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

***Results as of 9-09-2021, 11am***

## PURPOSE OF THIS RAPID STATUS UPDATE

Because of the ongoing COVID-19 surge, the Oregon Health Authority (OHA) wanted to provide an update to last week's epidemic trends and scenario projections more quickly than the typical 3-4 weeks between reports. This Rapid Status Update focuses more narrowly on modeling results than our typical Status Updates, but still uses numerous measures to create the most accurate picture of past COVID-19 transmission and incidence of infection over time in Oregon and projecting possible 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 OHA COVID-19 webpage.

## RESULTS UPDATED REGULARLY

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 report will continue to be updated at least every four 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 rapid status update, we used the COVID-19 modeling software Rainier. Rainier is software designed by 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 September 1 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, as well as hospital occupancy data from Oregon's Hospital Capacity Web System (HOSCAP). To account for delays in Opera reporting, diagnosed cases with a specimen collection date after August 31 were not used; we used the same cutoff date for deaths. Due to surge-related delays in hospitalizations being reported to Opera, a cutoff date of August 12 was used for hospital admissions in Opera,[2] and we used hospital occupancy data from HOSCAP to estimate the number of daily hospital admissions between August 13 and August 31. These estimates are based on the assumption that the typical relationship between HOSCAP daily occupancy and preceding Opera admissions have stayed consistent, but this assumption would be incorrect if the average patient length-of-stay changed concurrently with the recent surge in hospitalizations.

Of note: in the model, cases tested on August 31 reflect exposures that occurred around August 25.

See the August 19, 2021 Status Update for more detail on methods.

[1] Total diagnosed cases include confirmed (positive test) and presumptive cases (symptoms with epidemiologic link).
[2] These dates reflect 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.

## RESULTS

### Effective reproduction number ($R_e$)

From the model results (Figure 1), it is clear the statewide $R_e$ -- the average number of secondary cases that a single case generates -- has fluctuated up and down over time, with dramatic shifts often happening quickly.

After increasing sharply starting in late June, the best-estimate $R_e$ has declined since its late-July peak and has recently dropped below 1. Over the week ending August 25, the best estimate $R_e$ averaged 0.99. On the date of August 25, the statewide $R_e$ was likely between 0.83 and 0.94, with a best estimate of 0.88.

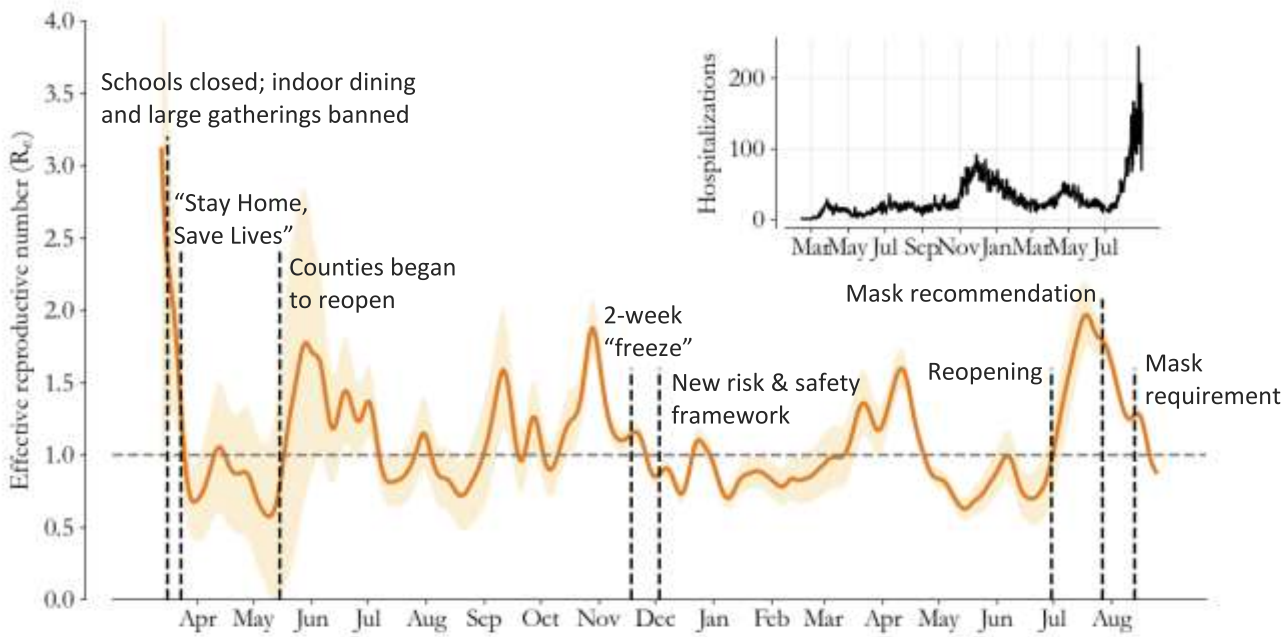


***Figure 1:*** *$R_e$ estimates over time for Oregon, with shaded 95% confidence interval.*[3] *Graph insert is the number of new hospitalizations over time in Oregon, a key input for the estimates. $R_e$ = 1 is the threshold for declining transmission.*

The observed changes in $R_e$ over time may be due to some combination of changing behaviors, changes in opportunities for potential exposure as counties' interventions become more or less stringent, changes in variants, and/or immunity (either from vaccination or recovering from infection). The summer surge in $R_e$ corresponded to the increase in the Delta variants (B.1.617.2 and AY.3) among cases in Oregon (OHA

[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.

Variant Dashboard)[4], as well as state reopening on June 30. The recent decline in $R_e$ suggests people have adopted more protective behaviors after the news of the surge and preventive recommendations. Indeed, data from a survey of Facebook users suggest mask wearing in public in Oregon has more than doubled since late July (CMU survey).

It is important to note that these estimates are based on statewide averages, yet the rate of increasing cases and hospitalizations vary dramatically by county (OHA County Dashboard), race, ethnicity, age (COVID-19 Weekly Report), and vaccination status (COVID-19 Monthly Report).

Our best estimate of the $R_e$ for August 25 (0.88) is similar to the estimate for that date from Harvard, Yale, and Stanford (0.91), and lower than that from Covid Act Now (1.09).[5]

## Model fit to Oregon COVID-19 data

Figure 2 shows how the transmission model captures trends in the daily Oregon COVID-19 outcomes over time.

[4] Since the week starting August 1, the highly-infectious Delta variants (B.1.617.2 and AY.3) has comprised over 95% of genetically-sequenced viral samples in Oregon (OHA Variant Dashboard).

[5] Model $R_e$ estimates are dated August 25, 2021. All were accessed on September 7, 2021. An exact estimate from CMMID was not available, but it appeared to be approximately 1.0. The latest estimate from IHME categorized effective R in Oregon as between 1.05 and 1.09 on August 19.

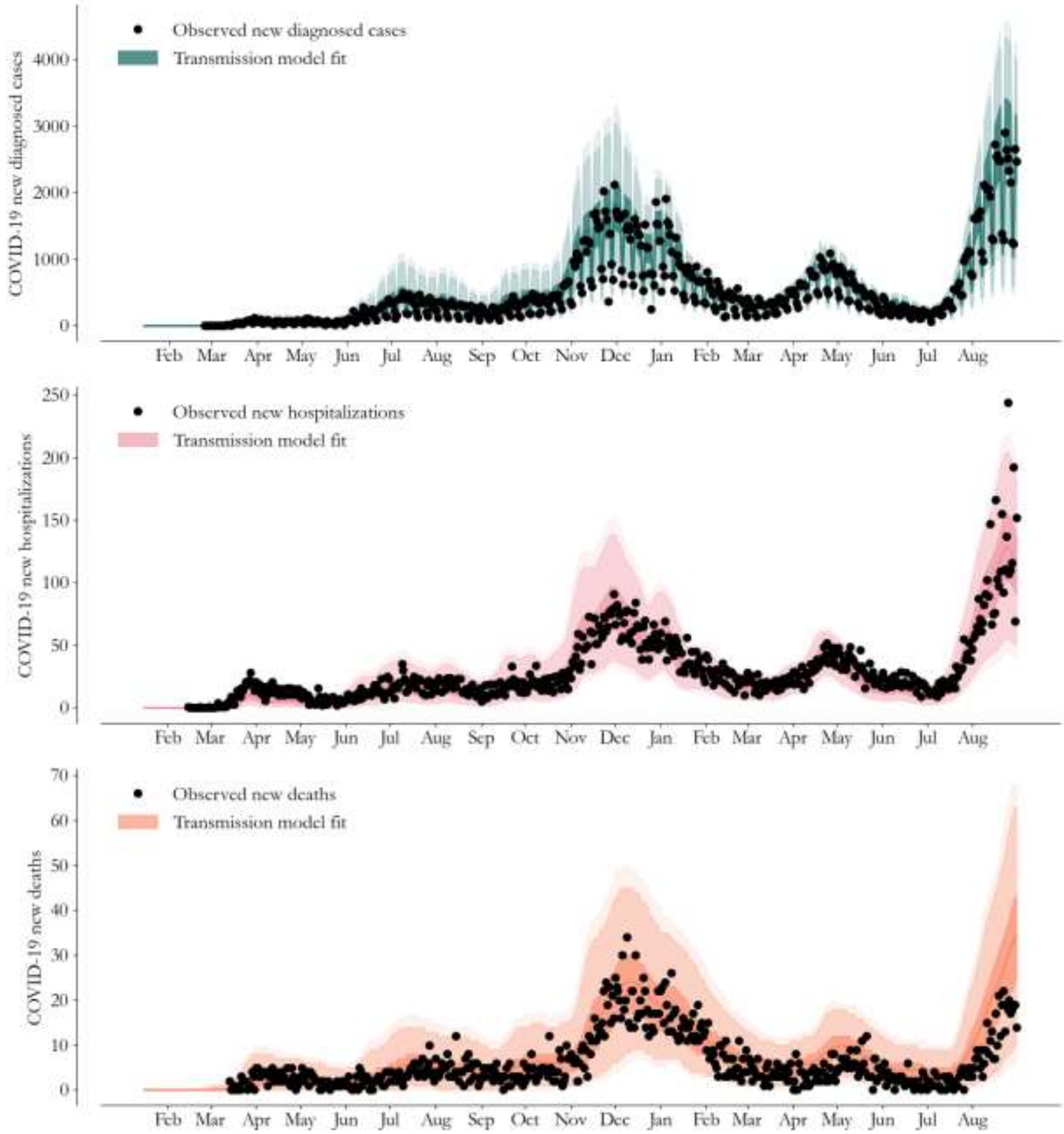


***Figure 2:*** *Fitting the transmission model to Oregon's COVID-19 data on diagnosed cases, hospitalizations, and deaths. The lines represent the mean of 10,000 runs; the 25th-75th percentiles are given in dark shaded areas, 2.5th-97.5th percentiles in the lighter shade, and 1st-99th percentiles the 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.*

## Population-level immunity

Figure 3 includes estimates of population-level immunity from SARS-CoV-2 infection over time.

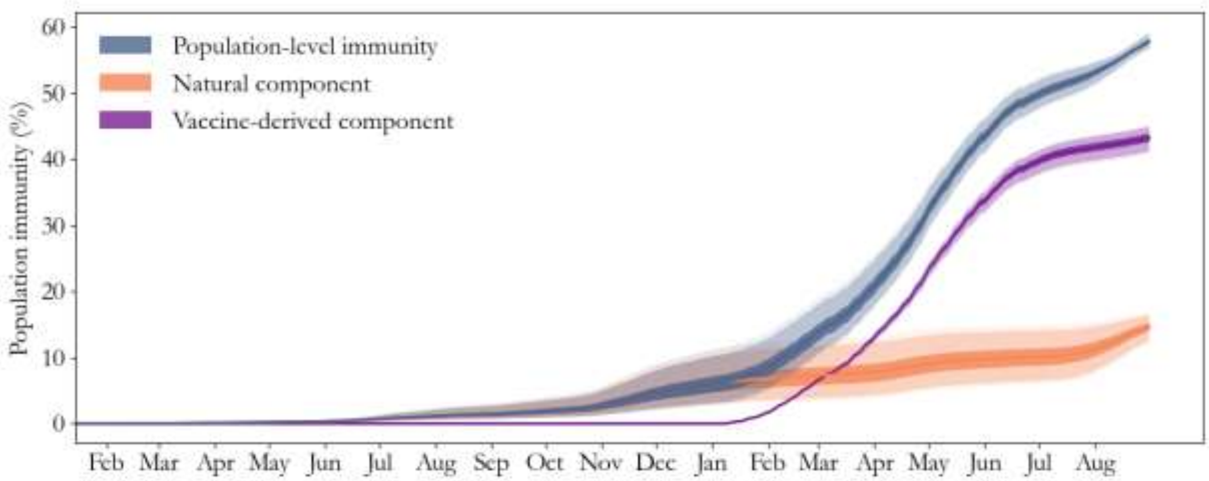


***Figure 3:*** *Estimated population-level immunity to SARS-CoV-2 infection over time. The "natural component" consists of people who developed and then recovered from COVID-19. The "vaccine-derived component" consists of people who were not previously infected, but who achieved immunity from a vaccination dose administered 21 days prior.*

Rainier estimates that as of August 31, the population-level immunity to SARS-CoV-2 was 57.8% (95% confidence interval: 56.8% - 59.0%). The actual population-level immunity to the Delta variants is unclear, but our immunity estimate (57.8%) is above that from Institute for Health Metrics and Evaluation (IHME) and below that from Oregon Health and Science University (OHSU).

The estimated immunity from vaccination (43.2%) is almost triple the estimate for natural immunity. Immunity due to vaccinations is helping prevent further spread of COVID-19. If we remove all of those who have immunity from the model calculations and look at the rate of infection, we see each infection spreading on average to 2.04 new people as of August 25. That is to say, without any immunity (largely due to vaccination), our estimated population $R_e$ would be 2.04 instead of 0.88, and new infections would still be increasing.

## COVID-19 trends after the data cutoff

Since we did not include COVID-19 data occurring after August 31 in our modeling dataset due to reporting delays in all the COVID-19 outcomes in Opera, we examined counts of Oregon COVID-19 hospital occupancy to see if trends have changed more recently. Data from HOSCAP indicate that COVID-19 hospital occupancy decreased by 12 patients (1%) between August 31 and September 9.

## Scenario Projections

With the fitted model, we can explore outcomes under future scenarios. That is, we do short-term projections to compare what *would* happen if we assume particular future scenarios, rather than specific forecasting about what *will* happen. More about this distinction is described here. The CDC, OHSU, and IHME have COVID-19 forecasts.

For the current report, we modeled two scenarios. Both assume recent vaccination levels will continue in the upcoming weeks. These scenarios assume that school reopening will not cause an increase in cases or hospitalizations in our state, but we could possibly see such an increase after school reopening with high baseline rates of hospitalization (CDC; Study from REACH).

Transmission continues at August 25 level: This scenario assumes the estimated transmission level as of August 25, a low point in transmission after a week of rapid decline.

- We would see a rapid decrease in diagnosed cases[6] (Figure 4). For the two-week period between September 15 and September 28, the projected number of new diagnosed cases would decrease to 490 per 100,000 people. This rate translates to a daily average of 1,460 cases.
- By September 28, there would be 80 people per day requiring hospital admission (Figure 5).

[6] Recent diagnosed cases appear to have quickly leveled off after a period of exponential growth, and the transmission model fit (based on cases, hospitalizations, and deaths) over-predicts recent case counts. We assume this discrepancy is likely due to case reporting delays or change in testing patterns, but we will reassess the trend and model fit next week.

Transmission continues at the average level over the week of August 19 - 25: The first scenario might be overly optimistic because it assumes the estimated transmission level being at the recent low point. In addition, that estimated transmission level was before many schools were reopened and before multiple large public events scheduled in September. Therefore, we ran a scenario assuming the average transmission level over the week of August 19 - 25 for comparison, which represents a more gradual decrease in transmission over the coming weeks.

- Diagnosed cases would decrease more slowly, though even at this transmission level the decrease in cases would accelerate as more people developed immunity[7] (Figure 4). For the two-week period between September 15 and September 28, the projected number of new diagnosed cases would be 635 per 100,000 people. This rate translates to a daily average of 1,910 cases.
- By September 28, there would be 107 people per day requiring hospital admission (Figure 5).

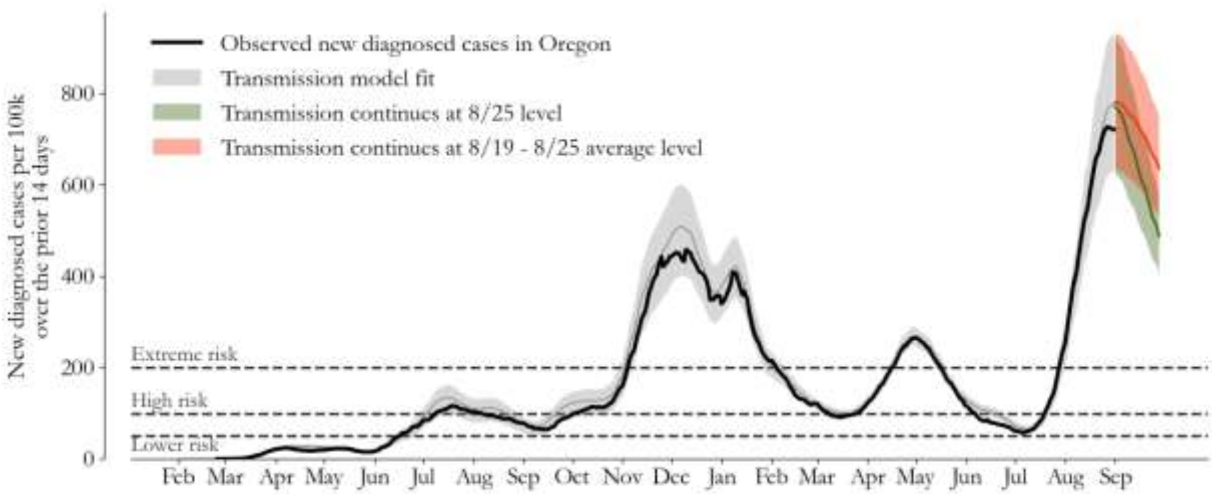


***Figure 4:*** *Observed diagnosed cases (per 100k population over the previous 14 days) for Oregon and projection scenario. The black line shows observed cases, the grey line shows model fit, and the colored lines show diagnosed cases projected assuming the estimated transmission rate of August 25 (green) or the average transmission rate of August 19 – 25 (red). Shaded areas: 25th-75th percentile ranges of the model fit. The dashed horizontal lines correspond to levels of Oregon Community Spread.*

[7] Rainier estimates that enough of the population will have developed immunity that the effective reproductive number would decrease further below one and infections would more rapidly decrease, assuming this level of protective behaviors. However, there is considerable uncertainty in the assumptions for estimating how many people have immunity in Oregon, such as how many total infections (included those undetected) have occurred, how long natural immunity lasts, and how well natural immunity protects against variants.

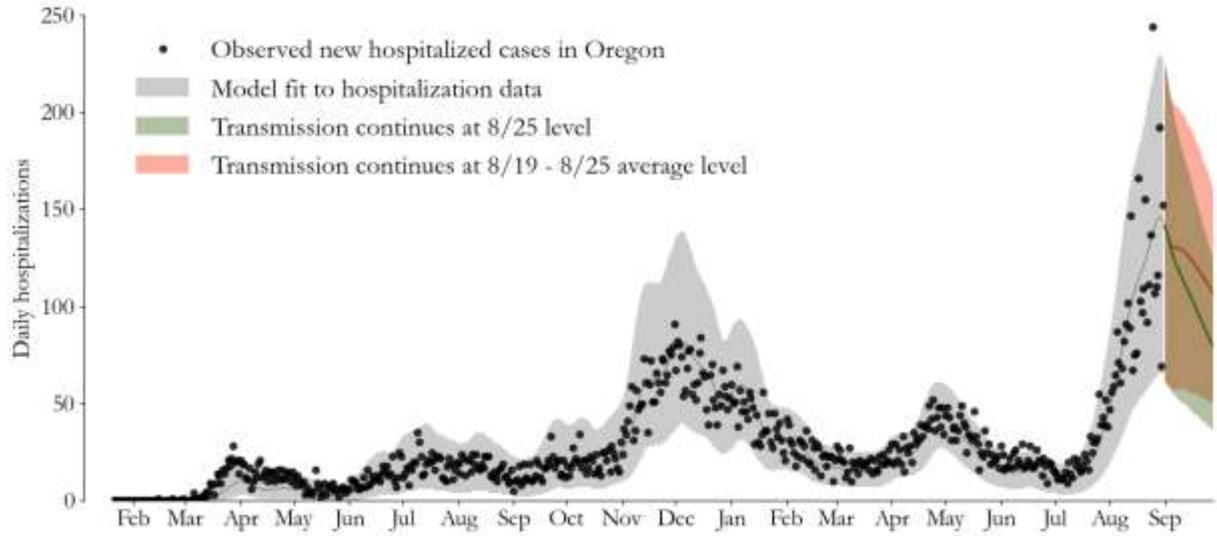


***Figure 5:*** *Observed hospitalized cases for Oregon and projection scenario. Black dots show observed daily counts, while the grey line shows model fit. The colored lines show hospitalizations projected assuming the estimated transmission rate of August 25 (green) or the average transmission rate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