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

Results as of 1-7-2021, 10:30am

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 and limitations to the methods.

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, and technical assistance. 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, hospitalization, and mortality time series. 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 January 6 from the Oregon Pandemic Emergency Response Application (Opera) on COVID-19 testing, total diagnosed cases,[1] hospitalized cases, and deaths among people living in Oregon. To account for delays in reporting, diagnosed cases with a specimen collection date after December 29 were not used; we used the same cutoff date for hospital admissions and deaths.[2] In the model, cases tested on December 29 are reflective of exposures that occurred around December 23.

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

RESULTS

Effective reproduction number

From the model results (Figure 1), it is clear the statewide R_e has continued to fluctuate up and down over time, with dramatic shifts sometimes happening very quickly. We estimate the statewide R_e fell dramatically in late November to around 0.8, stayed near that level through mid-December, then started a sharp increase. As of December 23, the statewide R_e was likely between 1.14 and 1.45, with a best estimate of 1.29.[3] This estimate does not reflect any potential further increase in transmission related to social gatherings over Christmas and New Year's Eve.

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-19 Weekly Report).

[1] Total diagnosed cases include confirmed (positive test) and presumptive cases (symptoms with epidemiologic link).
[2] 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.
[3] Our Re confidence may be narrower at times because of how we estimated specimen collection dates for negative tests (and thus positive test rate for each day), as described in Appendix 1

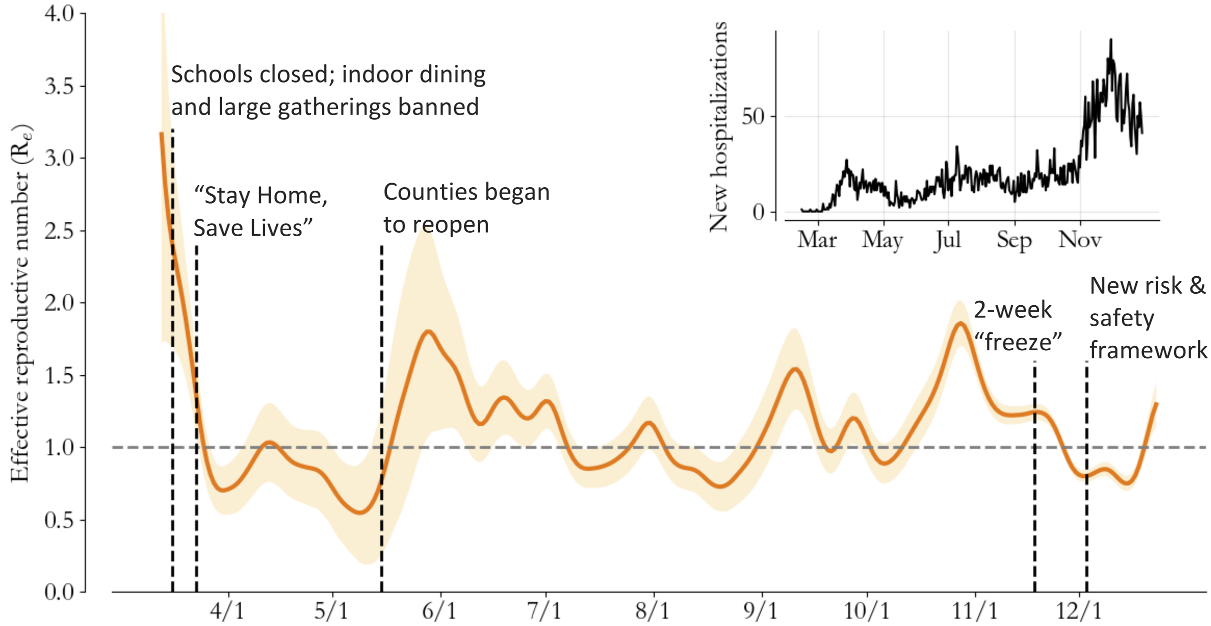

Figure 1: *R_e estimates over time for Oregon, with shaded 95% confidence interval. Graph insert is the number of new hospitalizations over time in Oregon, a key input for the estimates. Re = 1 is the threshold for declining transmission.*

Our best estimate of the R_e as of December 23 (1.29) is higher than the estimates[4] for that date from covid19-projections.com (1.13), CMMID (0.98; 90% credible interval: 0.93-1.04), Covid Act Now (0.93; 90% confidence interval: 0.83 – 1.03), and RT Live (0.92; 80% credible interval: 0.75-1.05). These other models estimate the R_e after December 23 increased somewhat (1.1, CMMID as of January 6; 1.04, Covid Act Now as of January 5) or stayed the same (0.92, RT Live as of January 5).

[4] Accessed January 6, 2021. Latest estimate from Covid-19-projections.com was for December 22, 2020.

Recent case trends

These R_e estimates are based on a model that used data on diagnosed cases, hospitalized cases, and deaths, while taking into account changes in testing volume and practice. Examination of these outcomes (Figure 2) helps explain the recent trends in the estimated Re: the 7-day rolling averages of both diagnosed and hospitalized cases in Oregon had been decreasing until late December, after which hospitalizations flattened out while diagnosed cases began to increase.

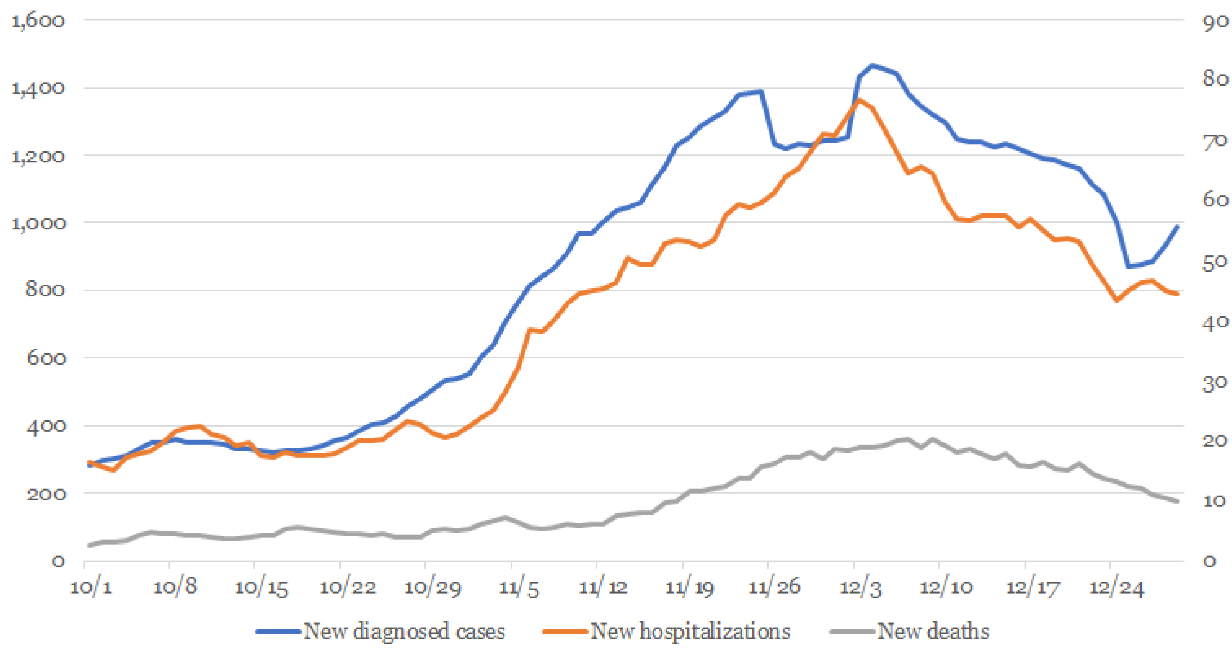

Figure 2: *Seven-day rolling average numbers of new diagnosed cases (left axis), new hospitalizations (right axis), and new deaths (right axis) due to COVID-19. Dates reflect when individuals had a test specimen collected (diagnosed cases), were admitted to the hospital, or when they died.*

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.

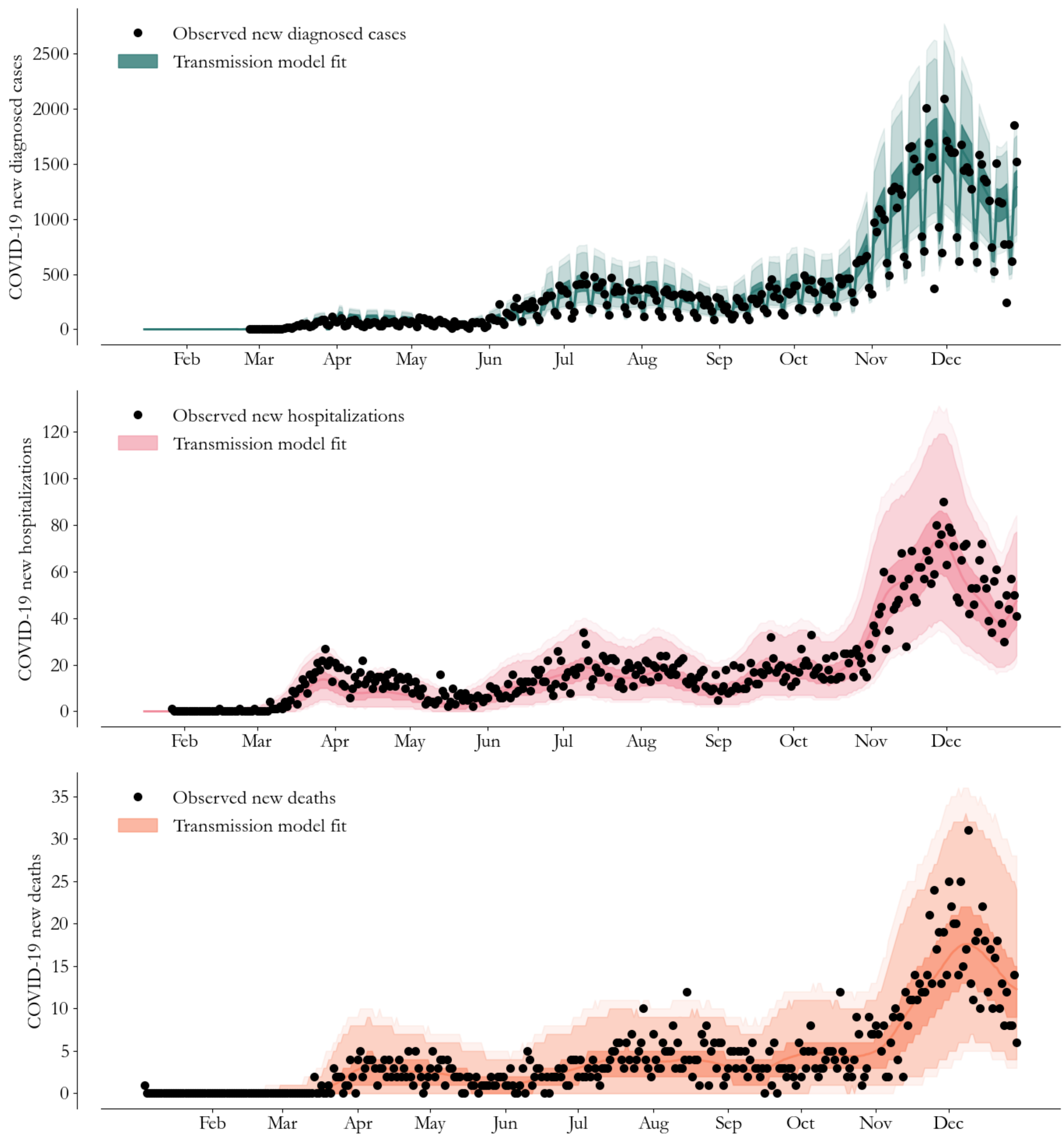

Figure 3: *Fitting the transmission model to Oregon's COVID-19 data on diagnosed cases, hospitalizations, and deaths. The lines represent the mean of 10,000 runs; the 25th-75th percentiles are given in dark shaded areas, 2.5th-97.5th percentiles in the lighter shade, and 1st-99th percentiles the lightest 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 hospitalizations by assuming hospitalizations are 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 January 6 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 December 29 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 since changed; those data indicate that hospital occupancy decreased between December 29 and January 1, then remained at that lower level on January 7 after a brief increase/decrease.

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 comprehensive measures of risk and protective behaviors over time, nor can we accurately predict them. We modeled two future scenarios to project what would happen to case trends in the short term if the R_e changed due to people's behavior. For these scenarios, we assume the estimated R_e on December 23 remains constant through January 8 and changes start January 9.[5]

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

- If people's prevention behaviors remained unchanged from December 23, with the R_e maintained at 1.29: We would continue to see an exponential increase in diagnosed cases. For the two-week period between January 13 and January 26, the projected number of new diagnosed cases would reach 590 per 100,000 people. This rate translates to a daily average of 1,780 cases. New hospitalizations would increase to 85 per day by January 26. These projections would look even more dire if the actual transmission level increased beyond 1.29 around Christmas and New Year's Eve.

- If people were to be more adherent to prevention recommendations starting January 9, returning to a transmission level where R_e = 0.9 (as in early December): New

[5] The scenarios do not specifically take into account possible increased infectivity from different strains of SARS-CoV-2. In addition, the scenarios do not project the potential effects of people being vaccinated for COVID-19. The Institute for Health Metrics and Evaluation (IHME) has some related projections here.

diagnosed cases would be 470 per 100,000 people for the two-week period between January 13 and January 26, an average of 1,400 new diagnosed cases per day. There would be about 55 new hospitalizations per day by January 26.

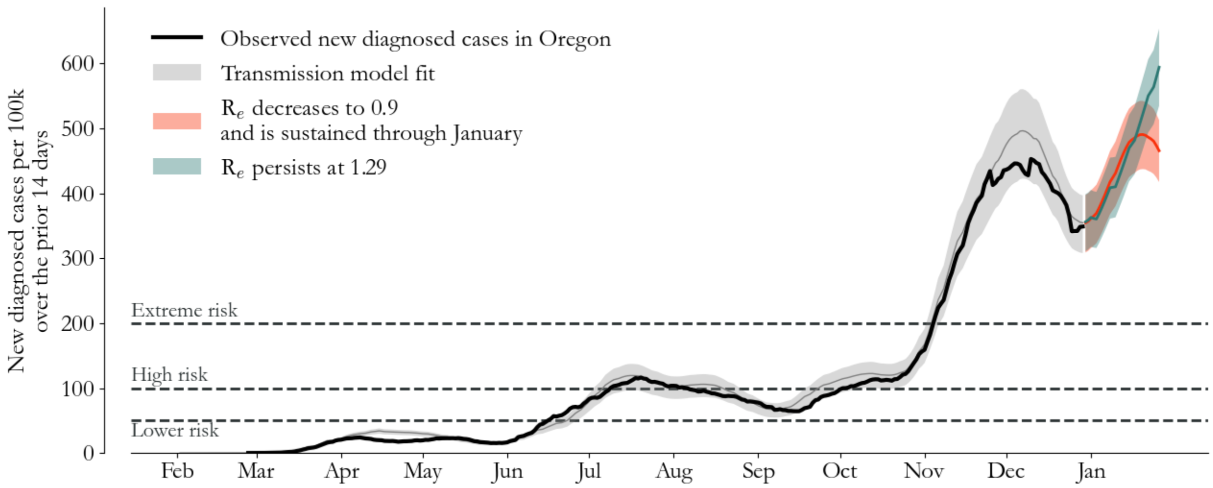

Figure 4: *Observed diagnosed cases (per 100k population over the previous 14 days) for Oregon and projected cases under two scenarios beginning December 30. The black line shows observed cases, while the grey shaded area shows the 25th-75th percentile range of the model fit. The blue line shows diagnosed cases projected if the transmission level estimated for December 23 (R_e = 1.29) persists, while the red line shows projected diagnosed cases if R_e decreases to 0.9 after January 8 (shaded areas: 25th-75th percentile ranges). The risk levels of COVID activity (dashed horizontal lines) are defined by the [Oregon Framework for County Risk Levels](#).*

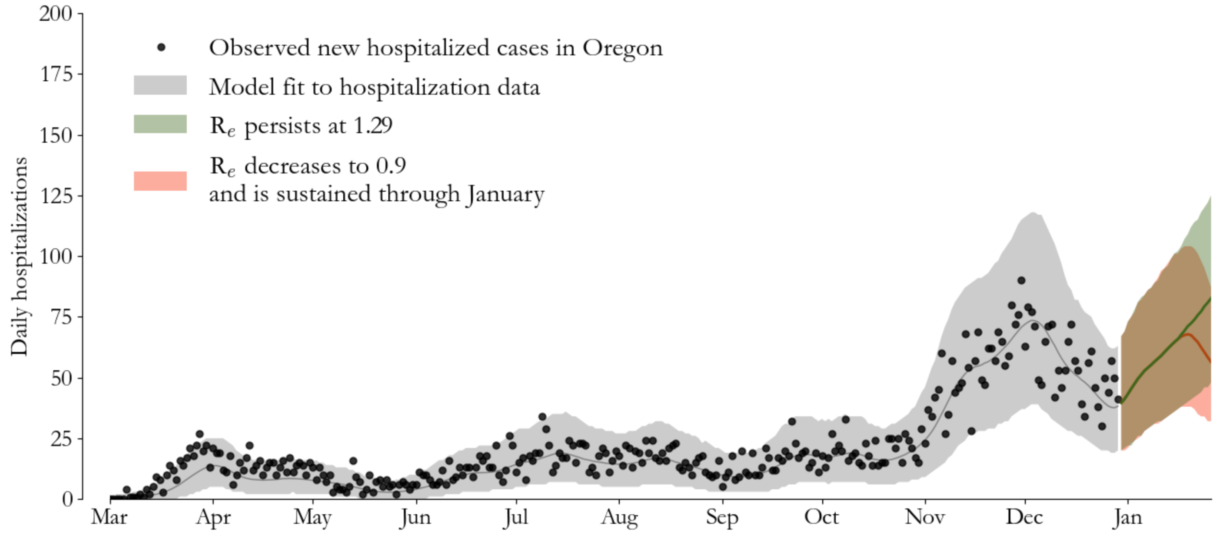

Figure 5: *Observed hospitalized cases for Oregon and projections under two scenarios beginning December 30. Black dots show observed daily counts, while grey region is the model-based 95% confidence interval. The green line shows daily hospitalized cases projected if the transmission level estimated for December 23 (R_e = 1.29) persists, while the red line shows projected hospitalized cases assuming transmission decreases to R_e = 0.9 after January 8 (shaded areas: 2.5th-97.5th percentile ranges).*

These results highlight how the COVID-19 case rates over the coming months will depend strongly on our collective efforts. The first COVID-19 vaccines arrived in Oregon on December 14, but vaccinations are still months away for most Oregonians (Press Release). For now, all Oregonians need to continue doing their part to stop the spread of COVID-19 -- wearing a mask, physical distancing, and avoiding indoor gatherings.

Appendix 1: Additional assumptions and limitations

We used a COVID-specific transmission model fit to Oregon data on testing, confirmed COVID-19 cases, hospitalized 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 methods information, 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, hospitalized 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.
- We assumed free / undefined numbers of importations occurring on January 20 and February 1, and specified changes in testing volumes occurring around April 1, June 23, September 29, November 1, November 28, and December 5.
- 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-hospitalized time of 12 days. Note that Rainier adjusts the overall IHR over time based on the data.
- We use test specimen collection date for new cases, but have only lab report date for negative tests. To better align these two outcomes, we redistributed negative test counts. These counts were reallocated among the laboratory report day and the two days prior, according to distribution of positive cases (by specimen date) occurring over those same three days. Because Rainier's R_e uncertainty is partially based on variation in percent positive, this redistribution of negative cases may cause the R_e confidence intervals to narrow.
- Point estimates should be interpreted with caution due to considerable uncertainty behind COVID-19 model assumptions and limitations to the methods.