospitalization ratios (IHRs) based on CDC COVID-19 Planning Scenarios, as well as a mean exposure-to-severe time of 12 days. Note that Rainier adjusts the overall IHR over time based on the data.