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

Results as of 2-18-2021, 9am

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 different 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 February 17 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 February 9 were not used; we used the same cutoff date for hospital admissions and deaths.[2] In the model, cases tested on February 9 are reflective of exposures that occurred around February 3.

It is important to note that our current version of Rainier detects changes in transmission, but that these changes may be due to some combination of changing behaviors, vaccination coverage, and/or viral infectivity; the individual contributions of these changes cannot currently be estimated separately.

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 quickly. Indeed, the 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).

In 2021, people in Oregon have so far kept the average R_e below 1, driving cases down. We estimate the statewide R_e increased to above 1.0 for a week in late December 2020, but has since wavered between about 0.8 and 0.9. The best-estimate R_e averaged 0.85 over the week ending on February 3, and 0.88 over the two-week period

[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.

ending on February 3. As of February 3, the statewide R_e was likely between 0.65 and 1.12, with a best estimate of 0.88.

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]).

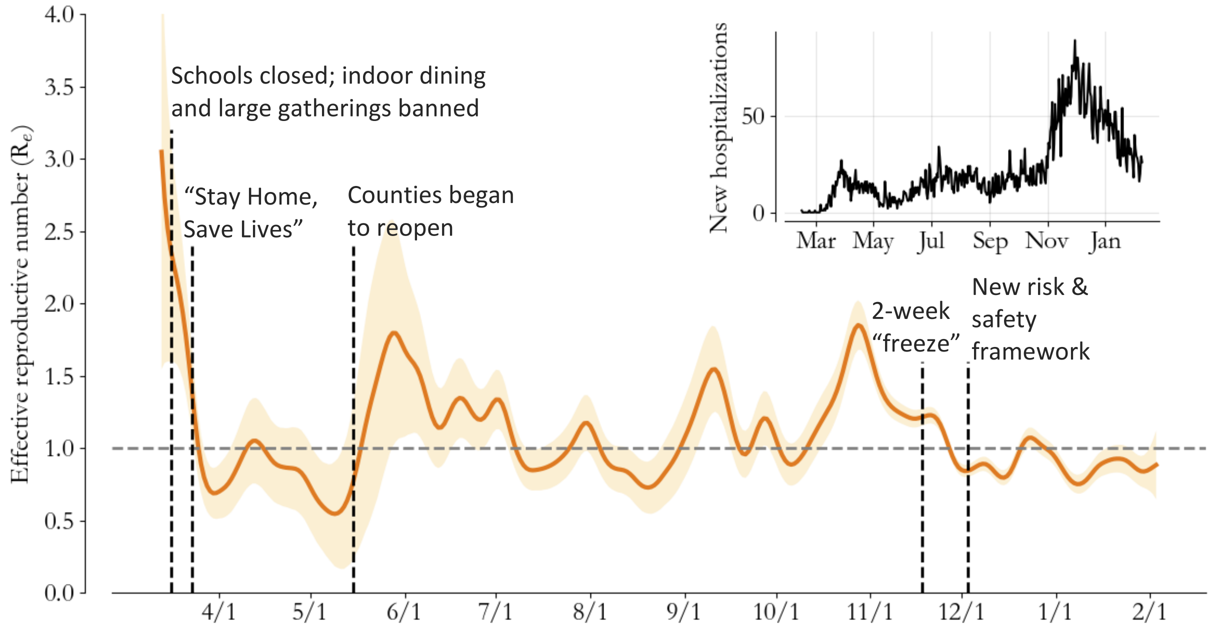

Figure 1: *R_e estimates over time for Oregon, with shaded 95% confidence interval.*[3] *Graph insert is the number of new hospitalizations over time in Oregon, a key input for the estimates. R_e = 1 is the threshold for declining transmission.*

Our estimates of R_e fluctuate more than some other national models, likely because Rainier utilizes more exact data and is more sensitive to detecting such changes in transmission. Our best estimate of the R_e for February 3 (0.88) is similar to recent estimates[4] from Covid Act Now (0.87), CMMID (0.89), covid19-projections.com (0.83), and Harvard and Yale (0.93).

[3] Our R_e confidence interval 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.
[4] Model R_e estimates are for February 3, 2021, except for covid19-projections.com (February 1, 2021). All were accessed on February 16, 2021.

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 R_e: the 7-day rolling average of diagnosed cases saw a temporary post-holiday increase (with holiday-related fluctuations in testing volume), followed by a rapid decline in mid-January and a steady decline over the last few weeks. The 7-day rolling average of hospitalizations (less affected by fluctuations in testing) has been steadily decreasing since its late-November peak.

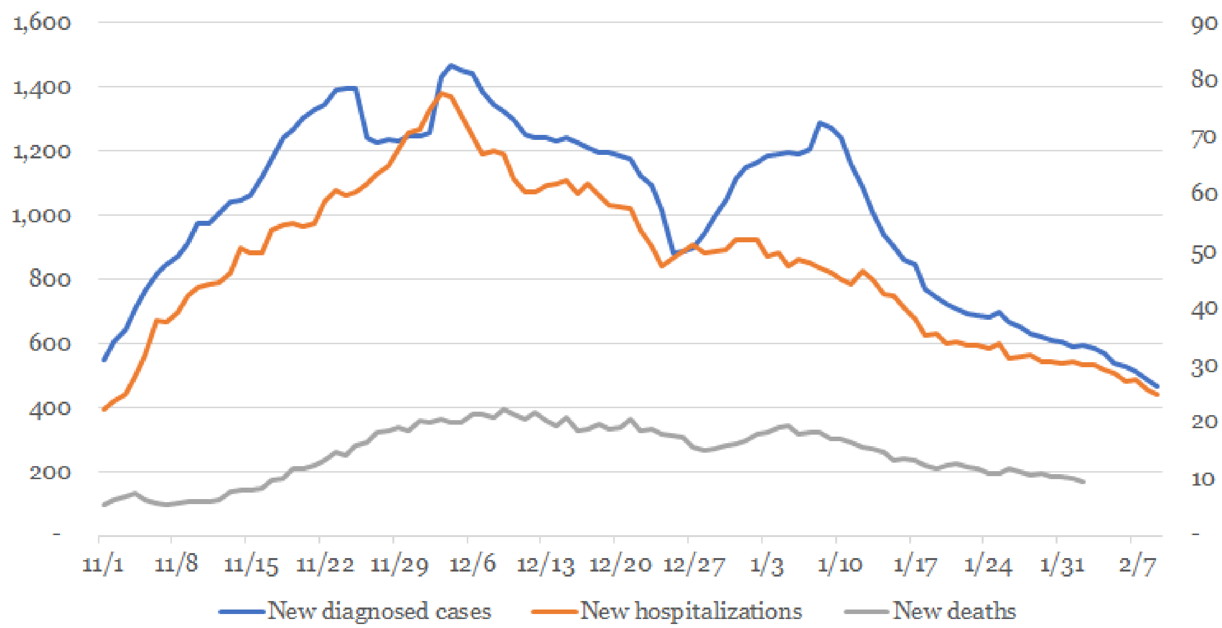

Figure 2: *Seven-day rolling average numbers of new diagnosed cases (left axis), new hospitalizations (right axis), and new deaths (right axis) due to COVID-19. Dates reflect when individuals had a test specimen collected (diagnosed cases), were admitted to the hospital, or when they died.*

Model fit to Oregon COVID-19 data

Figure 3 shows how the transmission model captures trends in the daily Oregon COVID-19 outcomes over time.

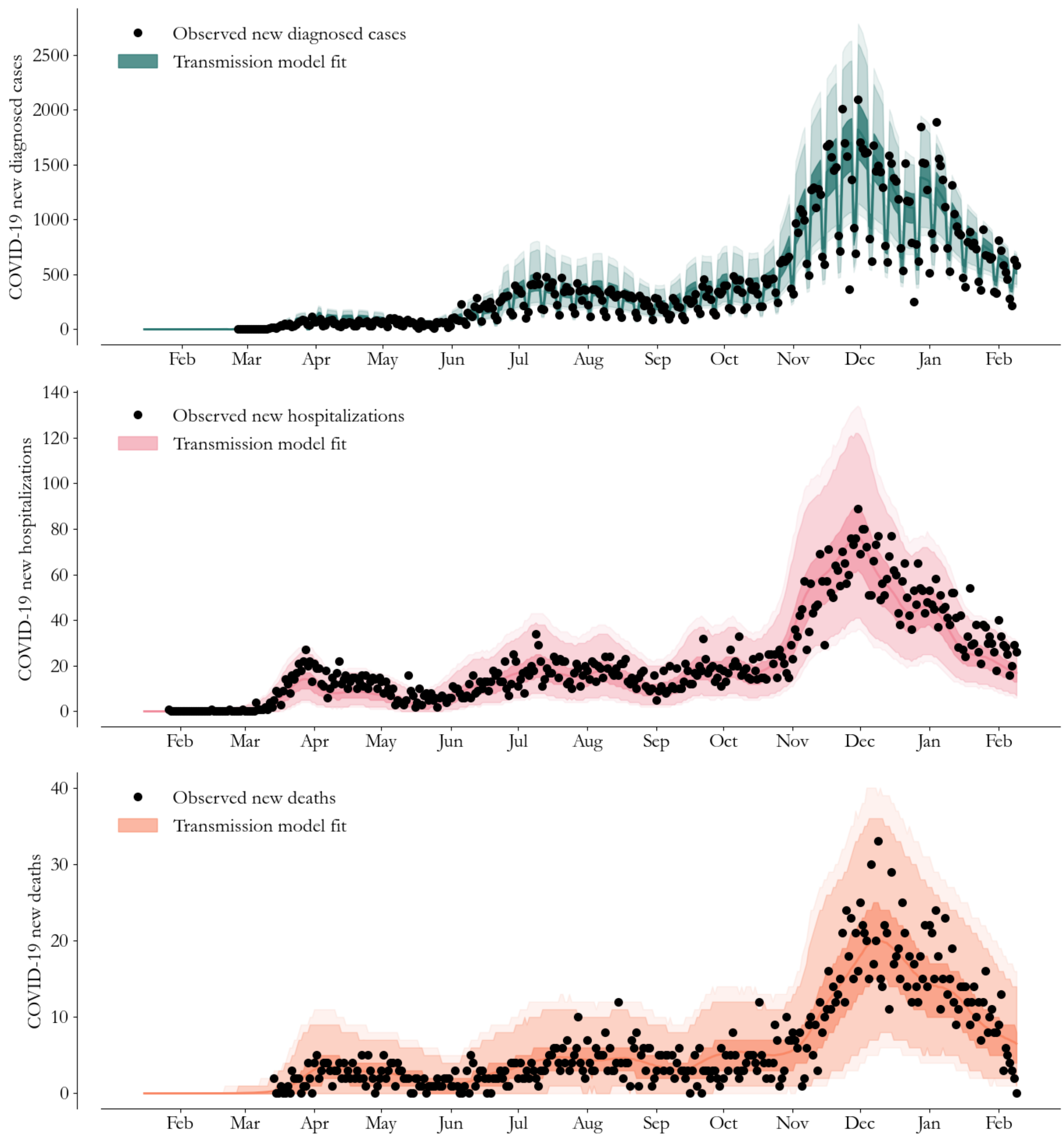

Figure 3: *Fitting the transmission model to Oregon's COVID-19 data on diagnosed cases, hospitalizations, and deaths. The lines represent the mean of 10,000 runs; the 25th-75th percentiles are given in dark shaded areas, 2.5th-97.5th percentiles in the lighter shade, and 1st-99th percentiles the lightest 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, 2020 and February 1, 2020. 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.*

Trends after the data cutoff

Since we did not include events occurring after February 9 in our modeling dataset, we examined counts of Oregon COVID-19 hospital occupancy to see if trends have changed since that date. Data from HOSCAP, which is updated daily, indicate that hospital occupancy continued to decrease between February 9 and February 17.

Scenario Projections

With the fitted model, we can explore outcomes under future scenarios. That is, we do projections to compare what *would* happen if we assume different future scenarios, rather than specific forecasting about what *will* happen. More about this distinction is described here.

For the current report, we modeled what would happen to case and hospitalization trends under two different future scenarios.[5] For both of these scenarios, we assume the estimated R_e for February 3 remains constant through February 9 and any changes start February 10.

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

- If the R_e maintained at 0.88:
  - We would continue to see a decrease in diagnosed cases. For the two-week period between February 24 and March 9, the projected number of new diagnosed cases would fall to 107 per 100,000 people. This rate translates to a daily average of 320 cases.
  - New hospitalizations would decrease to 10 per day by March 9.
- If R_e were to increase by 30% to 1.1. This scenario is intended to illustrate what would happen over the next month if the R_e were to increase slightly above 1 again. We could see such an increase if people were to become less adherent to prevention recommendations and/or a strain with higher infectivity were to circulate more widely. In addition, as some counties' risk levels are lowered and their interventions become less stringent, there will be more opportunities for potential exposure.

[5] R_e estimates for scenarios are rounded in text and figures: values used in models were 0.884 for "as-is" and 1.149 for "increasing transmission."

- New diagnosed cases would reach 170 per 100,000 people for the two-week period between February 24 and March 9; this rate translates to a daily average of 510 cases.
- New hospitalizations would be about 17 per day by March 9.

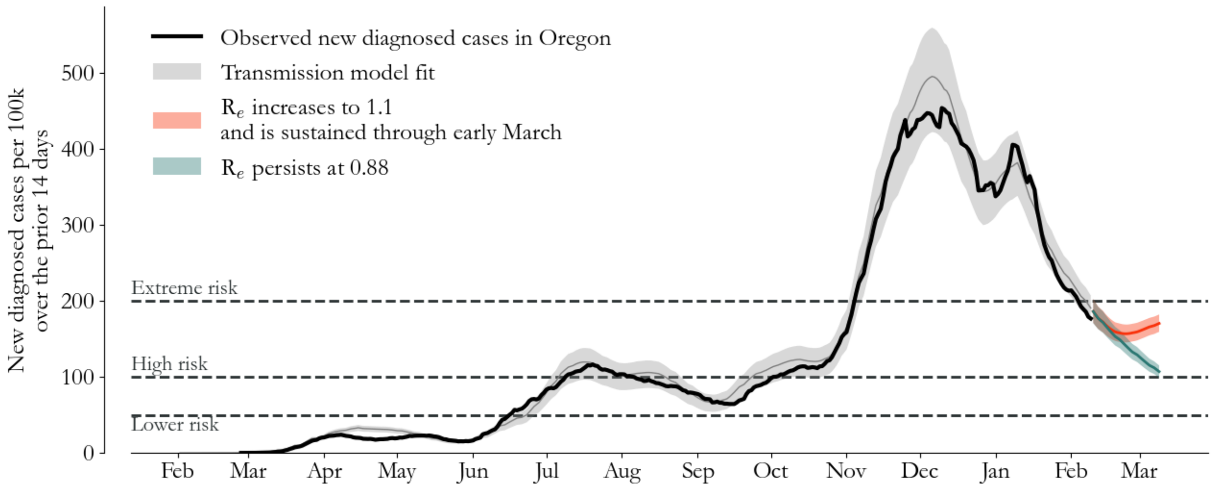

Figure 4: *Observed diagnosed cases (per 100k population over the previous 14 days) for Oregon and projected cases under two scenarios. The black line shows observed cases, while the grey shaded area shows the 25th-75th percentile range of the model fit. The blue line shows diagnosed cases projected if the transmission level estimated for February 3 (R_e = 0.88) persists, while the red line shows projected diagnosed cases if R_e increases to 1.1 after February 9 (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](#).*

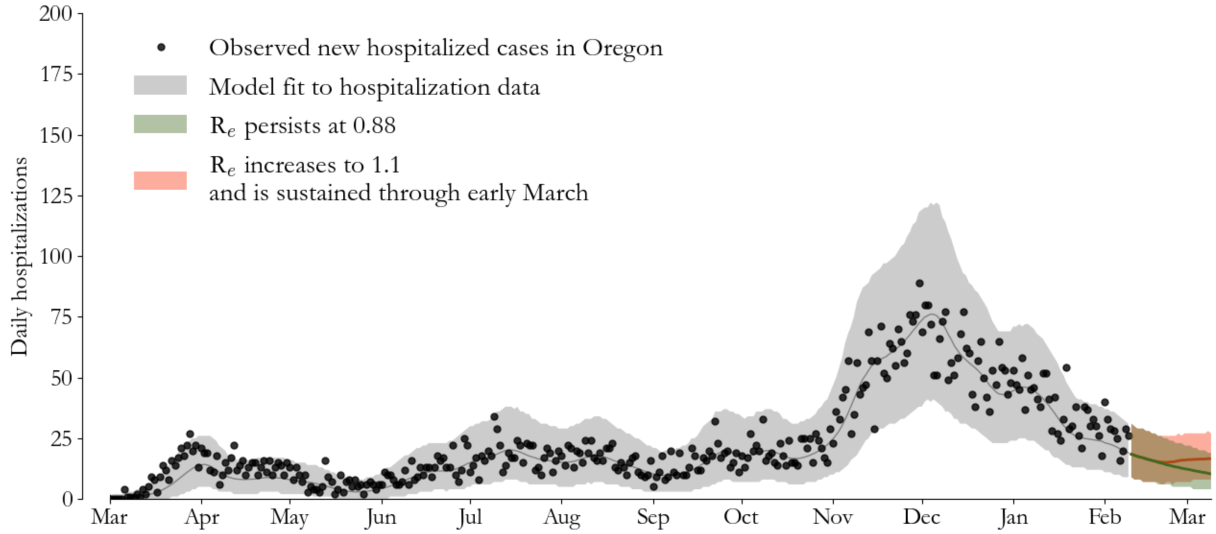

Figure 5: *Observed hospitalized cases for Oregon and projections under two scenarios. Black dots show observed daily counts, while grey region is the model-based 95% confidence interval. The green line shows daily hospitalized cases projected if the transmission level estimated for February 3 (R_e = 0.88) persists, while the red line shows projected hospitalized cases assuming transmission increases to R_e = 1.1 after February 9 (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. As of February 16, over 495,000 Oregonians have received at least one COVID-19 vaccine dose, but vaccinations are still months away for most Oregonians (Phases). 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 1/20/20 and 2/1/20, and specified changes in testing volumes occurring around 4/1/20, 6/23/20, 9/29/20 11/1/20, 11/28/20, 12/15/20, and 12/27/20.
- 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.